TEEJAY PUBLISHERS

General Maths Book 4G

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PUPIL BOOK
4G

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S4 General Course Structure

The book, along with General Book 3G is aimed at three main groups, dependent on how it is used.

- Those General pupils who would struggle with the complexities of other General resources on the market at present, who find the change of pace and the level of difficulty too great to cope with - the result is usually for them to turn off and possibly give up trying.

- Top Foundation pupils who couldn't cope with General but find Foundation too easy - this textbook should allow them to tackle enough of the work to possibly gain a Grade 4 in the external exam.

- Middling to top General classes who can use this book also as the back-bone of the General course supplemented by the Extension, Assessment and Homework materials (in photocopiable form).

In Book 3G, we truncated the work in some chapters, for example :-

Pythagoras - Hypotenuse only

Circle work - Circumference only

Trigonometry - Tangent only (Trig tables at back of book),

in order to allow pupils to have access to these topics and feel confident with the work without burdening them with all the "tricky bits" !

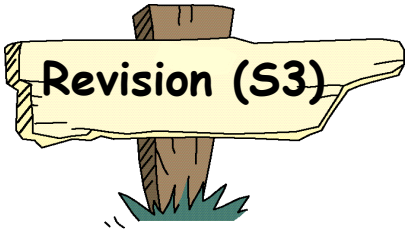
Though the missing topics from these chapters were covered in the Extension Materials in 3G, they are re-produced in this book with changed numbers.

Please let us know what you think of the two books and whether you believe they cover the General Course adequately - we're big enough to take (*some*) criticism !!!

Tom Strang and Jim Geddes

Contents

Chapter 0



1. Round to the nearest whole number :-

   (a) 7·9 (b) 14·18 (c) 39·987.

2. Round to the nearest 10 :-

   (a) 97 (b) 372 (c) 1107.

3. Round to the nearest 100 :-

   (a) 426 (b) 1349 (c) 15792.

4. Find :-

   (a) 27 x 10 (b) 100 x 45 (c) 360 x 100 (d) 402 x 1000

   (e) 380 ÷ 10 (f) 4600 ÷ 100 (g) 59000 ÷ 100 (h) 250000 ÷ 1000.

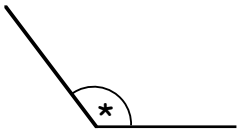
5. Do the following (no calculator) :-

   (a) 51 x 30 (b) 211 x 40 (c) 31 x 500

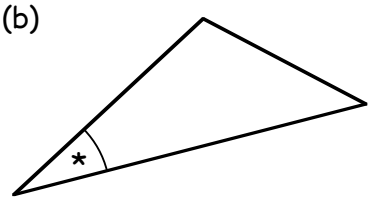
   (d) 960 ÷ 30 (e) 2800 ÷ 200 (f) 8000 ÷ 400.

6. Say what <u>kind</u> of angle each of the following is :-

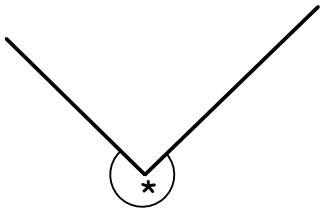
   (a)



   (b)

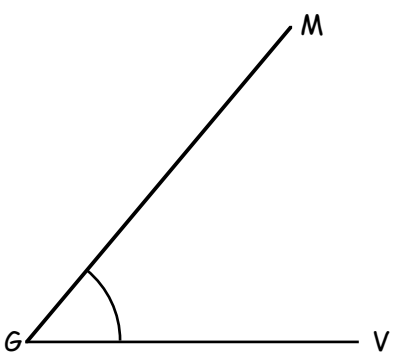


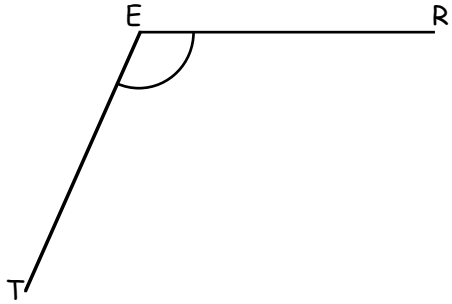
   (c)



7. For the two angles shown below :-

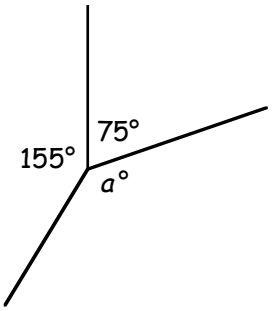
   (i) name each one using 3 letters,
   (ii) estimate the size of each (write down your guess),
   (iii) measure each one using a protractor.



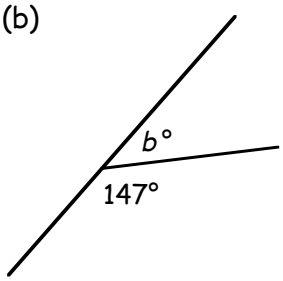


8. Calculate the sizes of all of the following angles :-

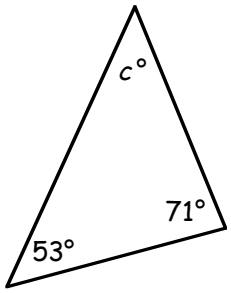
(a)



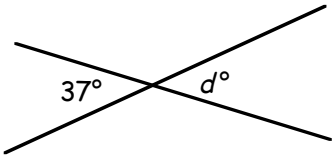
(b)



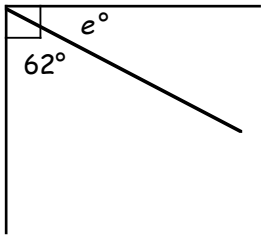
(c)



(d)

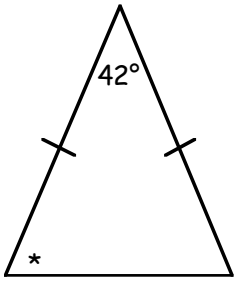


(e)

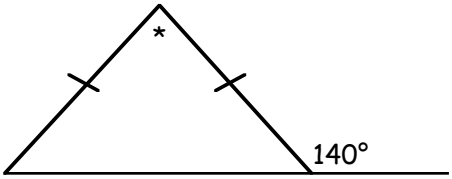


9. Calculate the sizes of the angles marked *.

(a)

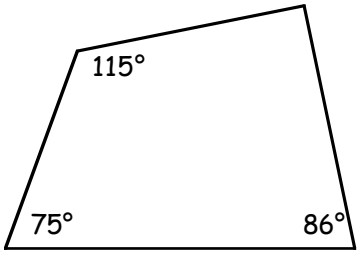


(b)

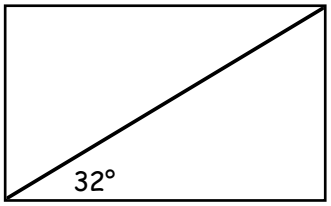


10. <u>Sketch</u> these figures and fill in the sizes of all the missing angles :-

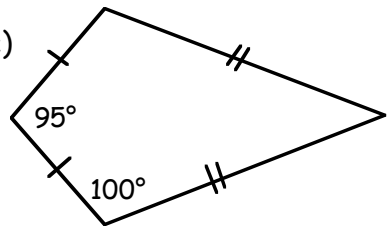
(a)



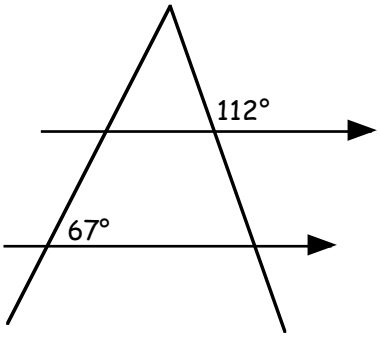
(b)



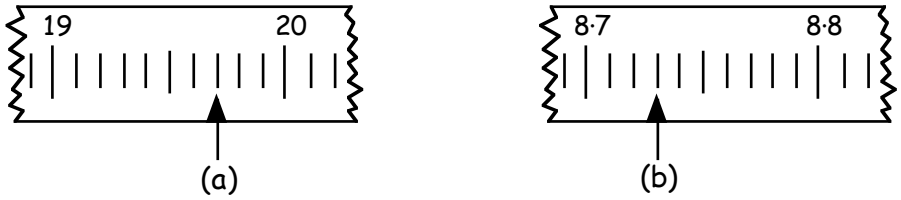
(c)



(d)



11. What numbers are represented below by (a) and (b) ?



12. Round to 1 decimal place :-

(a) 5·3186 (b) 19·0834 (c) 0·0667.

13. Round to 2 decimal places :-

(a) 3·5274 (b) 6·9045 (c) 0·7998.

14. Set down and find the following :-

(a) $\begin{array}{r} 18{\cdot}82 \\ -\ 8{\cdot}57 \\ \hline \end{array}$ (b) 19 – 13·53 (c) $\begin{array}{r} 32{\cdot}47 \\ \times\ 4 \\ \hline \end{array}$ (d) $7\overline{)46{\cdot}06}$

15. Write down the answers to :-

(a) 10 × 2·9 (b) 8·27 × 10 (c) 100 × 0·615

(d) 19·4 ÷ 10 (e) 56·24 ÷ 100 (f) $\frac{67}{100}$.

16. Change the following :-

(a) 4·8 m to cm (b) $3\frac{1}{4}$ km to m (c) 76 mm to cm

(d) 5800 ml to litres (e) 0·64 litres to ml (f) 7825 g to kg

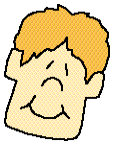
(g) 9·6 g to mg (h) 5700 kg to tonnes (i) 0·86 kg to g

17. Write the following percentages as fractions <u>in their simplest form</u> :-

(a) 60% (b) 35% (c) 15% (d) 24%.

18. Change to decimals (use a calculator) :-

(a) $\frac{4}{5}$ (b) $\frac{19}{20}$ (c) $\frac{13}{40}$ (d) $\frac{5}{8}$.

19. 

Billy scored 72 out of 90 in a test.

Calculate Billy's percentage mark.

20. Use your calculator to find :-

(a) 17% of £240 (b) 4% of £840 (c) $7\frac{1}{2}$% of £360.

21. Steve earned £18 400 in 2001. In 2002, he received a 4% pay rise.

What did Steve earn in 2002 ?

22. The price of a barrel of oil was $42 in 2001.
By 2002, it had fallen by 20%.

What was the price in 2002 ?

23. 

I bought a book for £8 and sold it for £10.

(a) What was my profit ?

(b) Express the profit as a percentage of the cost price.

24. Change the following test marks to percentages :-

Art	34 out of 40
Computing	18 out of 25
Geography	42 out of 60

25. 

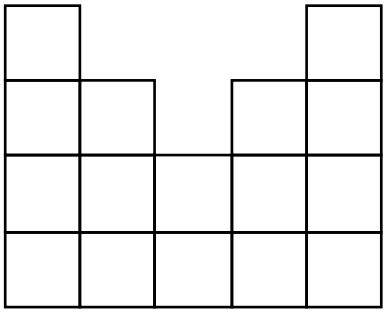
My comic collection grew from 80 in 2001 to 100 in 2002.

(a) By how much had my collection actually grown ?

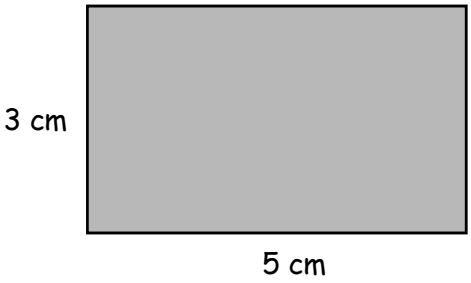
(b) Express this as a percentage of the 2001 figure.

26. Make a THREE times enlargement of this figure :-

(each box represents 1 square centimetre).



27. Shown is a scale drawing of Mr Brown's garden.



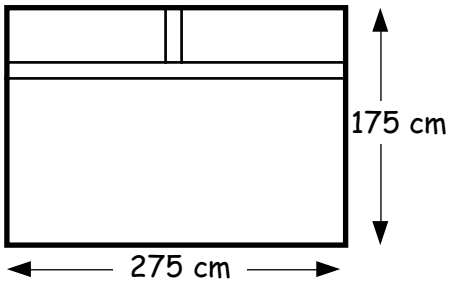
scale :- 1 cm = 4 metres

(a) Calculate the length and breadth of the REAL garden.

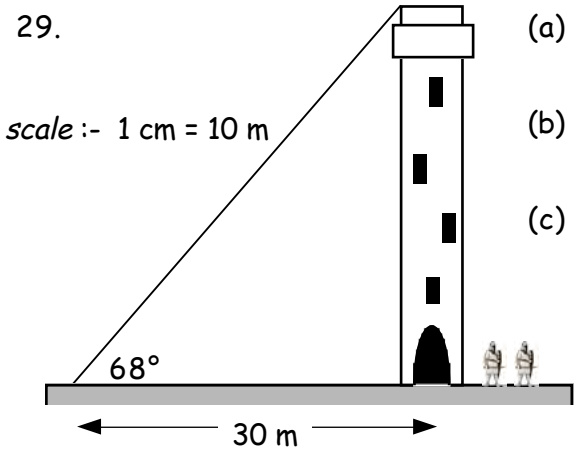
(b) Calculate the AREA of the garden (m^2).

28. This is a sketch of a large office window frame.

Make a scale drawing of the window frame using a scale 1 cm = 25 cm.



29.



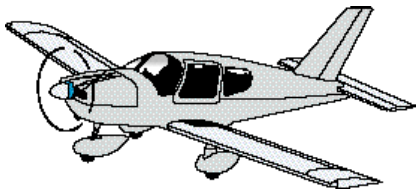
(a) Make a scale drawing showing this look-out tower and the cable attached to its top.

(b) Measure the height of the lookout tower on your scale drawing.

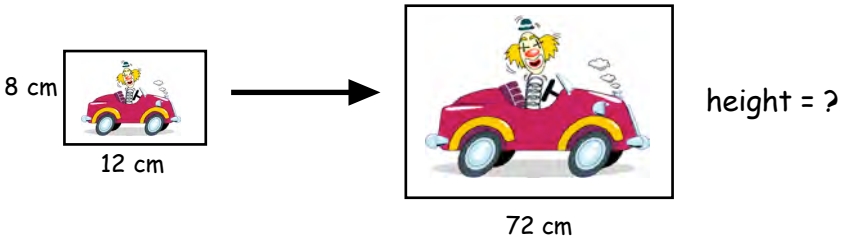
(c) Calculate the REAL height of the lookout tower.

30. (a) Jamie is facing North West. He makes a $\frac{1}{4}$ turn anti-clockwise.
In which direction is he now facing ?

(b) A plane is flying North East.
By how much will it have to change course in order for the pilot to be flying due South ?



31. An enlargement of a picture is made :-



(a) Find the scale factor for the enlargement.

(b) Use this to determine the height of the larger picture.

32.

Dani works in a call centre and earns £8·15 per hour.

How much will she earn in a week when she works 36 hours ?

33. Ann is a hotel receptionist and earned £340 last week, when she worked for 40 hours.

Calculate Ann's hourly rate of pay.

34. Gerry's monthly salary is £1320. Calculate her **annual** salary.

35. 

Dougie earns £39 000 per year as a computer programmer.

Calculate his <u>weekly</u> pay.

36. Ernie is a milkman and earned £13600 last year.
This year he got a 3% pay rise.

Calculate what he will earn this year.

37. Sandra sells double glazing. She receives a basic monthly salary of £960.
She also gets **commission** of 8% of any sales made.
This month, Sandra sold £6000 worth of double glazing.

(a) Calculate the commission due to Sandra.

(b) Calculate her total pay for the month.

38. Norma's normal hourly rate of pay is £4·80.
Overtime is paid at "time and a half".

How much would Norma get paid for working 10 hours overtime ?

39. Brian's rate of pay is £6·40 per hour.
Overtime is paid at "**time and a half**".

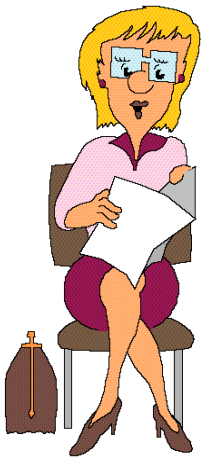
Use Brian's timesheet to calculate :-

Brian Jones	**T125436**
Basic Hours	**-**
36	

(a) his basic pay,

(b) his overtime pay,

(c) his total pay for the week.

40. 

Last month, Karen's **gross** pay was £1845.
Her deductions were :-

Income Tax	£305·86
Superannuation	£69·50
National Insurance	£42·71

(a) Calculate Karen's total deductions.

(b) Calculate her NET (take-home) pay.

41. Simplify :-

(a) $7x + 3x$ (b) $10b - 5b$ (c) $4a + 7 + 5a - 6$ (d) $12p + 5q - 9p - 4q$

(e) $4 \times m$ (f) $3p \times 4q$ (g) $t \times t$ (h) $8n \times 3n$.

42. Simplify :-

(a) $4(x + 5)$ (b) $7(2p - 3)$ (c) $5(4a + 7b)$

(d) $4(x + 3) - 10$ (e) $3(x + 5) + 2(x + 4)$ (f) $5(3h + 4) + 3(4h - 6)$.

43. Solve for x (show your lines of working) :-

(a) $x + 8 = 15$ (b) $x - 3 = 9$ (c) $4x = 20$ (d) $2x = 13$

(e) $5x + 1 = 26$ (f) $4x - 3 = 17$ (g) $3(x + 4) = 21$ (h) $6(x - 3) = 0$.

44. Solve for x :-

(a) $9x + 2 = 7x + 13$ (b) $8x - 1 = 5x + 29$ (c) $6x - 15 = x$.

45. Solve the following inequalities :-

(a) $x + 4 > 9$ (b) $x - 3 < 10$ (c) $3x \geq 18$

(d) $4x - 1 \leq 19$ (e) $3x + 7 > 25$ (f) $2(x - 3) < 16$.

46. I left £8000 in Borrowland Bank for one year.

(a) How much Interest was I due ?

(b) How much were my savings then worth ?

BORROWLAND BANK
Annual Interest Rate
4%

47.

Special Investment
Annual Rate
7·5%

I left £8000 at the special interest rate.

(a) How much interest would I be due at the end of a full year ?

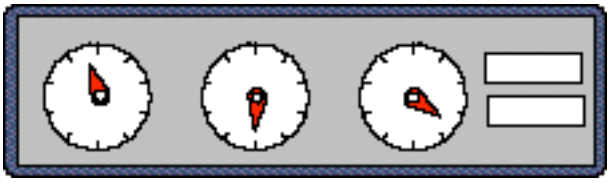
(b) How much would this work out at for 1 month ?

(c) How much interest would I be due if I left the money in the bank for 7 months ?

48. Copy this bill and complete it. (include the VAT)

Materials	-	£59·70
Labour (4 hours @ £8·25/hr)		£.....
	Total	£.....
COPY + VAT (at 17·5%)		£.....
	FINAL BILL	£.....

49. Copy and complete this electricity bill :-

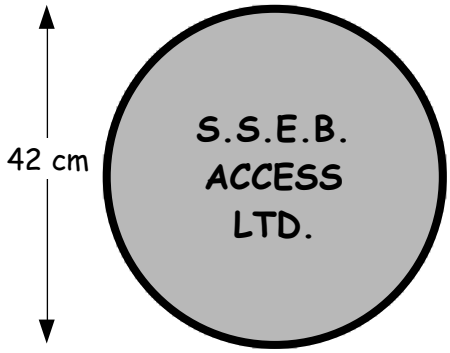


Western Electricity Board COPY

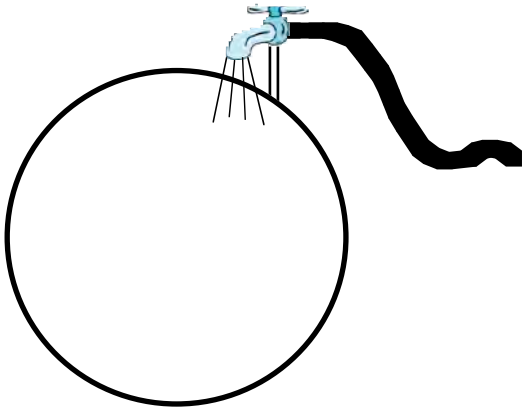
T Smith — May to July 2002

Units		COST	
present	07154	[ ] units @ 14·5p	= [ ]
previous	06827	+ VAT (at 8%)	= [ ]
units used -	[ ]	AMOUNT DUE =	[ ]

50.



Calculate the circumference of this man-hole cover.

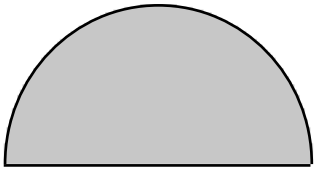


51. The radius of this garden pool is 7·5 metres.

Calculate its circumference.

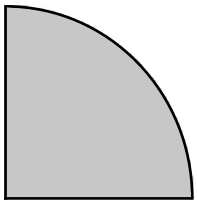
52. Calculate the PERIMETERS of these shapes which are made up of "part" circles :-

(a)



50 metres

(b)

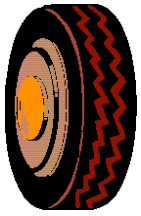


quarter circle

7·2 cm

53. The CIRCUMFERENCE of this wheel is 157 cm.

Calculate the DIAMETER of the wheel.



C = 157 cm

54.

This circular picture has a **radius** of 17 cm.

Calculate its AREA.

55. A circular frisbee has a DIAMETER of 8·6 cm.

(a) What is its radius ?

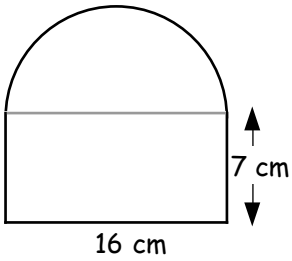
(b) Calculate its AREA.

56. This shape consists of a semicircle on top of a rectangle.
Calculate the <u>area</u> of :-

(a) the rectangle.

(b) the semi-circle.

(c) the whole shape.



57. Change to 24 hour notation :-

(a) 8·55 am (b) 4·40 pm (c) 10 past noon

58. Change to am/pm (12 hour) notation :-

(a) 1945 (b) 1405 (c) 0350

59. 

A film started at 7·35 pm and ended at 9·15 pm.

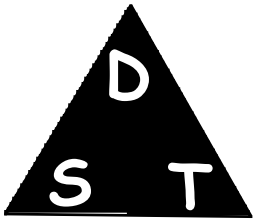
For how long had the film lasted ?

60. How far will you have travelled :-

(a) in 4 hours at 35 mph ?

(b) in $\frac{1}{4}$ hour at 80 km/hr ?

(c) in $\frac{1}{2}$ hour at 48 mph ?



61. What speed are you travelling at if you cover :-

(a) 150 miles in 5 hours ? (b) 100 km in $2\frac{1}{2}$ hours ? (c) 20 km in 30 mins ?

62. How long will it take you to travel :-

(a) 360 km at 80 km/hr ? (b) 105 miles at 70 mph ? (c) 15 miles at 20 mph ?

63. Change these times to decimal form :-

(a) 48 mins (b) 2 hr 12 mins (c) 3 hr 6 mins

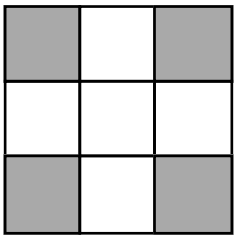
64. Express these times in hours and minutes :-

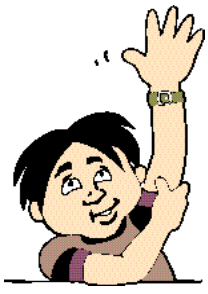
(a) 2·4 hours (b) 0·25 hours (c) 2·666... hours

65. What fraction of this shape is :-

(a) shaded ?

(b) not shaded ?





66. Write a second fraction equivalent to :-

(a) $\frac{1}{4}$ (b) $\frac{2}{5}$ (c) $\frac{3}{10}$

67. Simplify these fractions :-

(a) $\frac{16}{20}$ (b) $\frac{6}{18}$ (c) $\frac{28}{35}$

68. Find the following :-

(a) $\frac{1}{3}$ of 120 (b) $\frac{1}{5}$ of 300 (c) $\frac{1}{6}$ of 180

69. Find the following :-

(a) $\frac{3}{4}$ of 40 (b) $\frac{2}{5}$ of 30 (c) $\frac{9}{10}$ of 1800

70. Write down the simplest fraction equivalent to :-

(a) 50% (b) 25% (c) 20%

(d) 75% (e) $33\frac{1}{3}\%$ (f) 70%

71. Find (without using a calculator) :-

(a) 50% of 80 (b) 25% of 32 (c) 10% of 190

(d) $33\frac{1}{3}\%$ of 60 (e) 75% of £20 (f) 40% of £50

72. Find the following without a calculator :-

(a) $\frac{2}{5} + \frac{1}{5}$ (b) $\frac{7}{8} - \frac{3}{8}$ (c) $3\frac{1}{5} + 2\frac{1}{5}$

(d) $5\frac{9}{10} - 2\frac{3}{10}$ (e) $\frac{1}{4} + \frac{1}{2}$ (f) $\frac{3}{4} - \frac{1}{2}$

(g) $4\frac{3}{4} - 2\frac{1}{2}$ (h) $\frac{1}{4} + \frac{1}{3}$ (i) $\frac{5}{6} - \frac{1}{3}$

(j) $4\frac{1}{3} + 2\frac{1}{2}$ (k) $5\frac{5}{6} - 3\frac{2}{3}$ (l) $5 - 2\frac{4}{5}$

73. Find the following :-

(a) $3 \times \frac{4}{5}$ (b) $6 \times \frac{1}{3}$ (c) $\frac{3}{4}$ of 9

(d) $\frac{3}{10}$ of 8 (e) $2 \times 4\frac{1}{3}$ (f) $3 \times 5\frac{2}{5}$

(g) $5 \times 1\frac{1}{6}$ (h) $\frac{2}{5} \times \frac{3}{4}$ (i) $\frac{3}{5} \times \frac{2}{3}$

74. This stem-and-leaf diagram shows the heights (in cm) of a group of boys in a school rugby team.

(a) Martin was the smallest. What height was he ?

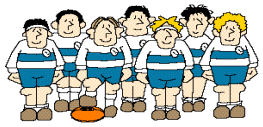
(b) How tall was the "second tallest" boy ?

(c) What was the most common height ?

(d) How many boy's heights were recorded ?

13	7
14	0 3 3 3 4 6 8
15	0 0 5 6 8
16	1 3

15 | 5 = 155 cm



75. The test marks of 16 girls were recorded :-

43	49	77	49	78	58	63	65
42	60	56	72	59	84	61	89

Draw an "ordered" stem-and-leaf diagram to show these marks.

76. What is the **range** of this set of prices :- £17, £20, £36, £41, £35, £87 ?

77. What is the **mode** for this set of numbers :-

16, 16, 15, 20, 16, 18, 13, 16, 13, 12, 16, 17 ?

78. Write down the **median** for each of these :-

(a) 4, 5, 6, 6, 9, 10, 11, 14, 17, 17, 19. (b) 25, 19, 29, 22, 24, 23, 32, 18, 24, 27.

79. Calculate the **mean** of each of the following :-

(a) £35, £45, £109, £141, £175. (b) 1·4, 2·8, 2·4, 2·4, 2·2, 2·6, 1·2, 1·0.

80. The **mean** age of 3 women is 29. Sue is 22 and Kim is 37. What age must Jill be ?

81. Construct a frequency table to show these golf scores :-

74	75	72	74	72	72	77	73	71	73	74	71	75
74	72	77	74	75	73	74	74	79	73	75	73	

Score	Tally	Freq
71		
72		
73		
74		
75		

82. (a) Copy this frequency table and complete the 3rd column to show $f \times x$.

(b) What is the **mode** ?

(c) What is the **median** age ?

(d) Write down the **range**.

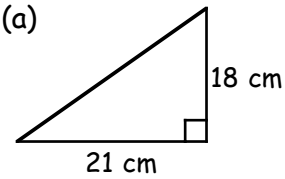
(e) Use the 3rd column to calculate the **mean** age.

(f) Draw a neat labelled **bar-graph** to show the ages.

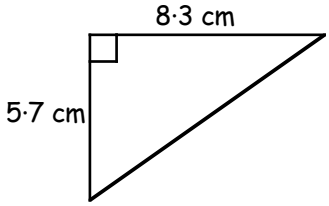
Age (x)	Freq (f)	$f \times x$
23	3	
24	7	
25	9	
26	6	
27	2	
28	3	

83. Calculate the lengths of the hypotenuse in each of these :-

(a)

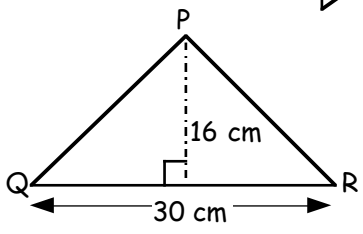


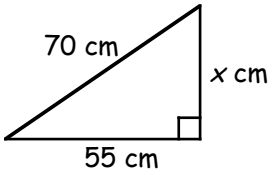
(b)

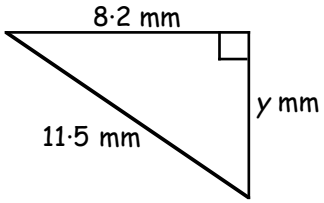


84. Shown is an isosceles triangle PQR.

Calculate the length of the sloping side PR.



85. 

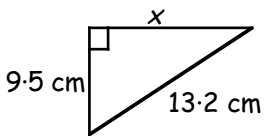


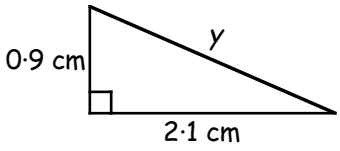
Calculate the lengths of the sides marked *x* and *y*.

86. (a) Draw a set of coordinate axes and plot the two points S(0, 3) and T(5, 6).
(b) Join S to T with a line. (c) Calculate the length of the line ST.

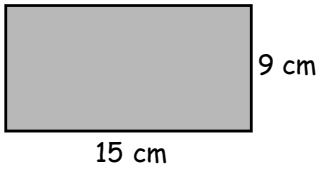
87. Decide which formula to use to calculate the missing sides in these triangles :-

$c^2 = a^2 + b^2$ or $a^2 = c^2 - b^2$

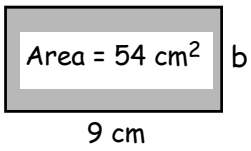
(a) 

(b) 

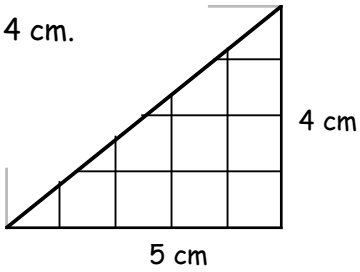
88. Calculate the area of this rectangle :-



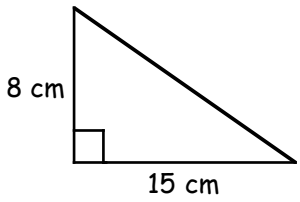
89. The area of this rectangle is 54 cm^2. Calculate its breadth.

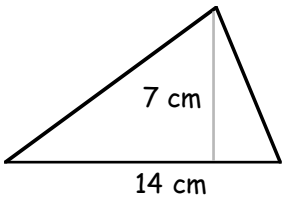


90. (a) Make a copy of this right angled triangle measuring 5 cm by 4 cm.
(b) Draw the surrounding rectangle and calculate the area of the rectangle.
(c) Now calculate the area of the right angled triangle.

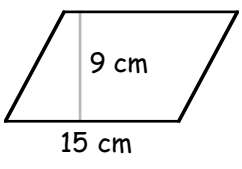


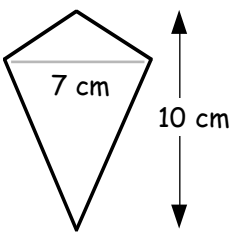
91. Use an appropriate formula to calculate the area of each of these triangles :-

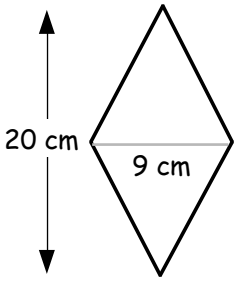
(a) 

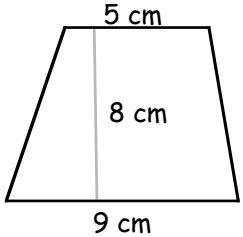
(b) 

92. Calculate the area of each of these shapes :-

(a) 

(b) 

(c) 

(d) 

93. Find the following without a calculator :-

(a) 50% of 1600 (b) 25% of 120 (c) $33\frac{1}{3}$% of 60

(d) 10% of 3700 (e) 20% of £35 (f) 75% of £40

94. A vase contained 360 ml of water. If 15% of it evaporated, how many millilitres were left ?

95. A shopkeeper bought a box of 12 "red noses" for a total of £17·59.
He sold all of the red noses at £1·75 each. Calculate his total profit.

96. (a) I bought a Playstation for £180 and sold it one year later for £135.

(i) How much of a loss did I make ?

(ii) Express this loss as a percentage of the cost price.

(b) I bought a pair of matching ornaments for £400 and sold them both for £220 each.

(i) Calculate the overall profit. (ii) Calculate my percentage profit.

97. The bathroom suite I chose for my flat was priced £720. I bought it on Hire Purchase by :-

- making a deposit of £70
- followed by 12 monthly payments of £62·30.

(a) How much did it cost altogether to buy the suite using Hire Purchase ?

(b) How much would I have saved if I'd paid cash ?

98. This TV set is priced £340.

(a) Calculate the deposit needed.

(b) How much more expensive is it to buy the TV set using Hire Purchase ?

Deposit - 10%
+ 18 payments of £19·75

99. (a) How much would it cost to insure a villa valued at £120 000 with LOWRISK ?

(b) My house is worth £95 000.
The contents are valued at £30 000.

LOWRISK Insurance
(annual rates)

Building	£3·25 per £1000
Contents	£7·15 per £1000

(i) What would my annual insurance premium be for the building ?

(ii) What would it cost to insure the contents ?

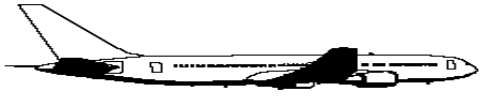
(iii) What would my total annual insurance premium be ?

100.

WORLDWIDE Exchange
£1 = 1·60€
£1 = $1·54

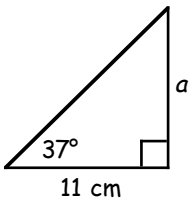
(a) How many American dollars will I receive if I exchange £250 ?

(b) I brought back 450€ from my holiday in Spain.
How many £'s should I receive in exchange ?

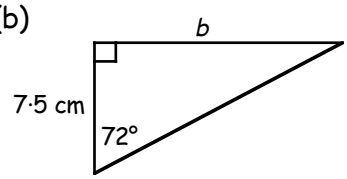


101. Use **tangents** to calculate the sizes of the 3 sides marked *a*, *b* and *c*.

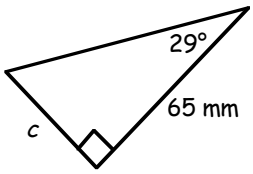
(a)



(b)

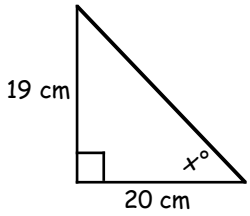


(c)

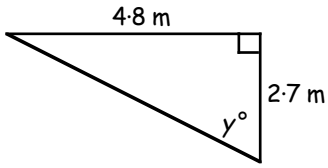


102. Use tables or <u>2 buttons</u> on your calculator to find the sizes of the angles marked *x*, *y* and *z*.

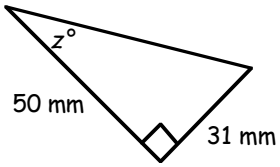
(a)



(b)



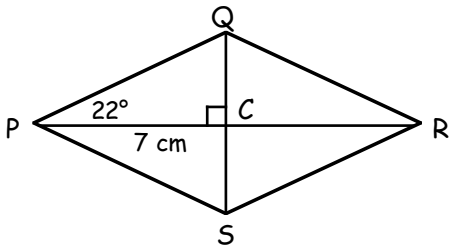
(c)



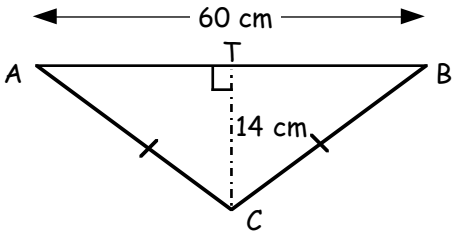
103. PQRS is a rhombus. The "semi"-diagonal PC = 7 cm, and ∠QPC = 22°.

(a) Calculate the length of the line QC.

(b) Write down the lengths of both diagonals.



104.

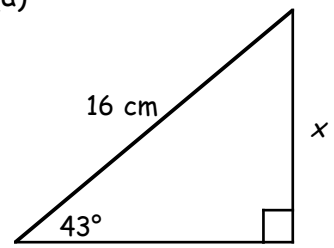


ABC is an isosceles triangle.
AB = 60 cm and TC = 14 cm.

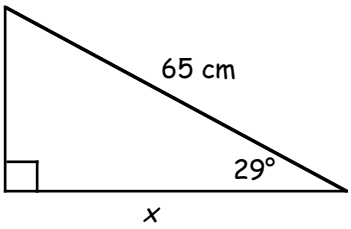
Calculate the size of ∠BAC.

105. In each of the following triangles you must decide which trig ratio is required, (sine, cosine or tangent), to calculate the size of the side marked *x*.

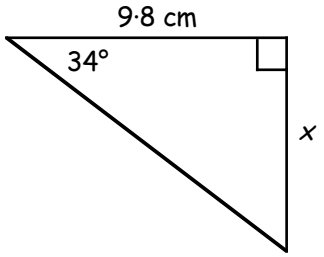
(a)



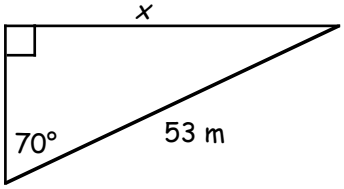
(b)



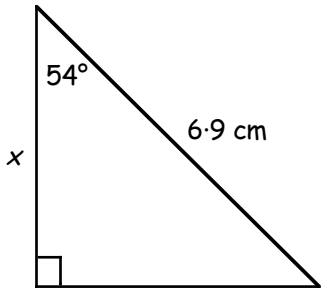
(c)



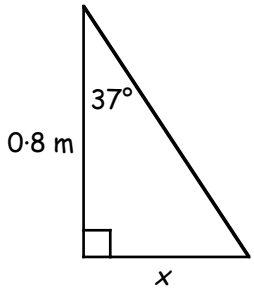
(d)



(e)

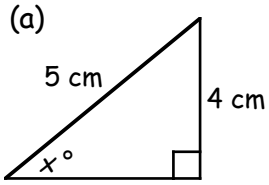


(f)

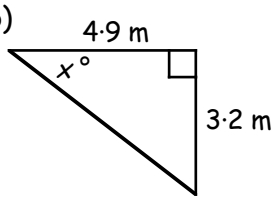


106. Again, you must decide which trig ratio to use here. Use tables or (two) buttons on your scientific calculator to find the size of the angle marked $x°$.

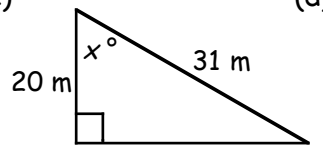
(a)



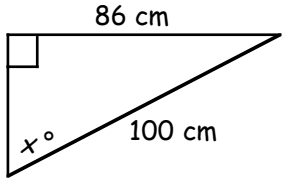
(b)



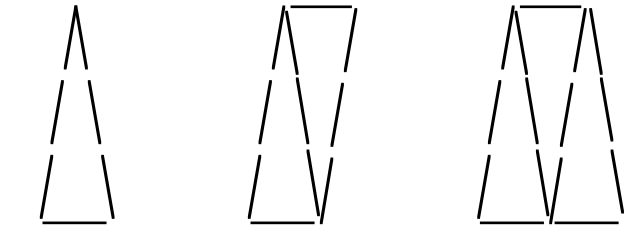
(c)



(d)



107. A pattern is made of triangles, using matches.



1 triangle
7 matches

2 triangles
11 matches

3 triangles
15 matches

(a) How many matches are needed for 4 triangles ?

(b) Copy and complete this table :-

Triangles (T)	1	2	3	4	5	6
Matches (M)	7	-	-COPY-			-

(c) Write down a formula which will allow you to calculate the number of matches needed (M) when you know the number of triangles (T).

M = ...

108. This table shows the weight (in grams) of a box with various numbers of tins of beans packed into the box.

number of tins (N)	1	2	3	4
weight (box + tins) (W)	550	1000	1450	1900

(a) By how many grams does the weight rise as each new tin of beans is added ?

(b) Find a formula for calculating the weight (W) of the box when any number (N) of tins are added.

W = ...

(c) Calculate the weight of a box with 12 tins of beans.

109. A single dice, marked 1 to 6, is rolled. What is the probability the dice shows :-

(a) the number 1 ? (b) an odd number ? (c) the number 10 ?

110.

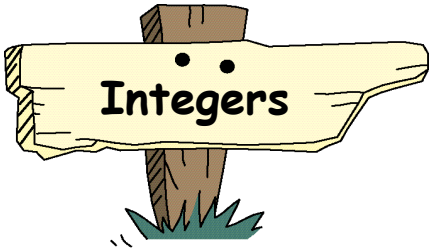
12 men and 8 women are sitting on a bus. What is the probability that the first person to get off the bus will be :-

(a) a man ? (b) a woman ?

111. Of the 30 players at a Rugby Union match, 5 of them received an injury during the game. Cyril was one of the 30 players.
What is the probability that Cyril was one of those injured ?

112. The probability of winning a particular game is $\frac{8}{15}$. The probability the game will be drawn is $\frac{2}{15}$. What must the probability of losing the game be ?

Chapter 1



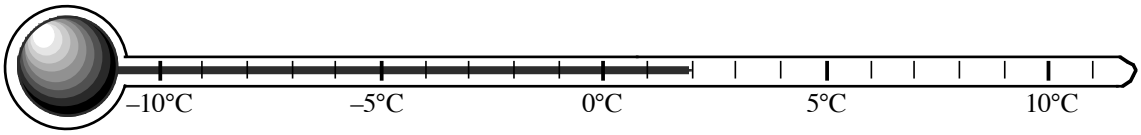
Definition An **INTEGER** is simply a POSITIVE or a NEGATIVE **whole number**.
(0 is also included in the set of integers)

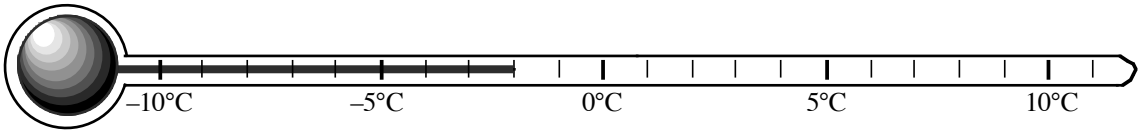
Examples :- –7, –19, 8, 23, 0, –5, 1000, –2003, etc. are all INTEGERS.

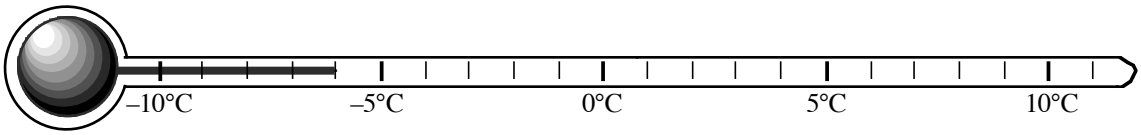
2·5, $\frac{1}{2}$, –2·1, $1\frac{3}{4}$, -13·6, etc are **NOT** integers

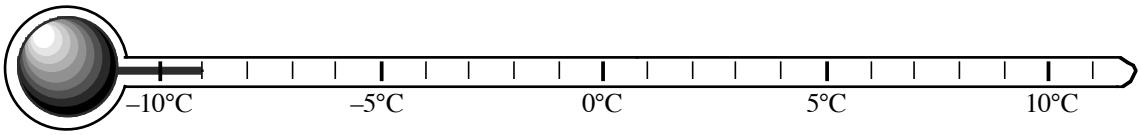
Exercise 1

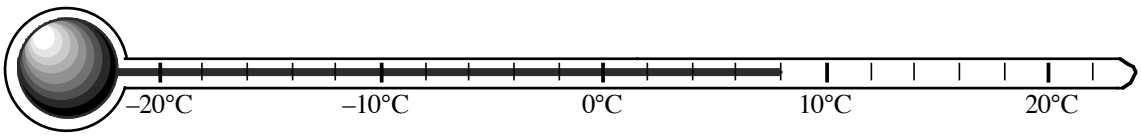
1. A thermometer is the most obvious place to see positive and negative numbers (integers). What temperatures are shown here :-

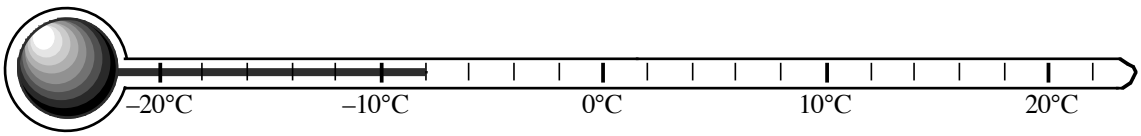
(a)


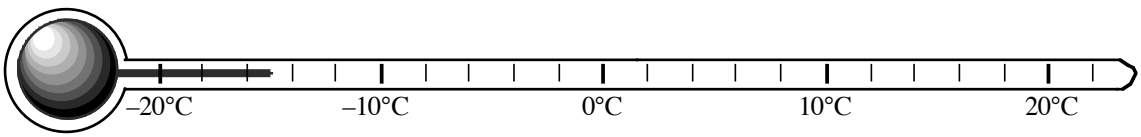
(b)


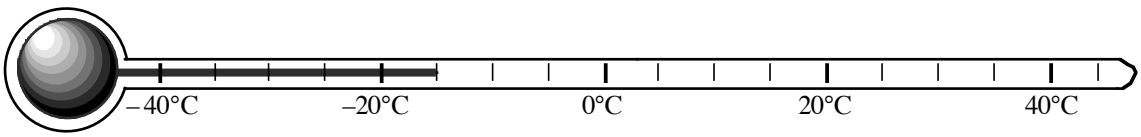
(c)


(d)


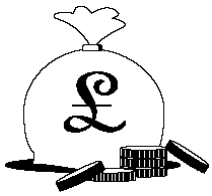
(e)


(f)


(g)


(h)


2. Negative numbers also occur when considering how much money you have (or don't have !) in a bank.



If you have £20 in your bank account, the computer notes this as

+£20·00

(a) If you are "overdrawn" by £20, what do you think the computer stores this as ?

(b) State what each of the following "bank balances" mean, in real terms :-

(i)

22/10/02

balance + £63·50

(ii)

15/11/01

balance - £18·00

(iii)

16/04/02

balance - £123·50

(iv)

20/12/99

balance £0·00

(c) I had £15 in my bank account and withdrew £20.

What will the computer show my balance to be now ?

(d) My bank balance is shown opposite.
I pay £10 into my account.

What will my new balance be ?

balance - £35·00

(e) My bank balance was exactly £0·00.
I withdrew £80.

What will my new balance be ?

(f) Last week my bank balance stood at - £40·00.
I withdrew a further £20.

What will my balance be now ?

(g) If my bank balance stood at - £85, how much must I deposit to "clear my overdraft" ?

(h) My balance showed +£15·50.
I signed two cheques, one for £18·20 and another for £7·90.

What will my new balance now show ?

3. When heights are measured as being above or below sea level, we can use negative numbers to describe them.

Heights **ABOVE** sea level are ***positive*** (+)

Heights **BELOW** sea level are ***negative*** (-)

cont'd .....

(a) Write down the heights or depths of the following :- (*use + or –*)
(*all measurements are in metres*)

(i) the gull

(ii) the pelican

(iii) the shark

(iv) the cliff top

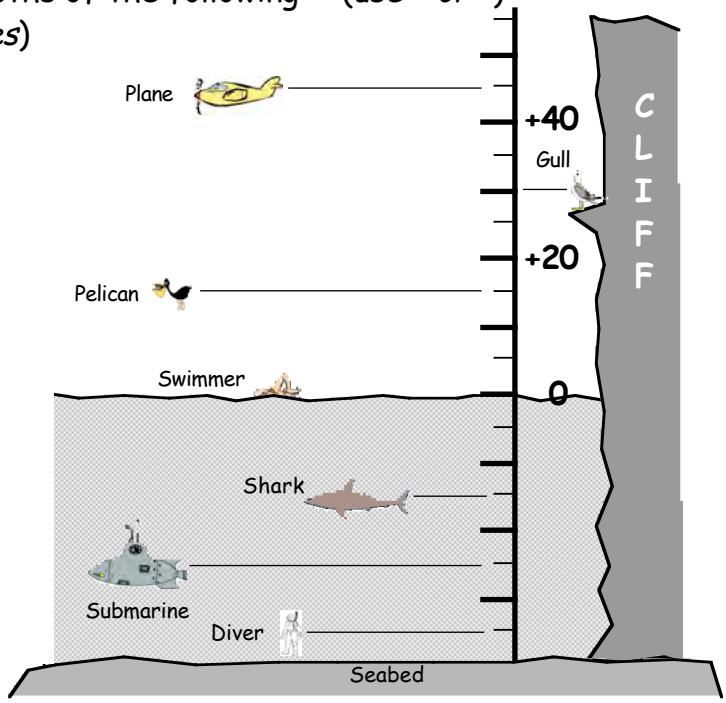
(v) the diver

(vi) the sea bed

(vii) the plane

(viii) the submarine

(b) How high is the pelican above the shark ?



4. A fourth use of negative numbers is in the context of **TIME**.

We say we live in the year 2003 A.D. (anno domini)

This means <u>2003 years since the birth of Christ</u>. (or **+2003**)

If someone lived in the year 50 B.C. (before Christ),
we say they lived in the year (– **50**).

(a) Write the following dates using the "+" or "–" signs :-

(i) 1066 A.D. (ii) 1812 A.D. (iii) 25 B.C. (iv) 1200 B.C.

(b) Artimus was born in 106 A.D. and died in 148 A.D.

How old was he when he died ?

(c) Maximus Plonktus was born in 82 B.C. and died in 22 B.C.

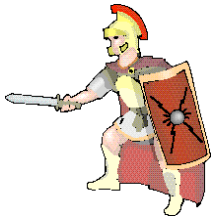
What was his age when he died ?

(d) Divinius Minumus was born in 15 B.C. and died in 35 A.D.

How old was he on his death ?

(e) Sanctius Catcus died in 24 A.D. at the age of 49.

In which year was he born ?



Studying Integers

The easiest way to handle integers is to draw or imagine them as temperatures on a thermometer.

Exercise 2 (No calculator)

1. Use a ruler to copy this thermometer neatly into your jotter.
(*it does not have to go all the way from –24 to +24*).

2. Look at your thermometer.

What is the temperature that is :-

(a) 5°C up from 8°C ?
(b) 9°C up from 0°C ?
(c) 12°C up from 6°C ?
(d) 6°C down from 11°C ?
(e) 9°C down from 20°C ?
(f) 4°C up from –2°C ?
(g) 7°C down from –3°C ?
(h) 20°C up from –6°C ?
(i) 6°C down from 5°C ?
(j) 10°C down from 0°C ?
(k) 4°C down from –5°C ?
(l) 12°C down from –2°C ?
(m) 2°C up from –10°C ?
(n) 15°C up from –20°C ?

3. Can you see that 4°C is "**5°C up from**" –1°C ?

Copy and complete these in the same way :-
(say whether it's " .. up from" or " .. down from" each time)

(a) 12°C is ..... from 4°C
(b) 6°C is ..... from 11°C
(c) 0°C is ..... from 15°C
(d) 4°C is ..... from –3°C
(e) –7°C is ..... from 0°C
(f) 2°C is ..... from –10°C
(g) –15°C is ..... from –10°C
(h) –4°C is ..... from 4°C
(i) 20°C is ..... from –20°C
(j) –50°C is ..... from –40°C

4. In Moscow, the temperature was –25°C.
In Stalingrad it was 15° colder.

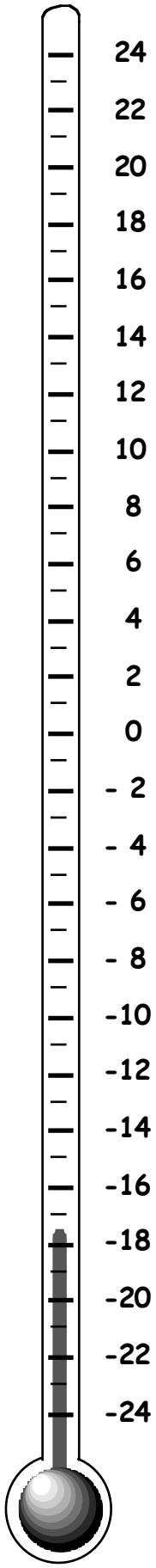
What was the temperature in Stalingrad ?

5. 

The temperature in the Sahara desert dropped from +35°C at noon to –15°C at midnight.

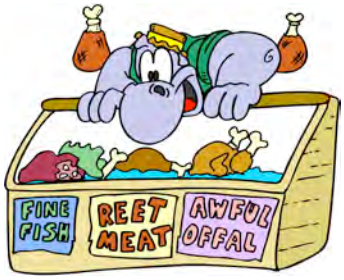
By how much had the temperature dropped ?

DO NOT MARK THIS THERMOMETER SCALE



6. When I left my freezer door open for an hour, the temperature rose from –22°C to –13°C.

By how much had the temperature risen ?

7. 

When a butcher put a side of beef in his freezer, its temperature fell by a **steady amount** each hour.

It started at 12°C and fell to 7°C in one hour.

What would the temperature be after :-

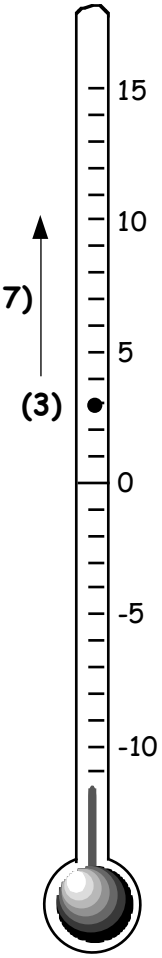
(a) 2 hours ? (b) 3 hours ?

(c) 4 hours ? (d) 10 hours ?

Adding and Subtracting Integers

When adding and subtracting integers, the best way is to draw or imagine them as temperatures on a thermometer.

Example 1 :- To find (3) + 7,
imagine the 3 on a thermometer.
To do the "+7" bit you go UP by 7 —> 3 + 7 = 10



Example 2 :- To find 4 + (–6),
imagine the 4 on a thermometer.
To do the "+ (–6)" bit you go DOWN by 6 —> 4 + (–6) = –2

Example 3 :- To find (4) – 7,
imagine the 4 on a thermometer.
To do the "–7" bit you go DOWN by 7 —> 4 – 7 = –3

Exercise 3 (No calculator)

1. Use the thermometer which you drew from the last exercise, (or draw a new one), to help you here.

Write down each question first, then the answer :-

(a) 5 + 7	(b) 3 + 8	(c) 0 + 9	(d) 8 + (–2)
(e) 6 + (–1)	(f) 12 + (–12)	(g) 4 + (–5)	(h) 2 + (–10)
(i) 0 + (–9)	(j) (–3) + 6	(k) (–5) + 5	(l) (–1) + 17
(m) (–10) + 6	(n) (–15) + 11	(o) 2 + (–7)	(p) (–2) + (–7)
(q) (– 4) + (– 4)	(r) (–5) + (–10)	(s) (–12) + 2	(t) (–12) + (–2)

2. Again use your thermometer to help here :-
(remember :- 8 – 9 means "go to 8, then move <u>down</u> by 9").

(a) 9 – 3	(b) 10 – 10	(c) 4 – 1	(d) 3 – 5
(e) 5 – 10	(f) 2 – 12	(g) 0 – 15	(h) (–1) – 4
(i) (–7) – 3	(j) (–11) – 5	(k) (–1) – 21	(l) 0 – 35
(m) 19 – 39	(n) (–15) – 25	(o) 100 – 300	(p) (–71) – 29

3. A **<u>Mixture</u>** !! The rule is simple.

Picture the first number on your thermometer.

If you add a positive number move **UP**.
If you add a negative number or take away a number move **DOWN**.

(a) 3 + 6	(b) 2 + (–5)	(c) 4 – 7	(d) (–3) + 10
(e) –2 + (–3)	(f) 8 – 12	(g) (–2) – 5	(h) (–20) + (–15)
(i) –15 + 20	(j) 0 – 13	(k) 0 + (–13)	(l) (–15) + (–7)
(m) 15 + (–7)	(n) (–15) + 7	(o) (–11) + 11	(p) 63 – 97

<u>Simple Multiplication and Division of Integers</u>

Since 3 x 5 = 15, then obviously 3 x (–5) cannot also be 15.
3 x (–5) means "3 lots of –5" = –15.

<u>Some Examples</u> :- 2 x (–7) = –14 5 x (–8) = –40.
(–3) x 6 = –18 (–10) x 10 = –100.

Similarly :- since 10 ÷ 2 = 5 then obviously (–10) ÷ 2 cannot also be 5.
(–10) ÷ 2 = "–10 shared by 2" = –5.

<u>Some Examples</u> :- (–12) ÷ 4 = –3 (–20) ÷ 10 = –2.
(–36) ÷ 6 = –6 (–100) ÷ 20 = –5.

Exercise 4 (No calculator)

1. Write down each of the following and find the answers :-

(a) 4 x (–5)	(b) 6 x (–7)	(c) 2 x (–9)	(d) 5 x (–5)
(e) (–8) x 3	(f) (–9) x 4	(g) (–11) x 2	(h) (–10) x 7
(i) 6 x (–8)	(j) 8 x (–3)	(k) 4 x (–12)	(l) 7 x (–7)
(m) 9 x (–1)	(n) (–9) x 3	(o) (–2) x 10	(p) (–9) x 5

2. Write down each of the following and find the answers :-

(a) (–30) ÷ 6	(b) (–20) ÷ 5	(c) (–56) ÷ 7	(d) (–63) ÷ 9
(e) (–40) ÷ 2	(f) (–90) ÷ 10	(g) (–33) ÷ 3	(h) (–32) ÷ 4
(i) (–8) ÷ 8	(j) (–5) ÷ 1	(k) (–54) ÷ 6	(l) (–100) ÷ 5

3. Find the answers to the following :-

(a) $(4 \times 9) \div 6$ (b) $(2 \times (-10)) \div 5$ (c) $3 \times (-2) \times 4$ (d) $5 \times (-1) \times 6$

(e) $3 \times (-8) \div 6$ (f) $(-6) \times 6 \div 4$ (g) $6 \times (-4) \div 2$ (h) $10 \times (-10) \div 5$

4. Find the following :- (*hint : find the bit in brackets first*)

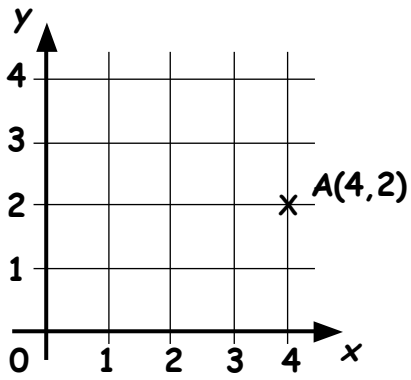
(a) $(8 + (-5)) \times 7$ (b) $6 \times (4 - 7)$ (c) $((-10) + 2) \times 2$

(d) $((-4) - 8) \div 2$ (e) $10 \times (12 - 14)$ (f) $(8 - 3) \times (-5)$

(g) $((-3) - 4) \times 5$ (h) $(6 + (-12)) \div 3$ (i) $((-9) - 11) \div 5$

(j) $(-4) \times ((-2) + 7)$ (k) $(8 + (-8)) \times 5$ (l) $(-60) + (-30)) \div 10$

Coordinates



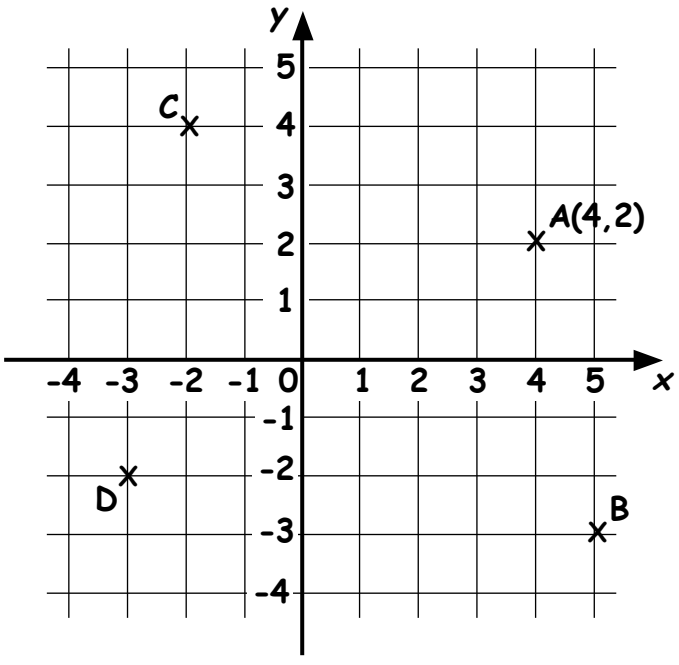
Revision :- You should know what a Cartesian diagram (or a co-ordinate diagram) looks like.

Remember :- *x*-axis (or horizontal axis).
y-axis (or vertical axis).
the origin (*O*).
A is 4 (right) and 2(up) from the origin.
=> *A*(4, 2) has *x*-coordinate 4 and *y*-coordinate 2.

We now extend the set of *x* and *y* axes backwards and downwards.

Look at the numbers on the *x*- and *y*– *axes.*

They now include **NEGATIVE** values.



Can you see the following :-

the point B is 5 (to the right) and 3 (down) from the origin —> B(5 ,-3)

the point C is 2 (to the left) and 4 (up) from the origin —> C(-2, 4)

the point D is 3 (to the left) and 2 (down) from the origin —> D(-3, -2) ?

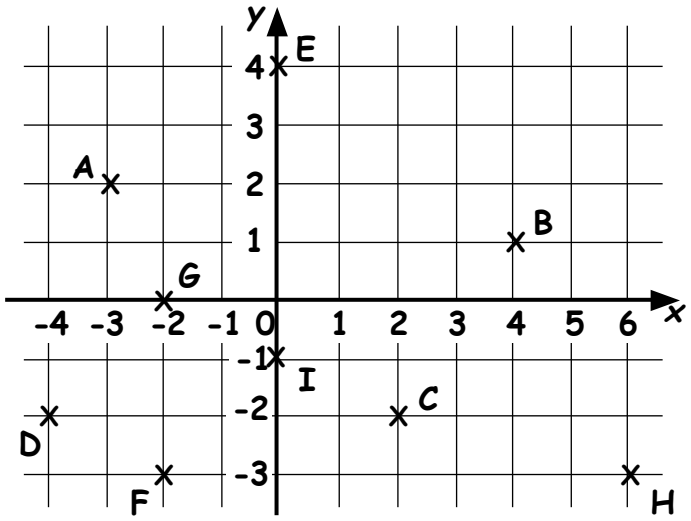
Exercise 5

1. Look at this coordinate diagram.

   The coordinates of A are

   A(–3, 2)

   Write down the coordinates of the other 8 points.



2. Draw a large set of axes (–10 to 10 on both scales).
   Plot each set of points, join them up and state what shape each is :-

   (a) A(3,3) B(5,4) C(7,3) D(5,–2).

   (b) E(–7,5) F(–5,8) G(2,8) H(0,5).

   (c) I(–10,3) J(–8,3) K(–9,–3).

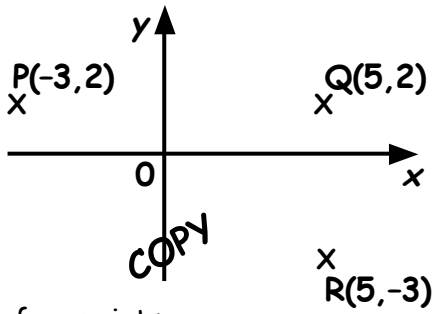
   (d) L(1,–5) M(–4,–4) N(–5,1) O(0,0).

   (e) P(4,–5) Q(6,–7) R(5,–9) S(3,–9) T(2,–7) P(4,–5).

   (f) U(–8,–3) V(–6,–3) W(–5,–5) X(–6,–7) Y(–8,–7) Z(–9,–5) U(–8,–3).

3. (a) Copy this diagram and plot the three points P(–3,2), Q(5,2) and R(5,–3).

   (b) Try to find a 4th point, (call it S) such that PQRS is a rectangle. Show S on your diagram, and write down its coordinates.



4. (a) Draw a set of axes, (–6 to 6 on both scales) and plot the four points A(2,1), B(3,5), C(5,5), D(6,1).

   (b) Join the four points and state which type of shape is formed.

   (c) "Flip" each of the four points over the *x*-axis to form a new four-sided shape. (This is called "**REFLECTING**" the shape).

   (d) Write down the coordinates of the four corners of this new reflected shape.

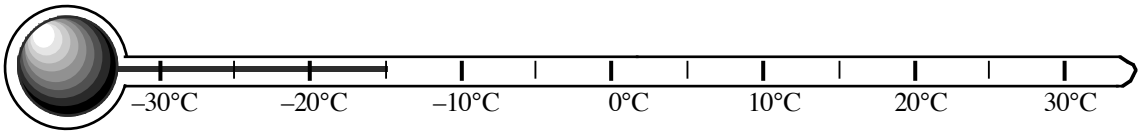
5. Draw a set of axes, (–5 to 5 on both scales). Join each of these sets of points with lines :-

(2, 3) to (4, 3)	(1, 0) to (1, –2)	(–2, 0) to (–4, 0)	(–1, –3) to (–1, –5)
(–1, 2) to (1, 2)	(–3, 1) to (–3, 3)	(–1, –5) to (–3, –5)	(2, 1) to (2, 3)
(2, 0) to (3, –1)	(0, –4) to (2, –3)	(–1, 3) to (–1, 1)	(3, –1) to (3, –2)
(–3, –3) to (–3, –5)	(–1, 0) to (–1, –2)	(2, 2) to (4, 2)	(0, –3) to (0, –5)
(–1, 0) to (1, 0)	(–4, –2) to (–3, –2)	(–1, 3) to (1, 3)	(–1, –1) to (1, –1)
(0, –4) to (2, –5)	(–1, 1) to (1, 1)	(–3, 0) to (–3, –2)	(2, 1) to (4, 1)
(4, 0) to (3, –1)	(–3, –3) to (–1, –3)	(–4, 3) to (–2, 3)	

   What message is produced ?

What have I learned ?

1. What temperature is shown here ?



2. I had £30 in my bank account and wrote a cheque for £50.

   What was my new balance ?

3. Artimus was born in the middle of 26 B.C. and died at the end of 44 A.D.
   How old was he when he died ?

4. What is the temperature that is :-

   (a) 7°C up from –2°C ? (b) 4°C down from –11°C ?

5. The temperature rose from –32°C to –18°C. By how much had it risen ?

6. Find the following :-

(a) 3 + (–7)	(b) (–2) + 8	(c) (–10) + 4	(d) (–6) + (–4)
(e) (–7) + 7	(f) 6 – 7	(g) 2 – 11	(h) (–5) – 3
(i) (–18) – 12	(j) 4 + (–7)	(k) 0 + (–7)	(l) (–6) + (–3)
(m) (–7) + 5	(n) 6 × (–2)	(o) (–8) × 4	(p) 0 × (–5)
(q) 9 × (–5)	(r) (–12) ÷ 6	(s) (–9) ÷ 9	(t) (–50) ÷ 5

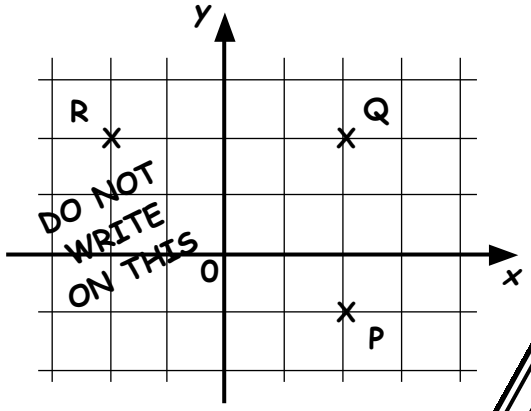
7. Find the following :-

(a) (3 × (–8)) ÷ 6	(b) 5 × (–2) × 4	(c) [6 + (–3)] × 5
(d) (2 – 5) × 7	(e) –2 × (–5 + 8)	(f) (– 40) + (–20) ÷ 10

8. (a) Write down the coordinates of the three points, P, Q and R.

   (b) Find a fourth point, (call it S) such that PQRS is a rectangle.

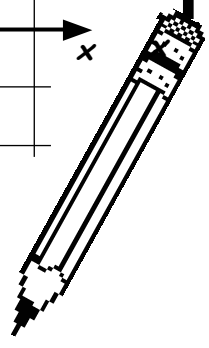
   Write down the coordinates of S.



9. (a) Draw a new set of axes, (–6 to 6 on each scale) and plot the points :-

   A(–3, 1), B(4, 3), C(3, –1) and D(– 4, –3).

   (b) Join A —> B —> C —> D. (c) What shape is ABCD ?



REVIEW

Rounding

NO CALCULATOR :-

1. Round to the nearest whole number :-

   (a) 21·9 (b) 17·62 (c) 203·4981

2. Round to the nearest 10 :-

   (a) 287 (b) 2135 (c) 1987

3. Round to the nearest 100 :-

   (a) 1548 (b) 3170 (c) 1987

4. Round to the nearest 1000 :-

   (a) 17502 (b) 49792 (c) 1987

5. By rounding each number first, find an ESTIMATE to :-

   (a) 388×13 (b) $5839 \div 29$ (c) $(29)^2$

6. Write down the answer to :-

   (a) 37×10 (b) 10×3106 (c) 62×100

   (d) 100×509 (e) 1000×7 (f) 94×1000

7. Use the "two-step" method to find :-

   (a) 31×40 (b) 211×60 (c) 34×30

   (d) 200×62 (e) 700×12 (f) 204×800

8. Use the "two-step" method to find :-

   (a) $1560 \div 30$ (b) $8240 \div 40$ (c) $25500 \div 50$

   (d) $3600 \div 600$ (e) $22800 \div 200$ (f) $186000 \div 3000$

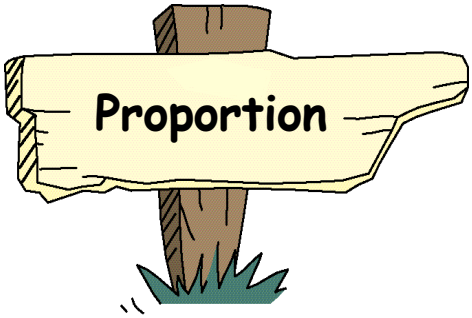
9. A jar contains 36 lollipops. How many lollies are there in 30 jars ?

10. 50 people have a share in a lottery win of £245 000.
    How much will each person receive ?

11. A rectangle measures 287 mm by 62 mm. Write down an estimate of its **area**.

12. 892 grams of cake mix are to be piped into 32 small cake cases.
    Approximately how much mixture goes into each case ?

Chapter 2



Rates

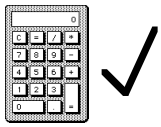
If you know how many miles you drive and how many litres of petrol you use, you can calculate the number of miles per litre your car travels.

Example – I drove 72 miles on 8 litres of petrol

—> **DIVIDE** => 8 litres —> 72 miles

1 litre —> 72 ÷ 8 = 9 miles

(Rate =) 9 miles per litre



Exercise 1 (You may use a calculator here, but show your lines of working).

1. A car covered a distance of 320 miles on 8 gallons of petrol.

   Calculate the rate in "miles per gallon".

   Set down 8 gallons —> 320 miles

   1 gallon —> 320 ÷ 8 = ?

   = ? miles/gallon.

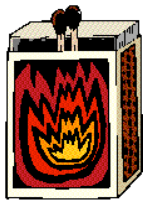
2. 

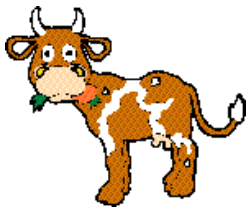
   A sprinter covered a distance of 108 metres in 12 seconds.

   Calculate his speed in metres/second.

3. When 6 boxes of matches are emptied into a pile, the pile contains 252 matches.

   Calculate the rate of matches/box.



4. 

   7 cows ate a total of 36·4 kilograms of hay.

   Calculate the rate of kilograms of hay per cow.

5. A bunch of 12 bananas cost me £1·80.

   Calculate the cost in pence per banana.

6. 

   It took 20 lorries to move 43 tonnes of rubble.

   Calculate the rate of tonnes per lorry.

7. When I parked my car for 6 hours in the multi-storey car park, I was charged £3·30.

Calculate the rate per hour.

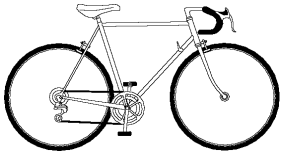
8. 

A dozen copies of a paperback costs £76·80.

Calculate the rate per book.

9. It costs me £14·40 to hire a bike for $4\frac{1}{2}$ hours (4·5).

Calculate the rate per hour.



10. £5 can be exchanged for $7·50.

Calculate the rate of dollars/£.

11. 

Jane types 960 words in 8 minutes.

Calculate her rate of words/minute.

12. Nurse Laura measures a patient's heartbeat.
It beats 515 times over a 5 minute period.

Calculate the rate in beats/minute.

13. 

David worked 8 hours as a fruit picker and earned £36.
Shona worked as a packer for 6 hours and earned £30.

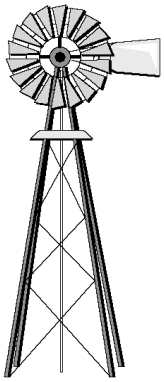
(a) Calculate David's rate of pay. (in £'s/hour)

(b) Calculate Shona's rate of pay. (in £'s/hour)

(c) Who has the higher rate of pay ?

14. The vanes of a windmill make 90 complete revolutions in a one hour period.

Calculate the number of revolutions per **minute**.



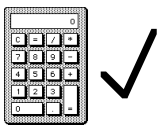
Direct Proportion

Two quantities, (for example, number of Mars Bars and total cost) are said to be in **direct proportion**, if :-

"*When you <u>double</u> the number of Mars Bars —> you <u>double</u> the cost*".

Example – 7 Mars Bars cost £3·15. What will 4 cost ?

Set down like this :-



Mars Bars		Cost
7	—>	3·15
(divide) 1	—>	3·15 ÷ 7 = 0·45
(multiply) 5	—>	5 x 0·45 = £2·25

Exercise 2 (In each of these, 3 lines of working as well as two headings are expected).

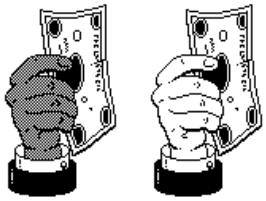
1. 6 copies of a textbook cost £69. Find the cost of 4 textbooks.

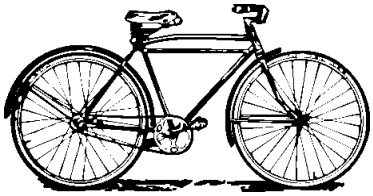
Set down like this :-

Textbooks		Cost
6	—>	£69
1	—>	£69 ÷ 6 = £.....
4	—>	

2. When I exchanged £10 for dollars, I received $15·20.

How many dollars would I get for £8 ?
(*Find how much I would get for £1 first*).



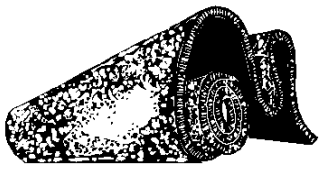
3. 

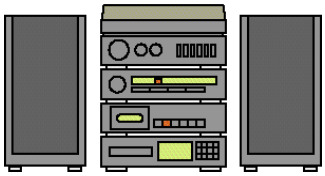
In 12 minutes, I cycled 4800 metres around a track.

How far would I travel in 15 minutes ?
(*Find how far I would travel in 1 minute*).

4. 20 square metres of carpet cost £150.

What would I pay for 32 square metres of carpet ?
(*Find the cost of 1 square metre first*).



5. 

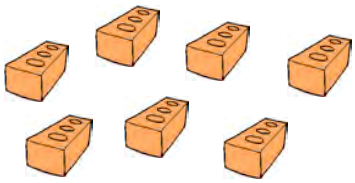
In 30 seconds, a C.D. spins 180 times.

How many times will it spin in :-

(a) 1 second ? (b) 7 seconds ?
(c) 45 seconds ? (d) 2 minutes ?

6. 50 bricks, end to end, make a wall 12·50 metres long.

How long would a row of 30 bricks be ?



7. 

4 metres of timber costs £6·32.

How much would I pay for 5 metres ?

8. A 5 storey block of flats stands 13 metres high.

How high would you expect a similar 6 storey block to be ?

9. 

Julie can type 375 words in 5 minutes.

How many words might she be able to type in 7 minutes ?

10. When 200 millilitres of water are poured into a cylindrical jar the depth of water is 5 centimetres.

How many millilitres are needed to fill the jar to a depth of 8 centimetres ?

11. 

A grandfather clock pendulum swings backwards and forwards 180 times in 3 minutes.

How many times will it swing in 5 minutes ?

12. A book, which is 4 centimetres thick, contains 1120 pages .

How many pages would the book have had if it was only 3 centimetres thick ?

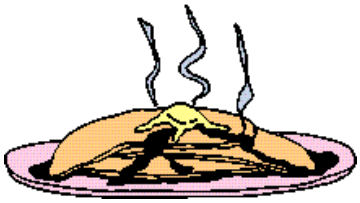
13. 

As the sun sets, a 3 metre high tree casts a shadow 7·5 metres long.

At the same time, what length of shadow would be cast by a 4 metre high tree ?

14. 2 eggs are required, along with other ingredients, in the making of 22 pancakes.

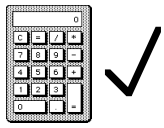
How many pancakes could Mrs White make with 5 eggs ?



What have I learned ?

1. A rock climber climbed 4 metres in 3 minutes.

   Calculate the rate of climb in metres/minute.



2. 

   Postman Pat delivered 45 letters in 15 minutes.
   Postman Mick delivered 70 letters in 20 minutes.

   (a) Calculate Pat's rate of delivery in letters/minute.
   (b) Calculate Mick's rate of delivery in letters/minute.
   (c) Who had the higher delivery rate ?

3. 3 tyres from "Slow-Fit" costs me £55·20.

   (a) What is the cost of 1 tyre ?

   (b) How much would it cost to replace all 4 of my tyres ?

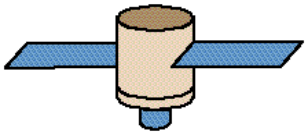
4. 

   I played a track on my C.D., (set to repeat), 4 times.
   This took exactly 12 minutes.

   How long would it take to play the same track 5 times ?

5. It took a satellite 130 hours to go around the earth 5 times.

   How long would the satellite take to go round 8 times ?



6. 

   George, the gardener, needed 72 grams of grass seed to cover an area of $8m^2$.

   How much seed would be needed for $15m^2$ of grass ?

7. When a tap is opened, water flows into a rectangular tank at a steady rate.
   In 6 minutes the depth of water rose to 8·4 centimetres.

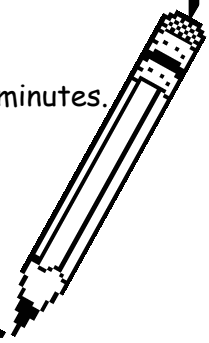
   How deep would the water be in :-

   (a) 8 minutes ? (b) 15 minutes ? (c) one hour ?

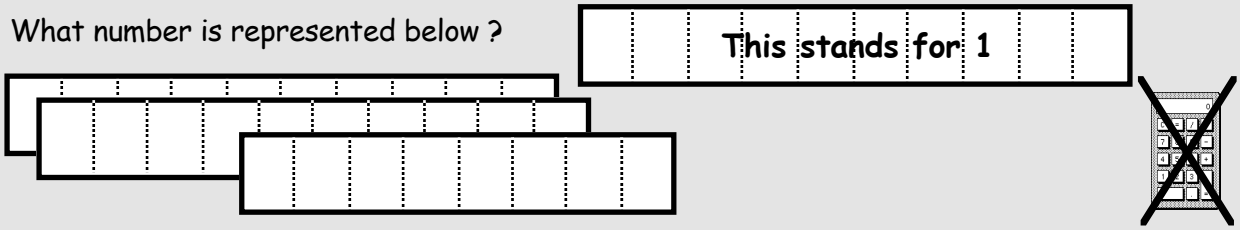
8. 

   In an eating competition, Laura ate 18 pies in 4 minutes.
   Louise ate 23 pies in 5 minutes.

   Which girl was the faster eater ?
   (*i.e. who had the higher rate ?*)



1. What number is represented below ?



2. Use a ruler to **neatly** represent the number 3·4 in the same way as shown above.

3. Round these numbers to 1 decimal place :-

(a) 5·27 (b) 23·94 (c) 7·45 (d) 0·88 (e) 13·97

4. Round these numbers to 2 decimal places :-

(a) 8·263 (b) 20·296 (c) 0·877 (d) 5·235 (e) 0·0396

5. Copy and do the following :-

(a) $\begin{array}{r} 7{\cdot}93 \\ +\ 2{\cdot}47 \\ \hline \\ \hline \end{array}$ (b) $\begin{array}{r} 19{\cdot}62 \\ -\ 7{\cdot}56 \\ \hline \\ \hline \end{array}$ (c) 32·6 + 7·39 (d) 16 – 3·62

(e) $\begin{array}{r} 21{\cdot}3 \\ -7{\cdot}64 \\ \hline \\ \hline \end{array}$ (f) 0·88 + 8·8 (g) $\begin{array}{r} 13 \\ -6{\cdot}4 \\ \hline \\ \hline \end{array}$ (h) 3 – 2·05

6. Copy and do the following :-

(a) $\begin{array}{r} 5{\cdot}4 \\ \times\ 3 \\ \hline \\ \hline \end{array}$ (b) $\begin{array}{r} 9{\cdot}3 \\ \times\ 7 \\ \hline \\ \hline \end{array}$ (c) $\begin{array}{r} 15{\cdot}4 \\ \times\ 5 \\ \hline \\ \hline \end{array}$ (d) $\begin{array}{r} 0{\cdot}82 \\ \times\ 6 \\ \hline \\ \hline \end{array}$

(e) $3\overline{)19{\cdot}2}$ (f) $8\overline{)59{\cdot}2}$ (g) $5\overline{)22{\cdot}65}$ (h) $9\overline{)7{\cdot}38}$

7. Write down the answers to the following :-

(a) 5·23 × 10 (b) 10 × 0·793 (c) 6·47 × 100 (d) 0·1 × 100

(e) 0·807 × 100 (f) 1000 × 4·863 (g) 0·0739 × 1000 (h) 0·0003 × 100

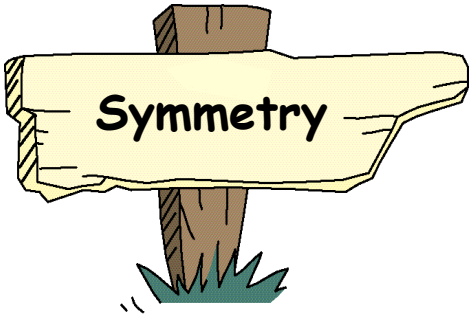
8. Write down the answers to the following :-

(a) $10\overline{)18{\cdot}4}$ (b) $10\overline{)9{\cdot}2}$ (c) $100\overline{)87{\cdot}6}$ (d) $10\overline{)9{\cdot}7}$

(e) $100\overline{)60{\cdot}5}$ (f) $100\overline{)65}$ (g) 56·7 ÷ 10 (h) 2·1 ÷ 100

(i) 3817 ÷ 1000 (j) $\frac{296}{1000}$ (k) $1000\overline{)11{\cdot}7}$ (l) $1000\overline{)0{\cdot}8}$

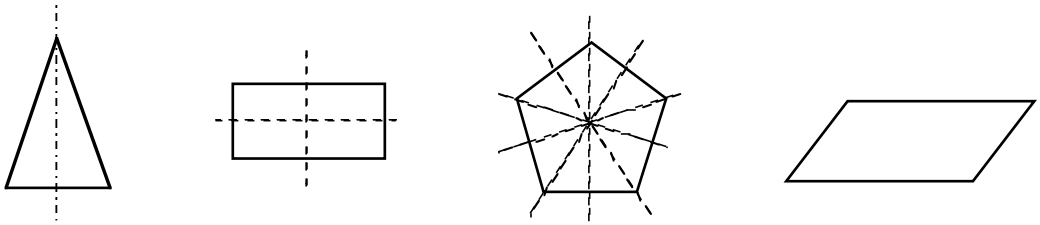
Chapter 3



Lines of Symmetry

Definition :- A shape has a line of symmetry if, when folded over the line :-
"the 2 halves of the shape match up exactly".

Examples :-

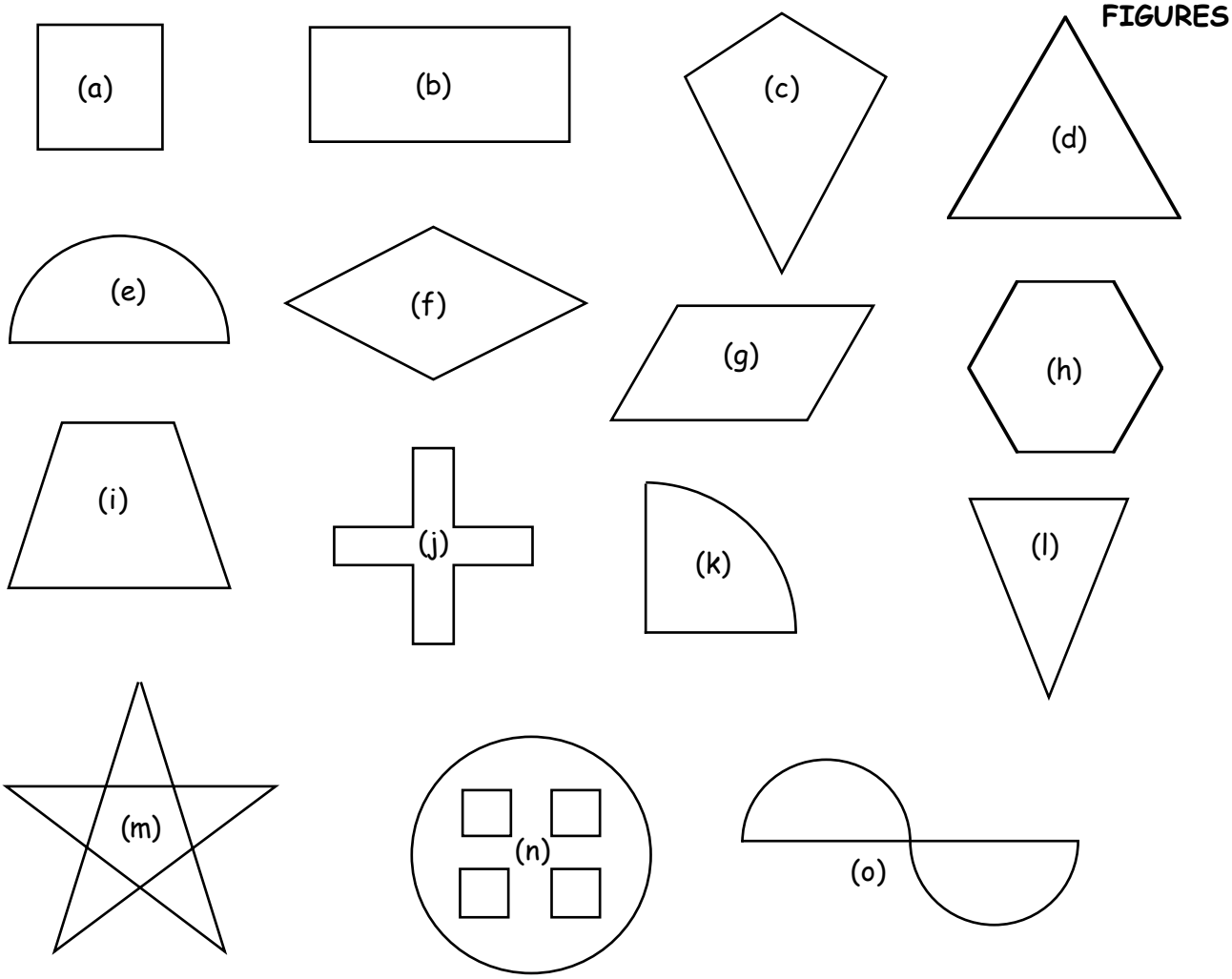


1 line of symmetry | 2 lines of symmetry | 5 lines of symmetry | No lines of symmetry

Exercise 1 (You will need a ruler and tracing paper)

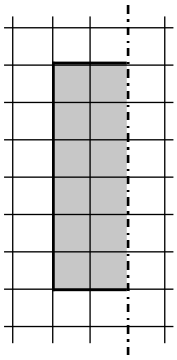
DO NOT MARK THESE FIGURES

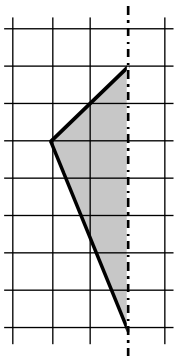
1. Copy each of the following neatly using tracing paper.
   Mark with a coloured pencil (or a dotted line) all the lines of symmetry.

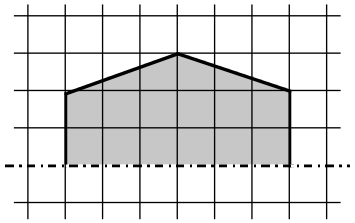


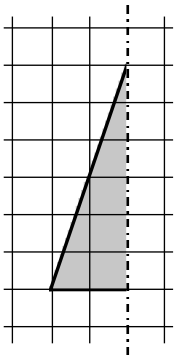
2. In this question, only half of each figure is shown.
Shown also is a line of symmetry.

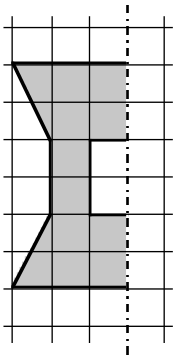
Either trace these shapes into your jotter or onto tracing paper and neatly draw the other half.

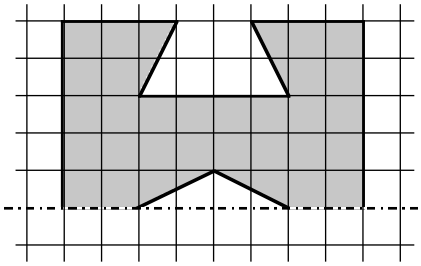
(a) 

(b) 

(c) 

(d) 

(e) 

(f) 

3. Shown below are all the CAPITAL letters of the alphabet.

A B C D E F G H I
J K L M N O P Q R
S T U V W X Y Z

(a) List **ALL** the letters which have exactly 1 line of symmetry.

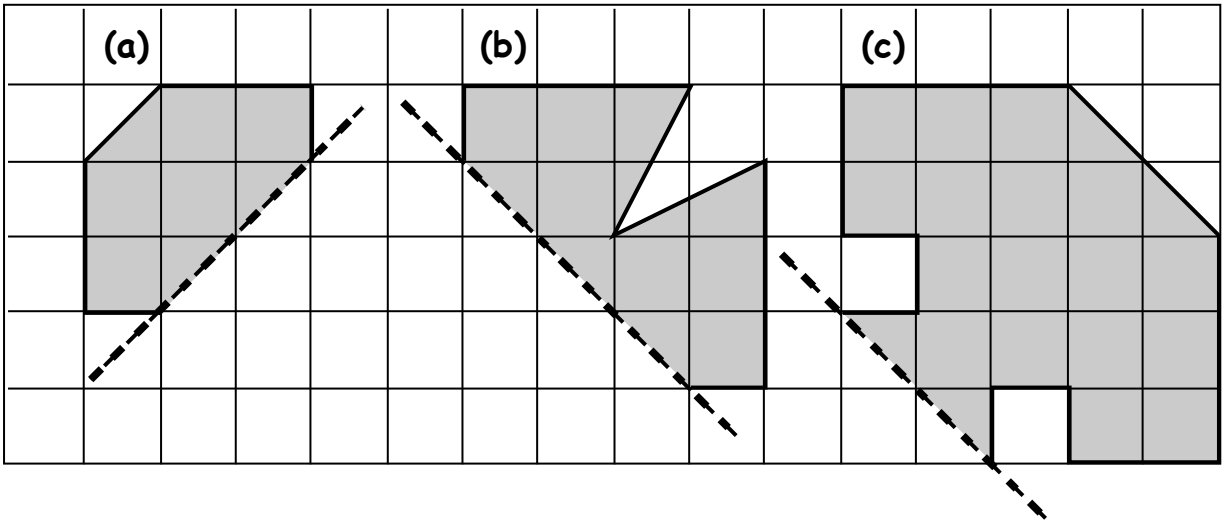
(b) List **ALL** the letters which have exactly 2 lines of symmetry.

(c) Which letters have **NO** lines of symmetry ?

(d) If the letters X and O are drawn this way,
how many lines of symmetry will each one have ?

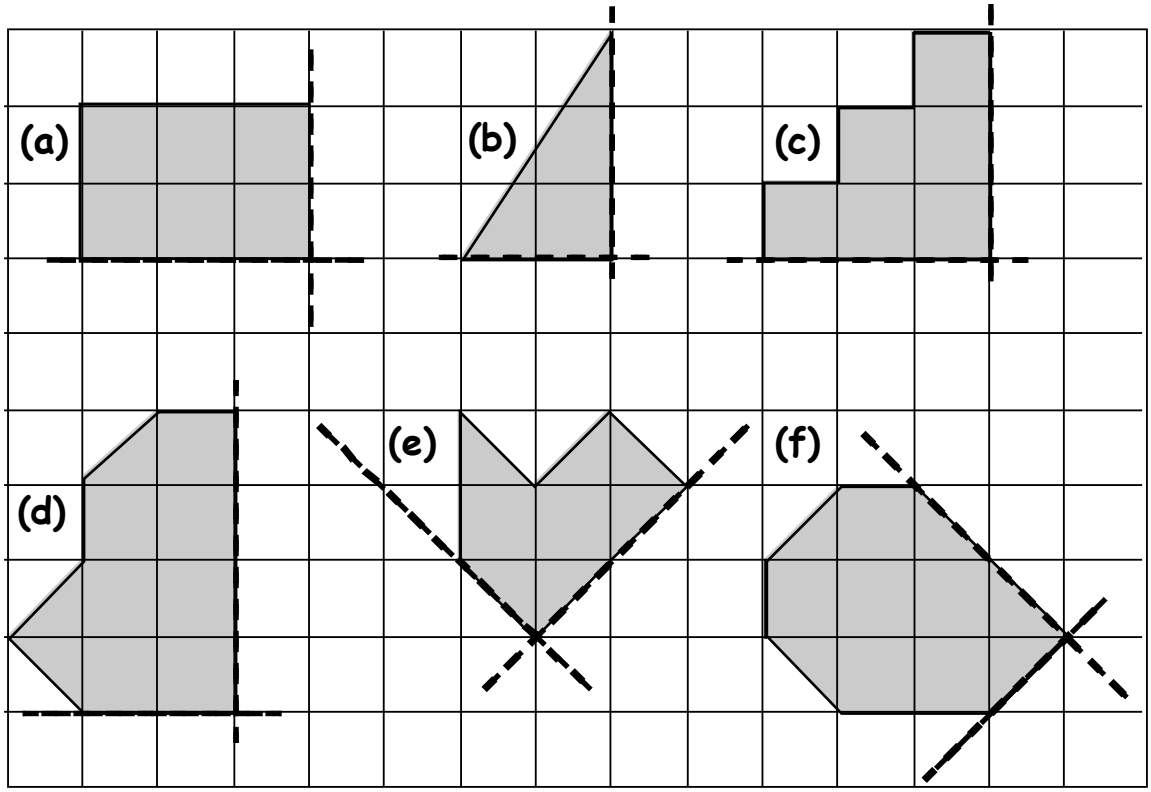
4. The following shapes have a sloping line of symmetry.

Trace each one onto tracing paper (harder to complete).
or copy each one onto 1 centimetre squared paper.
or trace each one carefully into your jotter ($\frac{1}{2}$ cm squared) and neatly complete each one.

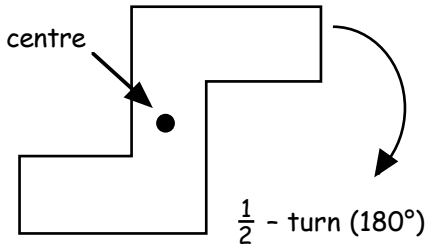


5. Do the same here.

This time, each shape has to have 2 lines of symmetry.



Half Turn Symmetry



Can you see that this "S" shape has NO lines of symmetry ?

It has a **different** type of symmetry.

It has "$\frac{1}{2}$-turn symmetry".

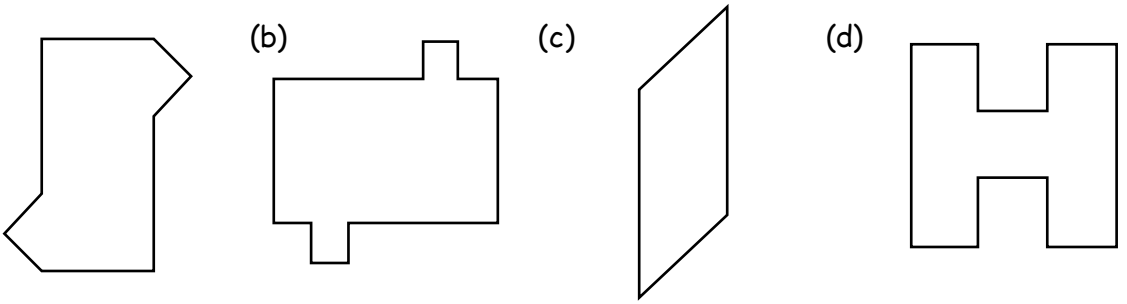
If a pin was stuck in its centre point and the shape turned (or rotated) by 180° around the point, it would fit back on itself.

DO NOT MARK THESE FIGURES

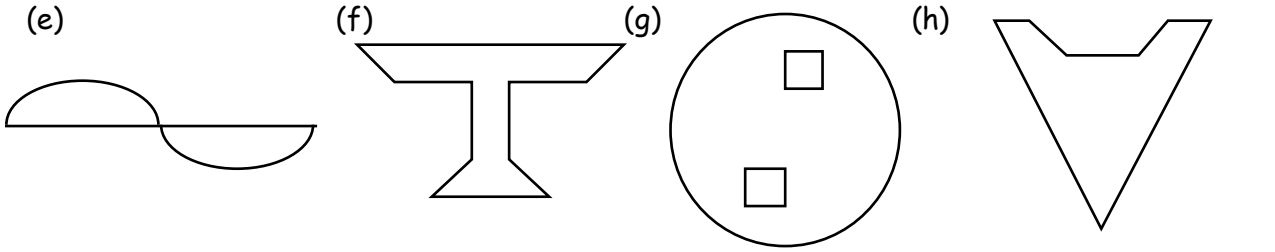
Exercise 2

1. Which of the following shapes have $\frac{1}{2}$-turn symmetry ?
   (You might like a piece of tracing paper to try them out if you are unsure).
   (Do **NOT** mark the figures in the book).

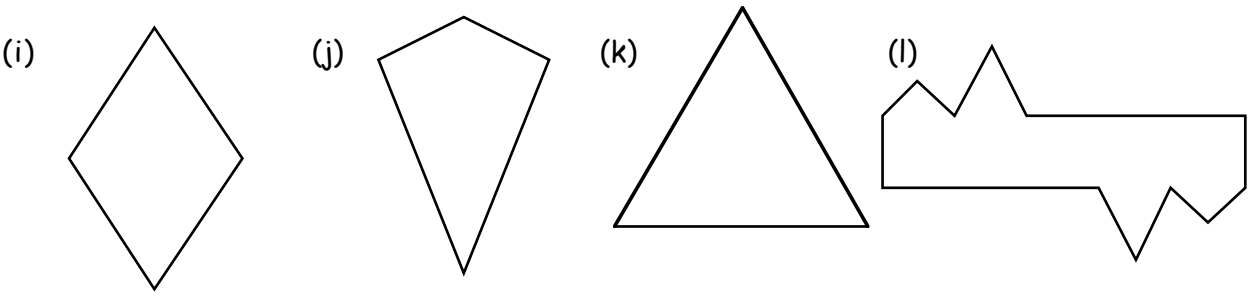
(a) (b) (c) (d)



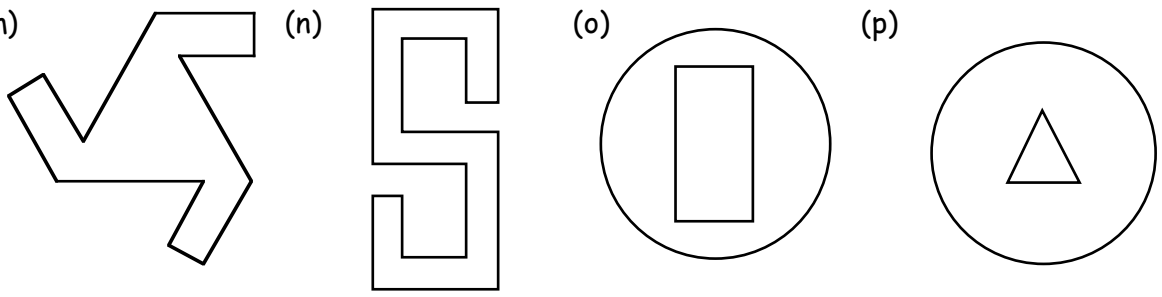
(e) (f) (g) (h)



(i) (j) (k) (l)



(m) (n) (o) (p)



2. In Exercise 1, you were asked to say which letters of the alphabet had lines of symmetry.

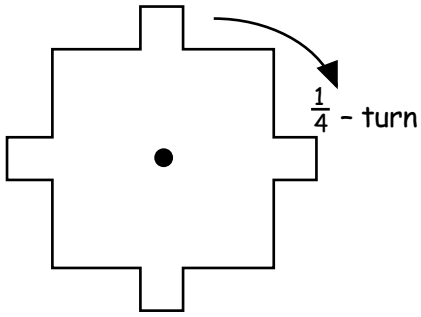
A B C ..... (look back three pages !)

(a) Which seven letters of the alphabet have $\frac{1}{2}$-turn symmetry ?

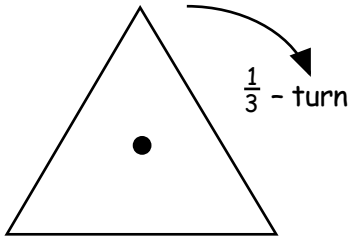
(b) Of the seven letters which have $\frac{1}{2}$-turn symmetry, only three do **not** have a line of symmetry. Which three ?

A shape has "$\frac{1}{2}$-turn symmetry" if it only takes a $\frac{1}{2}$-turn for the shape to fit on itself.

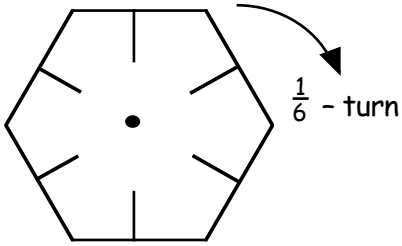
Some shapes have different types of "turn" symmetry.



$\frac{1}{4}$ - turn symmetry
(only needs a $\frac{1}{4}$ turn (90°) to turn on itself)



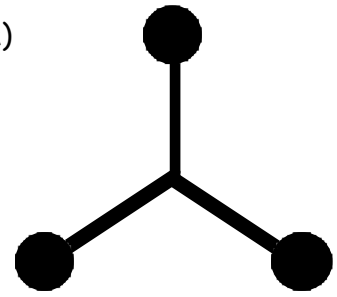
$\frac{1}{3}$ - turn symmetry
(only needs a $\frac{1}{3}$ turn (120°) to turn on itself)



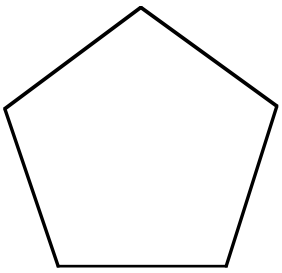
$\frac{1}{6}$ - turn symmetry
(only needs a $\frac{1}{6}$ turn (60°) to turn on itself)

3. Say what kind of "turn" symmetry each of the following shapes have.
($\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{8}$, etc) (tracing paper may help)

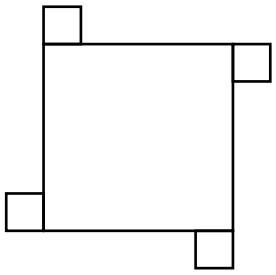
(a)



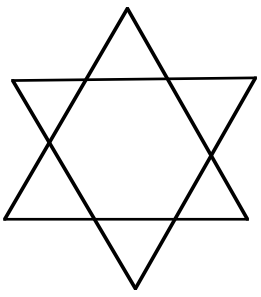
(b)



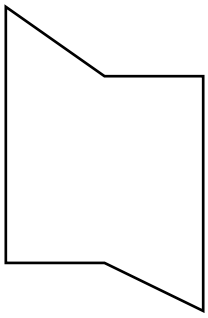
(c)



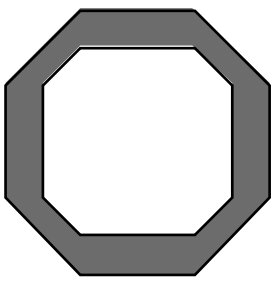
(d)

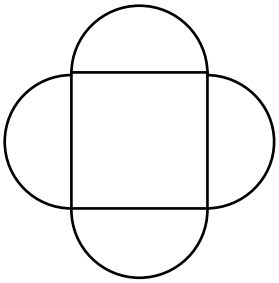


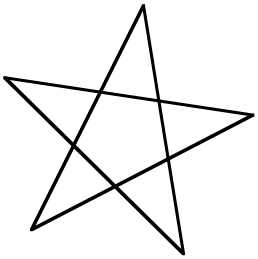
(e)

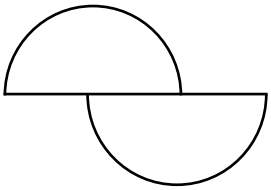


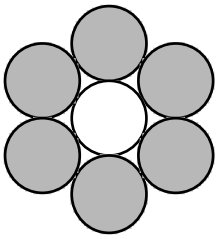
(f)

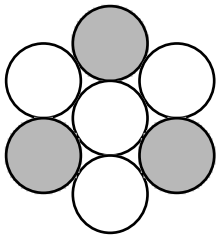


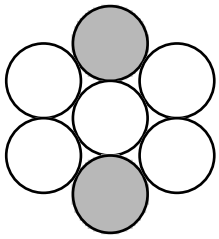
(g) 

(h) 

(i) 

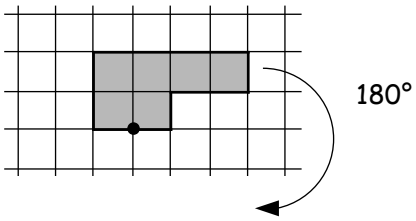
(j) 

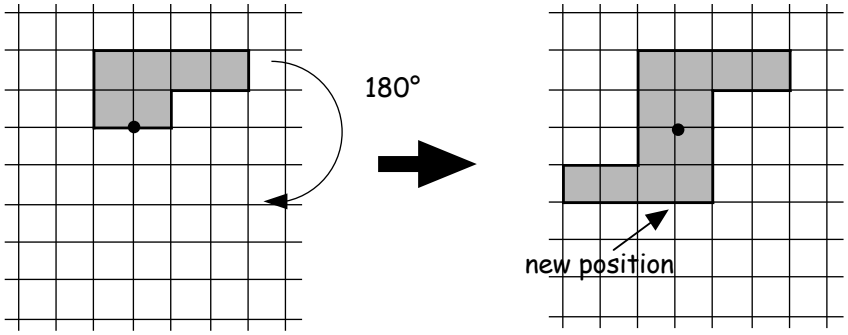
(k) 

(l) 

Rotating a given shape by a $\frac{1}{2}$ turn (180°)

The dot in this diagram has to be the centre of symmetry when the shape is rotated $\frac{1}{2}$ turn about it.

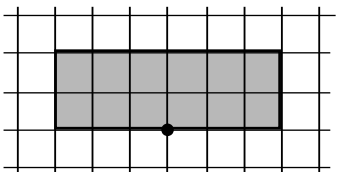




Exercise 3 (You will need a ruler or straight edge and $\frac{1}{2}$ cm squared paper)

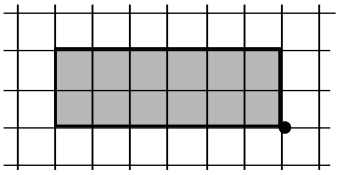
1. (a) Copy this rotation onto $\frac{1}{2}$ centimetre squared paper.

   (b) Rotate it by a $\frac{1}{2}$ turn around the dot.

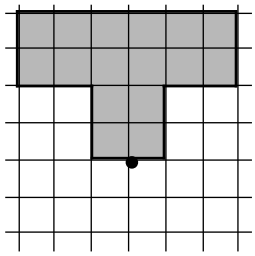


2. (a) Make a second copy of this rectangle.

   (b) This time, rotate it by half a turn around the new dot.

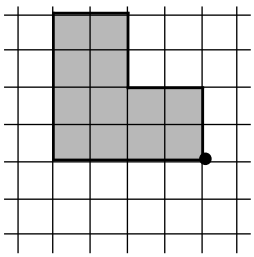


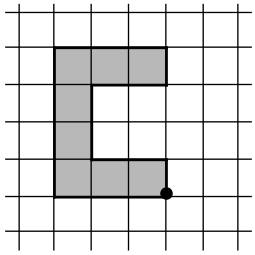
3. (a) Copy the letter "T" carefully onto $\frac{1}{2}$ centimetre squared paper.

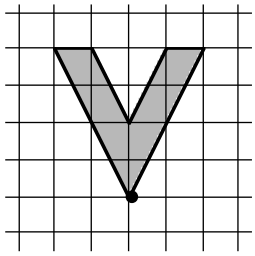


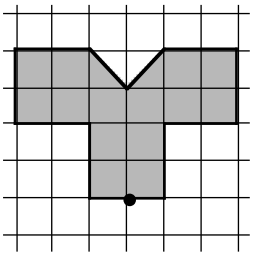
(b) Rotate it by half a turn around the dot.

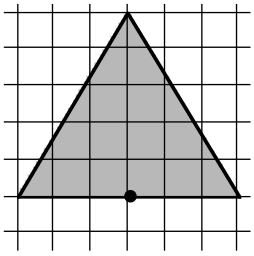
4. Copy each of the following shapes onto $\frac{1}{2}$ centimetre squared paper and rotate each by $\frac{1}{2}$ a turn :-

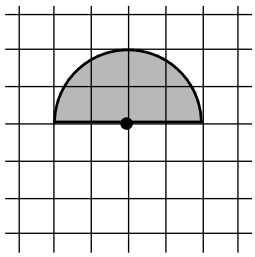
(a) 

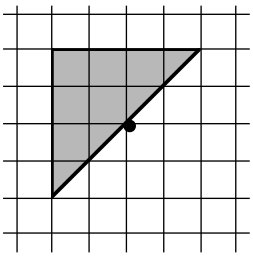
(b) 

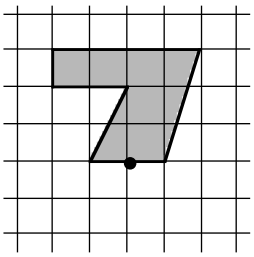
(c) 

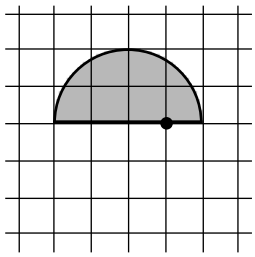
(d) 

(e) 

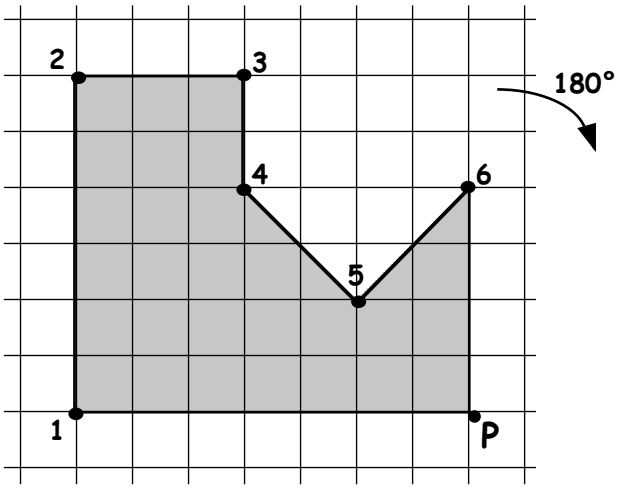
(f) 

(g) 

(h) 

(i) 

5. Here is how to rotate a complicated shape around a point using mathematics.



(a) Copy this shape carefully onto squared paper.

(b) Look at corner 1.
It is 7 boxes to the left of Point P.

When rotated, it will end up 7 boxes to the right of P. (Show this).

(c) Corner 2 is "7 boxes <u>left</u> and 6 boxes <u>up</u>" from P.

It will end up "7 boxes <u>right</u> and 6 boxes <u>down</u>" from P. (Show this).

(d) Corner 3 is "4 boxes <u>left</u> and 6 boxes <u>up</u>" from P.

It will end up "4 boxes <u>right</u> and 6 boxes <u>down</u>" from P. (Show this).

(e) Corner 4 is "..... boxes left and 4 boxes up" from P.
It will end up "..... boxes right and 4 boxes ....". from P. (Show this).

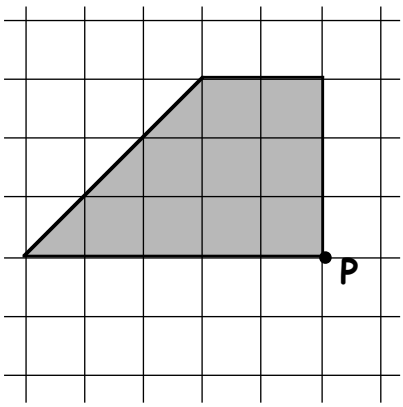
(f) Corner 5 is "..... boxes left and ..... boxes up" from P.
It will end up "..... boxes ..... and ..... boxes ....." from P. (Show this).

(g) Corner 6 is "..... boxes up" from P.
It will end up "..... boxes down" from P. (Show this).

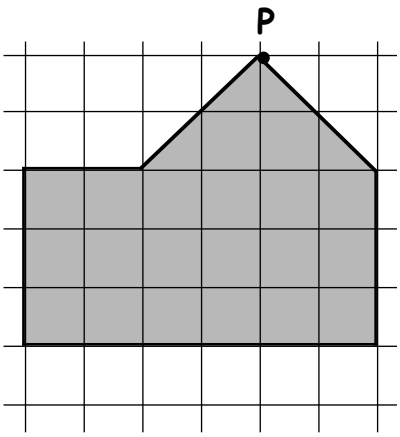
(h) Join up your dots including P to find the new shape.

6. Draw each of the following and use the "Counting" method to find each new corner when the shape is rotated by 180° around Point P.

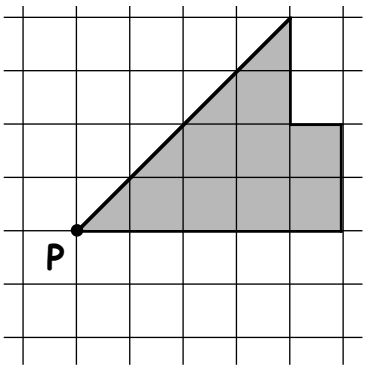
(a)



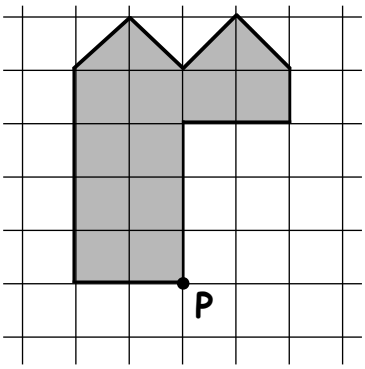
(b)

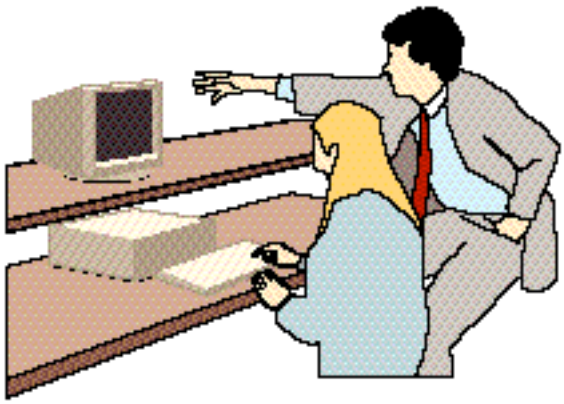


(c)



(d)

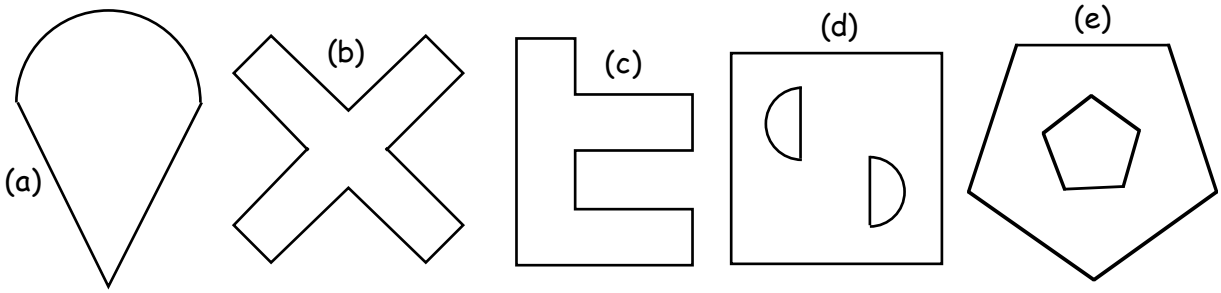




What have I learned ?

1. Make a neat sketch of the following figures.

   Mark on them (dotted lines) any lines of symmetry.

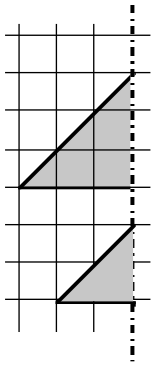


(DO NOT MARK THESE SHAPES)

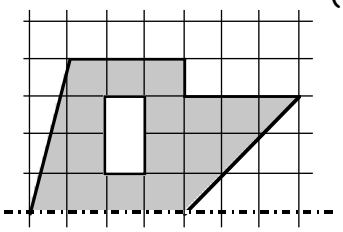
2. Copy each figure onto $\frac{1}{2}$ cm squared paper.

   Complete the figure so that the line shown is a line of symmetry.

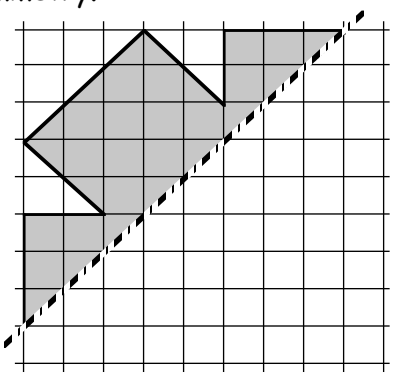
(a)



(b)

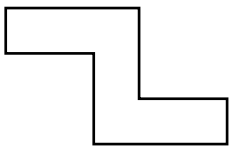


(c)

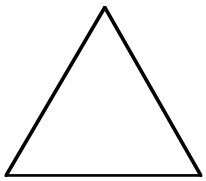


3. Say which of these shapes have turn symmetry ($\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, etc)

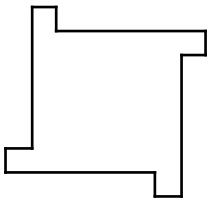
(a)



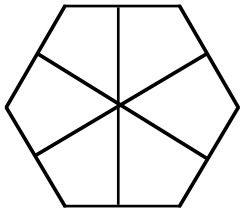
(b)



(c)



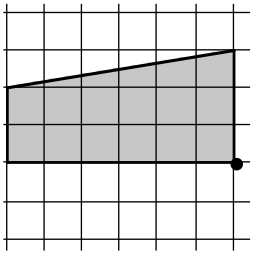
(d)



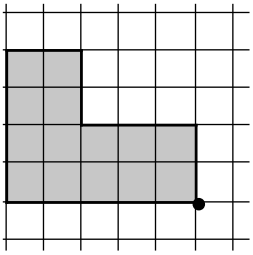
4. Copy each shape onto $\frac{1}{2}$ cm squared paper.

   Rotate each shape by 180° around the dot to produce a shape which has $\frac{1}{2}$ turn symmetry.

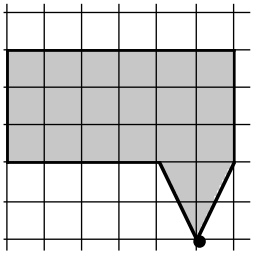
(a)



(b)



(c)



REVIEW

Percentages

1. Write 57% as (a) a fraction (b) a percentage.

2. Write each of the following as a fraction and simplify as much as possible.

   (a) 70% (b) 35% (c) 24%

3. Use your calculator to change each of the following fractions to a

   (i) decimal then (ii) percentage :-

   (a) $\frac{18}{40}$ (b) $\frac{13}{25}$ (c) $\frac{32}{48}$

4. Alana scored 27 out of 30 in a German speaking test.
   Write her score as a percentage.

5. Use your calculator to find the following :-

   (a) 29% of £350 (b) 31% of £750 (c) 6% of £41

   (d) 11% of £2600 (e) 4% of £280·50 (f) $12\frac{1}{2}$% of £160

   (g) $17\frac{1}{2}$% of £640 (h) 8·4% of £3000 (i) 23·7% of £170000

6. Lorna saw a leather jacket in MacDonald's priced at £220.

   (a) How much would she have saved in the Winter Sale ?

   (b) How much would the jacket have cost her in the sale ?

7. A bag contained 5 kilograms of potatoes.
   When they were peeled, the weight had dropped by 12%.
   What was the final weight of the peeled potatoes ?

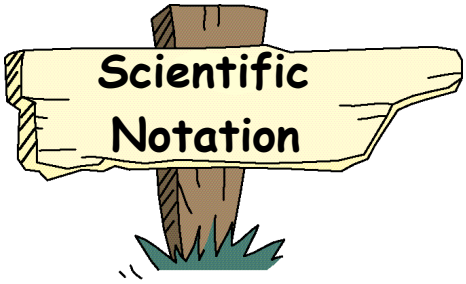
8. Brian's weight at the start of December was 48 kg and Pete's was 56 kg.
   Brian' weight increased by 5% over Xmas and Pete's went up by 4%.
   Which of the 2 boys gained more weight, and by how much ?

9. Nora's 3 test marks in August were :-

   Science - $\frac{32}{40}$ Geography - $\frac{17}{20}$ Technical - $\frac{36}{48}$

   Which was her best mark and which was her worst mark ?
   (Show your working and explain).

Chapter 4



Indexes – Powers

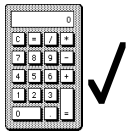
A short way of writing 3 x 3 x 3 x 3 x 3
is to write it as

3^5 – reads "3 to the power of 5"

3^5 means 3 x 3 x 3 x 3 x 3 = 243 (check it out by using a calculator)

(***the 5 is called the index, or power***).

Exercise 1



1. Find 4^3 (4 to the power of 3) = 4 x 4 x 4 = ?

2. Copy and find each of the following :-

   (a) $5^3 = 5 \times 5 \times .... =$
   (b) $3^4 = 3 \times ... =$
   (c) $2^4 = 2 \times ... =$
   (d) $10^3 = ...$
   (e) $4^4 =$
   (f) $6^2 =$
   (g) $8^3 =$
   (h) $2^6 =$
   (i) $7^3 =$
   (j) $10^6 =$
   (k) $5^1 =$
   (l) $1^7 =$

3. (a) Find each of the following :-

   (i) 1^2 (ii) 1^3 (iii) 1^5 (iv) 1^{10} (v) 1^{20} (vi) 1^{60}

   (b) What can you say about $1^{(anything)}$?

4. Which is bigger and by how much ?

   (a) 2^3 or 3^2 (b) 4^3 or 3^4 (c) 5^2 or 2^5
   (d) 6^3 or 3^6 (e) 1^5 or 5^1 (f) 4^5 or 5^4
   (g) 3^5 or 5^3 (h) 7^2 or 2^7 (i) 10^2 or 2^{10}

5. Find :-

   (a) $3^2 + 4^2$ (b) $6^2 + 7^2$ (c) $8^2 + 9^2 + 10^2$
   (d) $12^2 - 7^2$ (e) $30^2 - 20^2$ (f) $10^2 + 11^2 - 12^2$

6. 5^2, (5 to the power 2), has a special name. It is called "5 squared".

   What is the special name for 4^3 ?

7. What is the value of p^3 when :-

   (a) $p = 2$ (b) $p = 5$ (c) $p = 7$?

8. Write down the value of :-

   (a) 10^2 (b) 10^3 (c) 10^4 (d) 10^5 (e) 10^6

9. Look at the above pattern. What do you think these are :-

   (a) 10^7 (b) 10^1 (c) 10^0 ?

10. Optional — (only if you have a scientific calculator)

    If you have a scientific calculator, it will have a button like this

    [x^y] or [y^x]

    It is handy for finding powers of a number.

    (a) Find 3^7 by writing it as 3 x 3 x 3 x 3 x 3 x 3 x 3 = ?

    (b) Now find 3^7 by using the [x^y] button as follows

    Press [3] [x^y] [7] [=]

    Did you get the same answer ?

11. Use your scientific calculator to find :-

    (if you do not have one, find the answers by repetitive multiplication)

    (a) 3^4 (b) 5^5 (c) 10^4 (d) 8^3

    (e) 9^2 (f) 3^5 (g) 4^8 (h) 6^4

    (i) 1^{17} (j) 0^{10} (k) 2^{12} (l) 7^4

    (m) 3^6 (n) 5^7 (o) 100^3 (p) 5^6

12. (a) Powers of 2 – Find each of the following :-

    (i) 2^1 (ii) 2^2 (iii) 2^3 (iv) 2^4 (v) 2^5 (vi) 2^6

    (b) Write out the pattern you discovered in part (a) :- 2, 4, 8 .....

    (c) What do you think 2^7 will be (no calculator) ?

    (d) What do you think 2^0 is ? (make a guess)

    Now use your [x^y] button to check it.

(Scientific Notation)

A number such as 2700 can be written in a different way.

2700 = 270 × 10 (can you see this ?)

= 27 × 10 × 10 (follow this ?)

= 2·7 × 10 × 10 × 10 (still following ?) = $\boxed{2{\cdot}7 \times (10^3)}$

$2{\cdot}7 \times 10^3$ is called the "**standard form**" of 2700.

It is also said to be in scientific notation when the number at the start.

(the 2·7) lies between 1 and 10.

More examples :-

(a) 35000 = (3500 × 10) = (350 × 10 × 10) = (35 × 10 × 10 × 10)

= (3·5 × 10 × 10 × 10 × 10) = $\boxed{3{\cdot}5 \times 10^4}$ (3·5 lies between 1 and 10).

(b) 127000 = (12700 × 10) = (1270 × 10 × 10) = (127 × 10 × 10 × 10)

= (12·7 × 10 × 10 × 10 × 10)

= (1·27 × 10 × 10 × 10 × 10 × 10) = $\boxed{1{\cdot}27 \times 10^5}$ (1·27 lies between 1 and 10).

This is a handy way (a standard way) of writing large numbers.

Exercise 2

1. Copy and complete the following :-

1900 = 1900 × 10 = 190 × .... × .... = 19 × .... × .... × ....

= 1·9 × ..... (Stop here, since 1·9 lies between 1 and 10).

= $1{\cdot}9 \times 10^{\cdots}$

2. Write the following numbers in scientific notation :-

(a) 4600 = 460 × 10 = ... = $4{\cdot}6 \times 10^{\cdots}$

(b) 980 = 98 × 10 = ... = $9{\cdot}8 \times 10^{\cdots}$

(c) 24000 = 2400 × 10 = ... = 2·4 × ....

(d) 325000 = 32500 × 10 = ... = 3·.... × ....

3. Write the following in scientific notation :-

(a)	7900	(b)	6720	(c)	15000
(d)	24900	(e)	63850	(f)	450000
(g)	297000	(h)	807600	(i)	6800000
(j)	1800000	(k)	7350000	(l)	26000000

(Scientific Notation) – a quick way !!!!

We have seen that :–

$2700 = 270 \times 10 = 27 \times 10 \times 10 = 2{\cdot}7 \times 10 \times 10 \times 10 = (2{\cdot}7 \times 10^3)$

$18000 = 1800 \times 10 = 180 \times 10 \times 10 = 18 \times 10 \times 10 \times 10 = 1{\cdot}8 \times 10 \times 10 \times 10 \times 10 = (1{\cdot}8 \times 10^4)$

Did you also notice that changing 2700 to 2·7 meant moving the decimal point 3 places, and changing 18000 to 1·8 meant moving the decimal point 4 places ?

$(2{\cdot}7 \times 10^3)$ and $(1{\cdot}8 \times 10^4)$

A quick way to change to scientific notation is as follows :–

436000	-> Step 1	move the decimal point till it comes after the 1st digit (the 4).	4·36
	Step 2	count how many places you have moved the point.	4·36000 (5)
	Step 3	complete the change by using this number as the power of 10.	$4{\cdot}36 \times 10^5$

Exercise 3

1. Change 26000 to scientific notation using the "quick" method.

   26000 => (2·6000) (4) => 2·6 x 10····

2. Write each of the following numbers in scientific notation :–

(a)	45000	(b)	7800	(c)	815000
(d)	475	(e)	9871	(f)	150000
(g)	6000	(h)	54000	(i)	90000
(j)	1860000	(k)	7900000	(l)	14600000

3. This table gives the distances of the planets in our solar system from the sun (in kilometres).

Planet	*Distance (km)*
Mercury	57 900 000
Venus	108 200 000
Earth	149 600 000
Mars	227 900 000
Jupiter	778 300 000
Saturn	1 427 000 0
Uranus	2 869 600 000
Neptune	4 496 700 000
Pluto	58 999 000 000

Write each of the distances in scientific notation.

4. **Remember** :-

7 million	=	7 000 000
2·6 million	=	2 600 000
$5\frac{1}{2}$ million	=	5 500 000

Write each of the following out in full, then write each one in scientific notation :-

(a) 13 million = 13 000 000 = $1{\cdot}3 \times 10^{\cdots}$

(b) 4·8 million = 4 800 000 = ...

(c) 2·75 million = 2 750 000 =

(d) $1\frac{1}{2}$ million = ... = ...

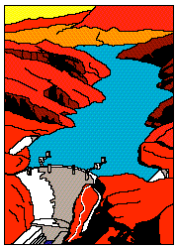
(e) 6 million (f) 45 million (g) 6·3 million

(h) 4·15 million (i) $3\frac{1}{2}$ million (j) $10\frac{1}{2}$ million

(k) 6·875 million (l) $1\frac{1}{4}$ million (m) $4\frac{3}{4}$ million

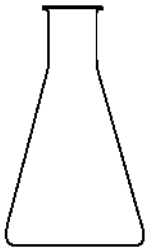
5. (a) A company's profits for the year 2002-2003 are £$8\frac{1}{2}$ million.

Write this amount in scientific notation.



(b) A reservoir holds 142 million litres of water.

Write this in scientific notation.



(c) A small flask contains 700 million oxygen atoms.

Write this in scientific notation.

(d) $26\frac{1}{2}$ million mobile phones have been sold to date in the United Kingdom.

Write this in scientific notation.

(e) Half a million people moved out of Glasgow City Centre between the years 1970 and 2000.

Write half a million in scientific notation.

(f) The bible contains 773 692 words and uses 3 566 480 letters.

Write both of these numbers in scientific notation.

(Scientific Notation) and rounding

2865427 in scientific notation becomes

$2{\cdot}865427 \times 10^6$,

which, when rounded to 1 decimal place becomes :-

$\boxed{2{\cdot}9 \times 10^6}$

6. Change each of the following to scientific notation then round the first part to one decimal place :-

(a)	17 642	(b)	24 381	(c)	157 169
(d)	288 000	(e)	6 789	(f)	4 975
(g)	1 485 000	(h)	6 247 126	(i)	37 695 284

7. Change each of the following to scientific notation, but this time round the first part to 2 decimal places :-

(a)	65 872	(b)	139 285	(c)	4 768
(d)	1 241 984	(e)	3 644 000	(f)	45 279 000

Changing from Scientific Notation back to Number Form

Can you see that :-

$2{\cdot}41 \times 10^4$ means

$2{\cdot}41 \times 10 \times 10 \times 10 \times 10$

$= 24{\cdot}1 \times 10 \times 10 \times 10$

$= 241 \times 10 \times 10$

$= 2410 \times 10$

$= \boxed{24100}$

$1{\cdot}67 \times 10^5$ means

$1{\cdot}67 \times 10 \times 10 \times 10 \times 10 \times 10$

$= 16{\cdot}7 \times 10 \times 10 \times 10 \times 10$

$= 167 \times 10 \times 10 \times 10$

$= 1670 \times 10 \times 10$

$= 16700 \times 10$

$= \boxed{167000}$

Exercise 4

1. Copy each step here to change $3{\cdot}87 \times 10^5$ to number form

$3{\cdot}87 \times 10^5 = 3{\cdot}87 \times 10 \times 10 \times 10 \times 10 \times 10$

$= 38{\cdot}7 \times 10 \times 10 \times 10 \times 10$

$= 387 \times 10 \times 10 \times 10$

$= 3870 \times 10 \times 10$

$= \ldots\ldots\ldots \times 10$

$= \ldots\ldots\ldots\ldots$

2. Change each of the following to number form using this method :-

(a) $1{\cdot}65 \times 10^3$ = $1{\cdot}65 \times 10 \times 10 \times 10$

= .....

= .....

= .....

(b) $4{\cdot}81 \times 10^4$ (c) $3{\cdot}69 \times 10^2$ (d) $5{\cdot}813 \times 10^5$

(e) $1{\cdot}6 \times 10^6$ (f) $7{\cdot}21 \times 10^5$ (g) $9{\cdot}12 \times 10^3$

(h) $3{\cdot}62 \times 10^7$ (i) $1{\cdot}97 \times 10^4$ (j) $2{\cdot}134 \times 10^6$

(k) 9×10^3 (l) $8{\cdot}64 \times 10^7$ (m) 2×10^5

A quicker way :- Instead of copying out each of these long time-consuming steps, it is easier to do the following :-

e.g. $6{\cdot}43 \times 10^4$ —> Step 1 Write down the 643 <u>without the point</u>

· 4 places

Step 2 Move the point (4) places to the right

$6{\cdot}43 \times 10^4$ = 6 4 3 0 0 = 64300

(can you see why we need the extra zero's ?)

3. Change $4{\cdot}92 \times 10^3$ using this method

$4{\cdot}92 \times 10^3$ = 4 9 2 ..... = ?

4. Change each of the following to number form using the "quicker" method :-

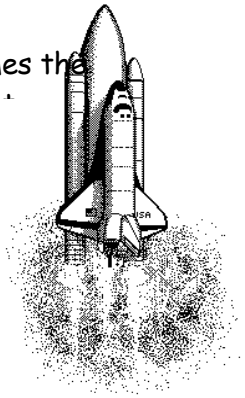
(a) $1{\cdot}8 \times 10^4$ (b) $2{\cdot}6 \times 10^2$ (c) $3{\cdot}87 \times 10^5$ (d) $1{\cdot}95 \times 10^3$

(e) $8{\cdot}461 \times 10^4$ (f) 7×10^1 (g) 9×10^6 (h) $5{\cdot}5 \times 10^6$

(i) $4{\cdot}135 \times 10^4$ (j) 6×10^7 (k

5. This table shows a quantity called the "Reciprocal Mass" of the planets in our solar system.

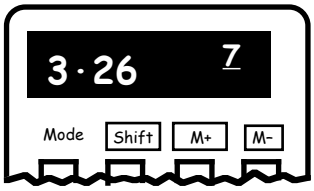
This is simply how many times the



Planet	*Reciprocal Mass*
Mercury	$5{\cdot}972 \times 10^6$
Venus	$4{\cdot}085 \times 10^5$
Earth	$3{\cdot}289 \times 10^5$
Mars	$3{\cdot}099 \times 10^6$
Jupiter	$1{\cdot}047 \times 10^3$
Saturn	$3{\cdot}50 \times 10^3$
Uranus	$2{\cdot}276 \times 10^4$
Neptune	$1{\cdot}933 \times 10^4$
Pluto	3×10^6

6. When large numbers turn up on a scientific calculator, they sometimes do so in scientific notation.

This calculator shows the number $3{\cdot}26 \times 10^7$



= 32600000

State the numbers shown on the following calculators :-

(a) 

(b) 

(c) 

7. **Very large numbers !!!!!**

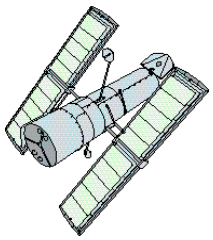
Remember :-

$10^3 = 10 \times 10 \times 10 = 1000$ (1 thousand)

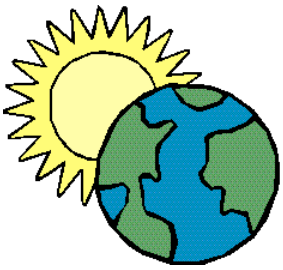
$10^6 = 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 1\,000\,000$ (1 million)

$10^9 = 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 1\,000\,000\,000$ (1 billion)

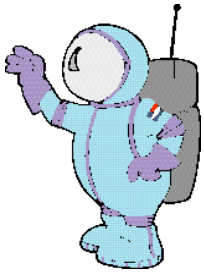
(a) The weight of the earth is $5{\cdot}98 \times 10^{24}$ kilograms.
Write this out in full.



(b) The sun is $1{\cdot}49 \times 10^{11}$ metres away from the earth.
Write this out in full.



(c) Light travels at 3×10^{10} centimetres per second.
Write this out in full.



(d) Jupiter weighs $1{\cdot}9 \times 10^{27}$ kilograms.
Write this out in full.

(e) There are about 8×10^9 people on the Earth.
Write this out in full.

(f) Approximately $1{\cdot}72 \times 10^{12}$ midges are hatched during the summer in Skye.

Write this out in full.

What have I learned ?

1. Copy and complete :-

   (a) $7^3 = 7 \times .... \times .... = ...$ (b) $5^4 = ...$

2. Use your calculator to find :-

   (a) 6^3 (b) 2^7 (c) 1^{10} (d) 10^5

   (e) 3^4 (f) 4^5 (g) 0^{20} (h) 8^4

3. Copy and complete the following :-

   $470\,000 = 47\,000 \times 10$

   $= 4\,700 \times .... \times ....$

   $=$

   $=$

   $= \qquad = 4{\cdot}7 \times 10^{...}$

4. Write each of the following numbers in scientific notation :-

   (a) 25 000 (b) 6 400 (c) 195 000

   (d) 749 (e) 2 800 000 (f) 16 700 000

   (g) 3 million (h) 7·4 million (i) $4\frac{1}{2}$ million

5. For each of the following :- (i) put the number into scientific notation
   (ii) round the first part to 2 decimal places

   (a) 3 786 (b) 25 837 (c) 2 966 841

6. Copy and complete :-

   $3{\cdot}61 \times 10^4 = 3{\cdot}61 \times 10 \times 10 \times 10 \times 10$

   $= 36{\cdot}1 \times 10 \times 10 \times 10$

   $=$

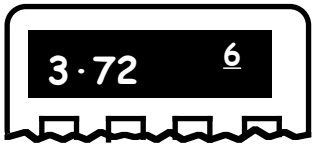
   $=$

7. Write the following in number form :-

   (a) $2{\cdot}8 \times 10^4$ (b) $1{\cdot}72 \times 10^4$ (c) $6{\cdot}8 \times 10^3$

   (d) 9×10^5 (e) $7{\cdot}81 \times 10^6$ (f) $2{\cdot}3 \times 10^7$

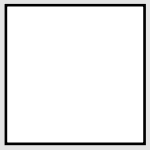
8. What number is represented on this calculator ?



1. Use a calculator to find the values of :-

   (a) 17^2 (b) 22^2 (c) $18{\cdot}5^2$ (d) 213^2

2. Calculate the **area** of this square :-

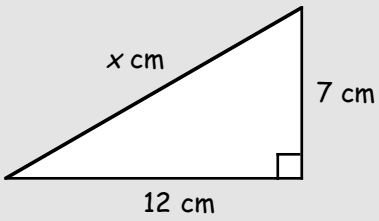


3. Use your calculator to find the following **to two decimal places** :-

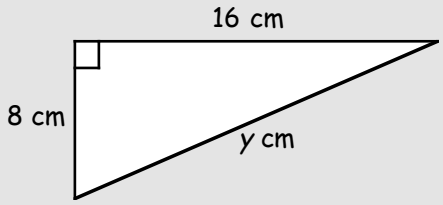
   (a) $\sqrt{30}$ (b) $\sqrt{72}$ (c) $\sqrt{19 \cdot 5}$ (d) $\sqrt{2016}$

4. Calculate the lengths of the hypotenuses of these right angled triangles :-
   (*give your answers to 1 decimal place*)

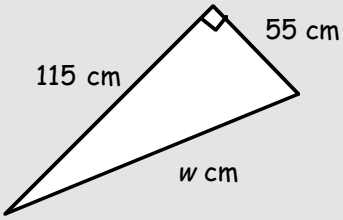
(a)



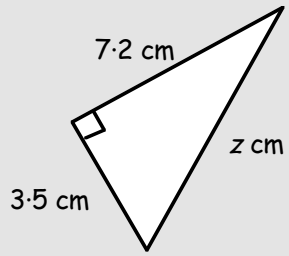
(b)



(c)

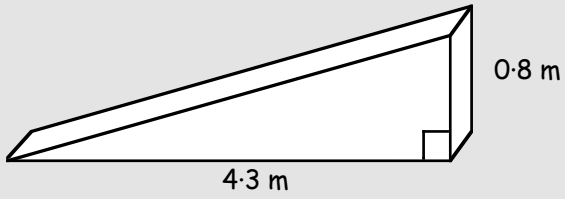


(d)

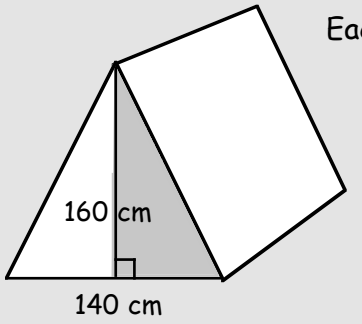


5. The edge of this wheelchair ramp is in the shape of a right angled triangle.

   Calculate the length of the sloping surface.



6.



Each half of the flap of this tent is a right angled triangle.

The base of the tent is 140 cm and the height is 160 cm.

Calculate the length of the sloping edge of the tent.

Non-Calculator Practice Exercise

Number Two

1. Set down and find :-

   (a) $\begin{array}{r} 27 \\ \times\ 35 \\ \hline \end{array}$ (b) $441 \div 7$ (c) 315×400 (d) $\begin{array}{r} 9000 \\ -\ 368 \\ \hline \end{array}$

   (e) $5276 + 495$ (f) $2 + 5 \times 3$ (g) $4 \times 4 \times 4$ (h) $(19 + 51) \div 5$

2. Set down and find :-

   (a) $\begin{array}{r} 26{\cdot}12 \\ \times\ 6 \\ \hline \end{array}$ (b) $\begin{array}{r} 29{\cdot}74 \\ +\ 56{\cdot}97 \\ \hline \end{array}$ (c) $4\overline{)305{\cdot}6}$ (d) $32{\cdot}14 \times 30$

   (e) $684 \div 200$ (f) $15 - 11{\cdot}387$ (g) $64 + 29{\cdot}637$ (h) $544 \div 400$

3. Find :- (a) $\frac{3}{5}$ of 35 (b) $\frac{5}{6}$ of 72 (c) $\frac{1}{7}$ of 3164

4. Simplify :- (a) $\frac{4}{10}$ (b) $\frac{7}{14}$ (c) $\frac{15}{20}$

5. Find and simplify where possible :-

   (a) $\frac{2}{7} + \frac{3}{7}$ (b) $\frac{1}{4} + \frac{5}{8}$ (c) $\frac{3}{4} \times \frac{2}{3}$ (d) $5\frac{7}{8} - 2\frac{1}{2}$

   (e) $5 \times 3\frac{1}{4}$ (f) $\frac{2}{5} \times \frac{5}{6}$ (g) $5\frac{2}{3} + 3\frac{1}{6}$ (h) $6\frac{3}{4} - 2\frac{1}{2}$

6. Write as mixed numbers (a) $\frac{11}{2}$ (b) $\frac{17}{6}$ (c) $\frac{32}{5}$

7. Express as a fraction :- (a) 30% (b) 75% (c) 5%

8. Find :- (a) 50% of £13 (b) 100% of 42 m (c) $66\frac{2}{3}$% of 150 mm

   (d) 4% of 600 g (e) 70% of £110 (f) 60% of £450

9. Express :- (a) 7 as a percentage of 10 (b) 5 as a percentage of 20

   (c) 4 as a percentage of 12 (d) 47 as a percentage of 100

10. Find :- (a) $(-2) + 8$ (b) $6 + (-20)$ (c) $(-9) \times 7$

    (d) $12 \times (-2)$ (e) $33 + (-19)$ (f) $(-15) + (-9)$ (g) $(-7) - (-2)$

    (h) $31 - (-20)$ (i) $0 \times (-17)$ (j) $0 - (-18)$ (k) $16 + (-20)$

11. From the set of numbers $\{-4, -3, -2, -1, 0, 1, 2, 3, 4\}$, list the values of x for which :-

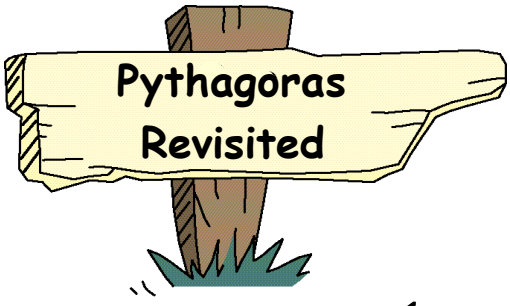
    (a) $x > -1$ (b) $x < 2$ (c) $x \leq -2$ (d) $x \geq 0$

12. Calculate the hours and minutes from :-

    (a) 1445 to 1710 (b) 7·35 pm to 10·25 pm

13. Change to hours and minutes (a) 0·25 hours (b) 2·5 hours (c) 5·75 hours.

Chapter 5

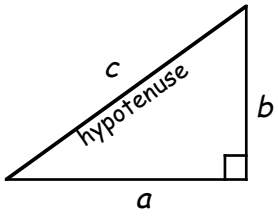


Finding the Smaller Side (Reminder)

To find the largest side c (hypotenuse) you squared and **ADDED**.

$$\Rightarrow \boxed{c^2 = a^2 + b^2}$$

note



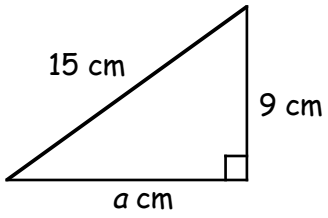
If you wish to find a smaller side (a), you must square and **SUBTRACT**.

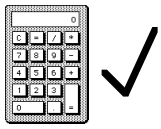
$$\Rightarrow \boxed{a^2 = c^2 - b^2}$$

note

Example To find the **smaller** side ->

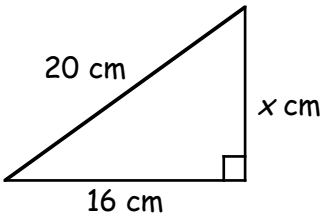
$$a^2 = c^2 - b^2$$
$$a^2 = 15^2 - 9^2$$
$$a^2 = 225 - 81 = 144$$
$$a = \sqrt{144} = 12 \text{ cm}$$





Exercise 1

1. Calculate the length of the **smaller** side.



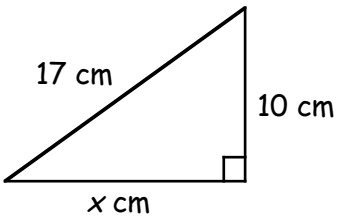
Copy :-

Can you see why ?

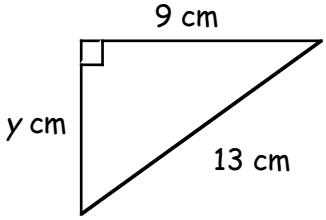
$$x^2 = 20^2 - 16^2$$
$$x^2 = 400 - 256$$
$$x^2 = ?$$
$$x = \sqrt{?} = ? \text{ cm}$$

2. Calculate the length of the **smaller** side each time here :-

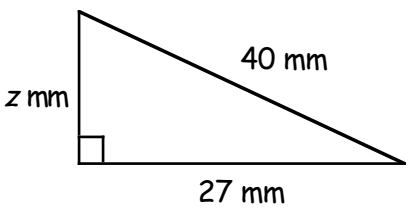
(a)



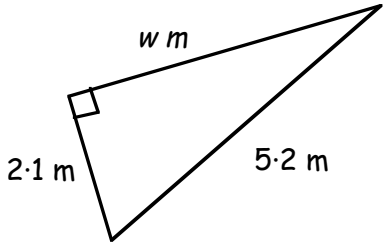
(b)



(c)

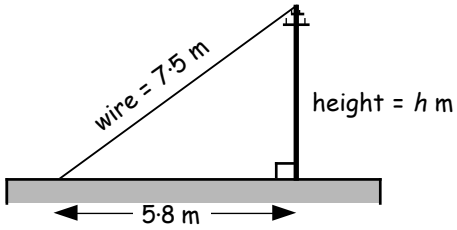


(d)



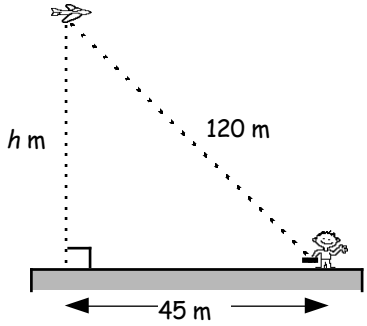
3. A 7·5 metre wire is used to support a telegraph pole. The wire is fixed to a point 5·8 metres from the base of the pole.

Calculate the height of the pole.



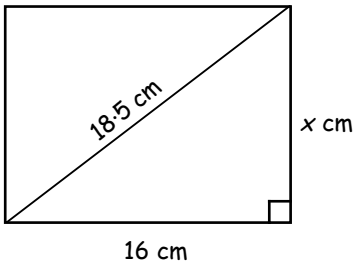
4. A boy is controlling his model plane. It is 120 metres away from him.

Calculate the height of the plane above the ground.



5. The diagonal of a rectangle is 18·5 centimetres long. The larger side is 16 centimetres.

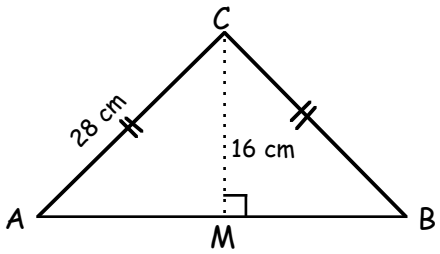
Calculate the length of the shorter side.



6. The height of an **ISOSCELES** triangle is 16 centimetres. The length of each of the sloping sides is 28 centimetres.

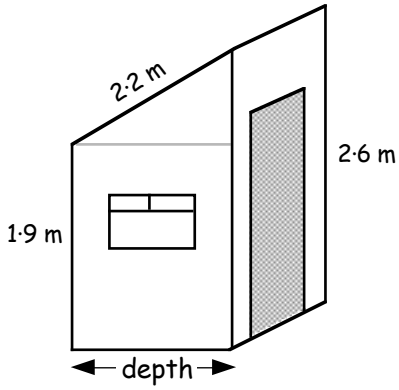
(a) Calculate the length of the side AM.

(b) What is the length of the base AB ?



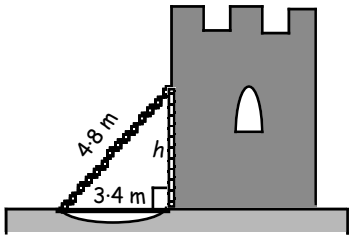
7. The height of the front of this hut is 2·6 metres. The height of the back is 1·9 metres. The sloping roof is 2·2 metres long.

Calculate the depth of the hut from front to back.



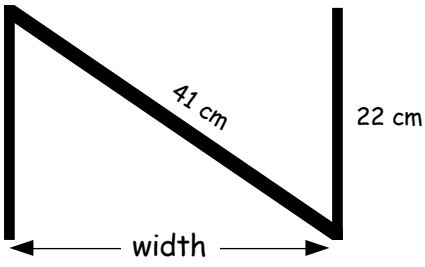
8. The drawbridge of a castle is 3·4 metres wide. The chain is 4·8 metres long.

Calculate the height of the entrance to the castle.

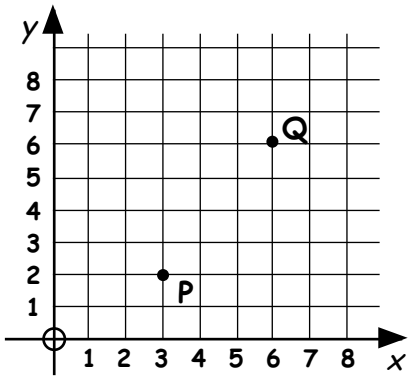


9. This letter N appears on a sign on top of a billboard.

Calculate the width of the letter N.



Distance between two points (Coordinates)



Reminder – Look at the coordinate diagram.

The 2 main lines are called **AXES**.

The horizontal one is the ***x*-axis**.
The vertical one is the ***y*-axis**.
The point where they meet is the **ORIGIN**.

Can you see that the point marked P
is 3 – to the right of the origin
and 2 – up from the origin ?

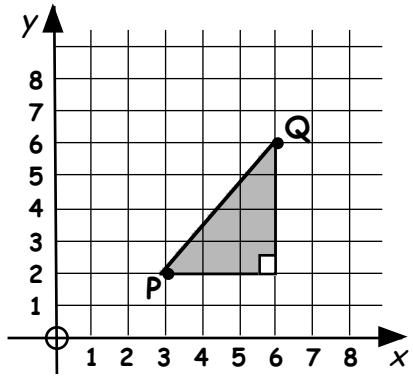
x coordinate
y coordinate
=> **P(3,2)**

Can you see that Q is the point Q(6, 6) ?

along up

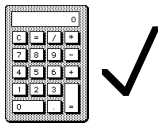
To calculate the length of the sloping side PQ, we make up a **RIGHT ANGLED TRIANGLE** by drawing a "horizontal line" through P and a "vertical line" drawn from Q.

The triangle is 3 boxes long and 4 boxes high.



(Use Pythagoras Theorem) =>

$(PQ)^2 = 3^2 + 4^2$
$(PQ)^2 = 9 + 16 = 25$
$PQ = \sqrt{25} = 5$



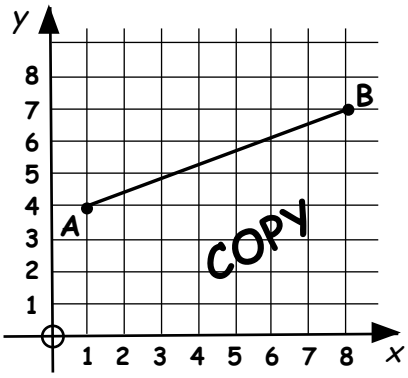
Exercise 2

1. (a) Write down the coordinates of the points A and B ?

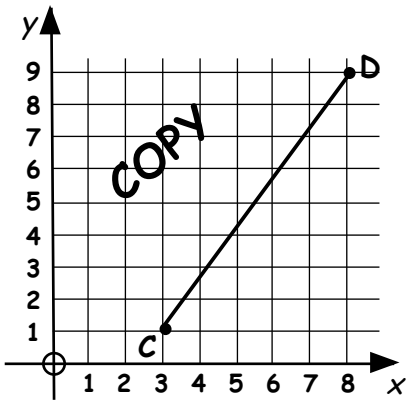
   (b) **COPY** the figure accurately showing the 2 points.

   (c) Join A to B and make a right angled triangle, similar to the one in the example shown.

   (d) Calculate the length of the line AB.



2.



(a) What are the coordinates of the 2 points, C and D in this figure ?

(b) Copy the figure accurately showing the 2 points, C and D.

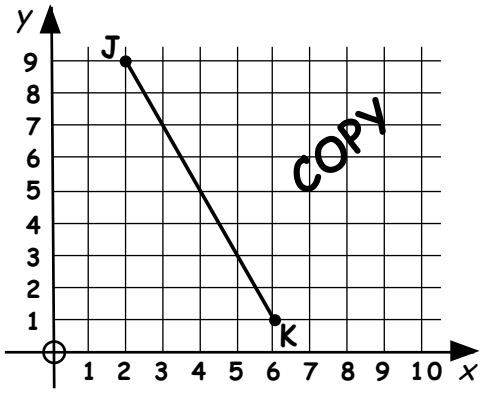
(c) Join C to D and make a right angled triangle.

(d) Calculate the length of the line CD.

3. (a) Write down the coordinates of the points J and K.

(b) Copy the figure accurately showing the 2 points, J and K.

(c) Join J to K, complete the right angled triangle and calculate the length of the line JK.



4. (a) Draw your own coordinate diagram measuring 8 boxes across by 8 boxes upwards.

(b) Mark on it the *x*-axis, the *y*-axis and the origin.

(c) Plot the 2 points, U(1, 4) and V(8, 6).

(d) Create a right angled triangle and calculate the length of the line UV.

5. (a) Draw a new set of axes, 10 boxes by 10 boxes, and label the *x*-axis and *y*-axis.

(b) Plot the 2 points, M(2, 8) and N(10, 3).

(c) Calculate the length of the line MN.

6. **Harder** !!

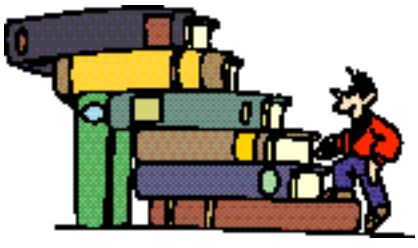
(a) Draw a final set of axes, 10 along by 8 up.

(b) Plot the 2 points, R(2, 8) and S(6, 3) and calculate the length of the line RS.

(c) On the same diagram, plot the point T(10, 8).

(d) Now calculate the length of the line ST.

(e) By comparing the 2 sides ST and RS, say what kind of triangle RTS must be.

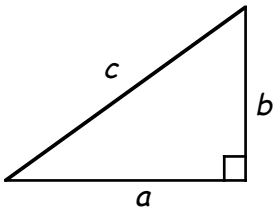


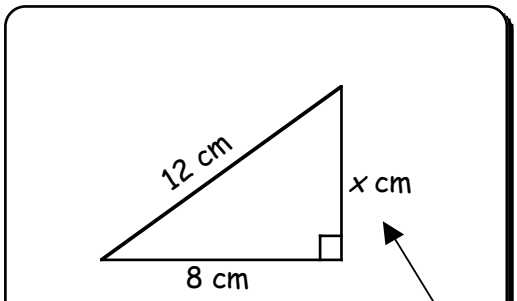
Mixed Examples

In this exercise you are sometimes asked to find

the hypotenuse (use $c^2 = a^2 + b^2$)
a smaller side (use $a^2 = c^2 - b^2$)

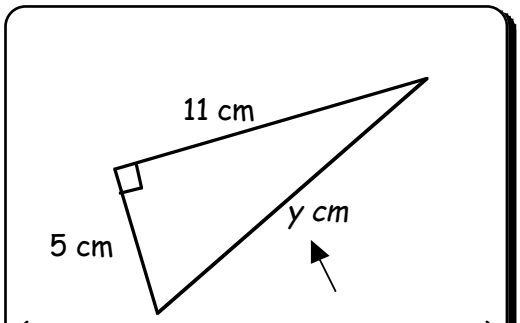
<u>You must decide which formula you have to use</u>.





(here you are looking for a short side)

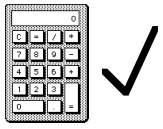
$x^2 = 12^2 - 8^2$ note
$x^2 = 144 - 64$
$x^2 = 80$
$x = \sqrt{80} = 8{\cdot}94$ cm



(here you are looking for the hypotenuse)

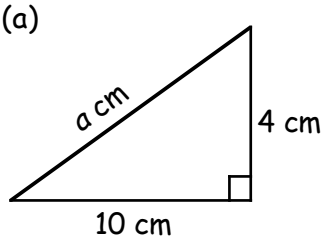
$y^2 = 11^2 + 5^2$
$y^2 = 121 + 25$
$y^2 = 146$
$y = \sqrt{146} = 12{\cdot}1$ cm

Exercise 3

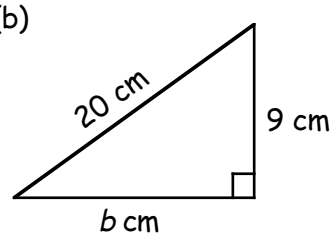


1. Use the correct formula to find the value of *a*, *b*, *c*, ...

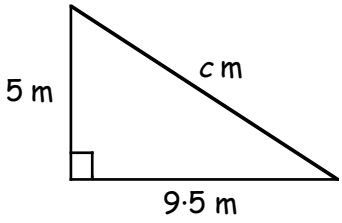
(a)



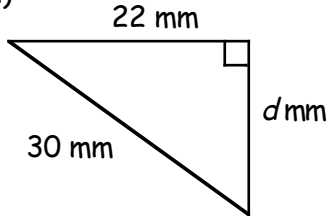
(b)



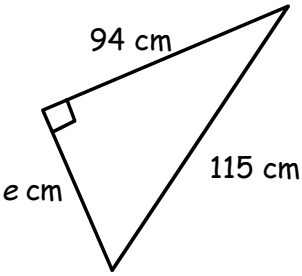
(c)



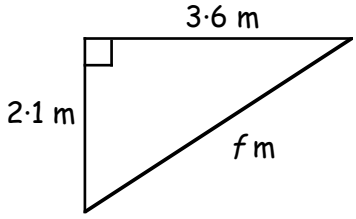
(d)



(e)



(f)



cont'd...

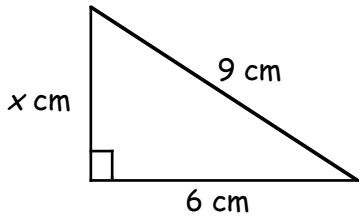
2. When Laura was asked to calculate the value of x, she began as follows :-

$x^2 = 9^2 + 6^2$

$x^2 = 81 + 36$

$x^2 = 117$

$x^2 = \sqrt{117} = 10{\cdot}8$ cm

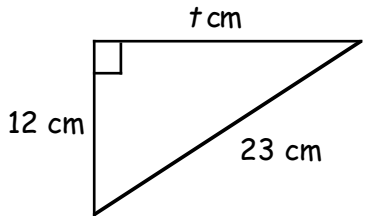


Explain in words, when Laura looked at her answer **AND** at the triangle why she should have known that her answer **had** to be wrong.

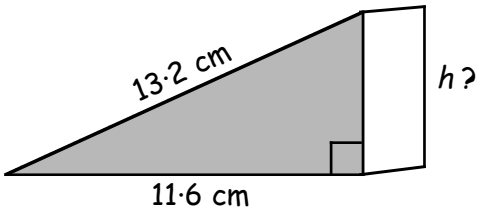
3. One of the following two answers is known to be the correct value for t.

$t = 19{\cdot}6$ cm or $t = 25{\cdot}9$ cm

Without actually doing the calculation, say which one it must be and why the other is obviously wrong.



4.

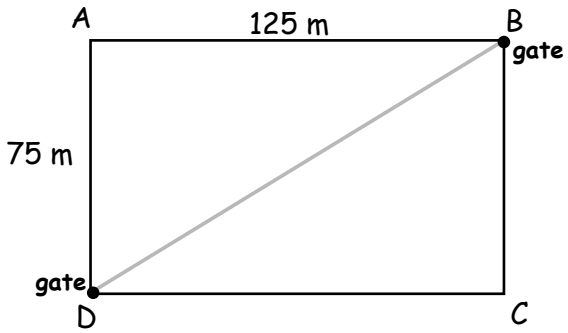


A door wedge is in the shape of a right angled triangle.

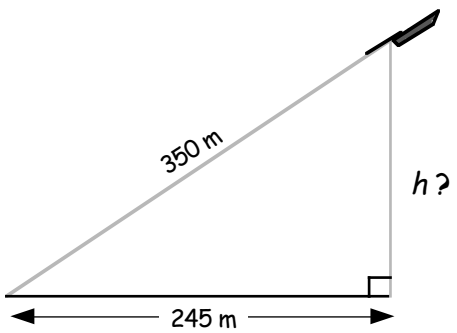
Calculate the height of the wedge.

5. Farmer Thomson has a rectangular field with a gate at two of the corners, "B" and "D".

What distance does he save by walking directly from gate B to D rather than the long way round the outside from B to C then from C to D ?



6.

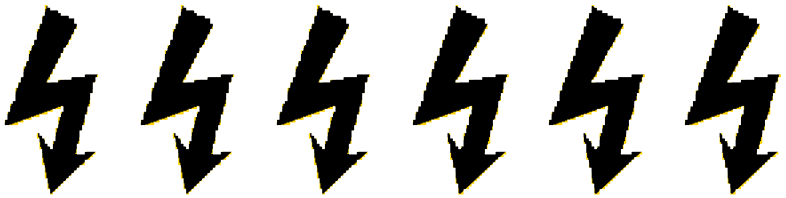


At a fireworks display, a rocket is set off and flies in a straight line for 350 metres before exploding.

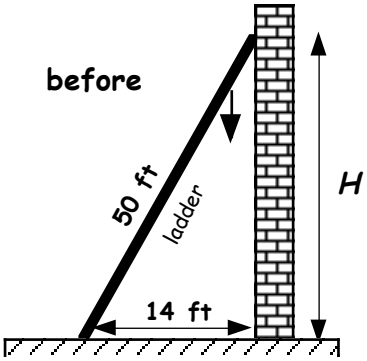
Calculate the height of the rocket when it exploded.

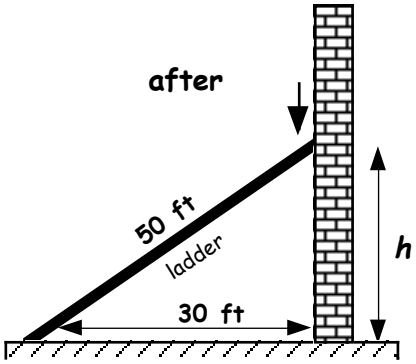
7. This warning sign is in the shape of an isosceles triangle.

Calculate the height of the triangle.



8. A ladder slid "partially" down a wall as shown in the two diagrams below.





(a) Calculate the original height (***H***) of the top of the ladder.

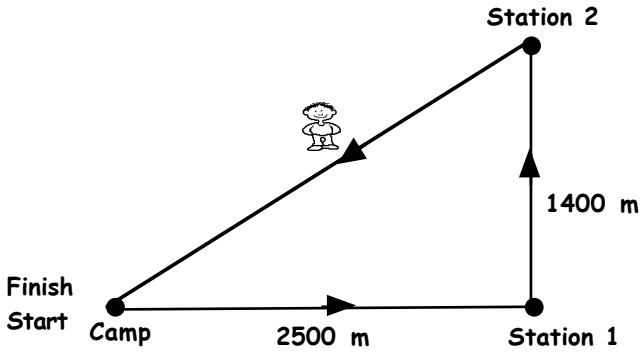
(b) Calculate the new height (***h***) of the top of the ladder.

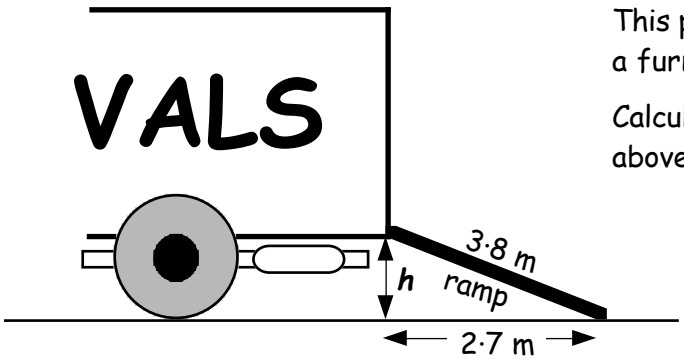
(c) By how many feet had the top of the ladder slipped ?

9. As part of an orienteering competition, a boy followed a course in the shape of a right angled triangle.

He set off East from Camp to Station 1.
He then walked North to Station 2.
He finally walked back to Camp.

Calculate the total distance travelled by the boy along his triangular path.



10. 

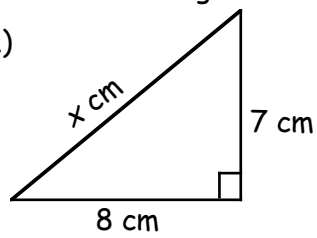
This picture shows the ramp at the back of a furniture removal van having been lowered.

Calculate the height (*h*) of the base of the van above the ground.

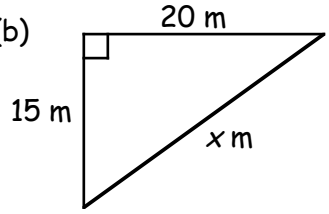
What have I learned ?

1. Calculate the length of the hypotenuse each time here :-

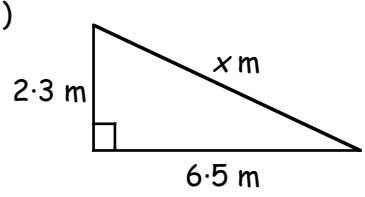
(a)



(b)

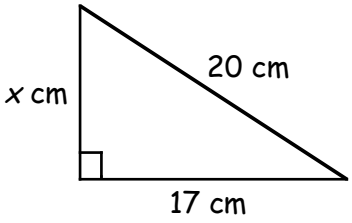


(c)

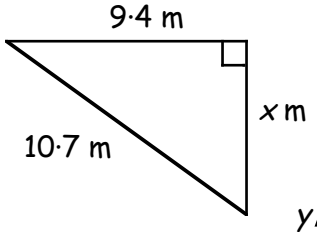


2. Calculate the length of each shorter side here :-

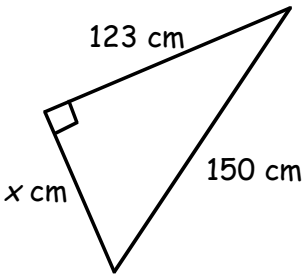
(a)



(b)



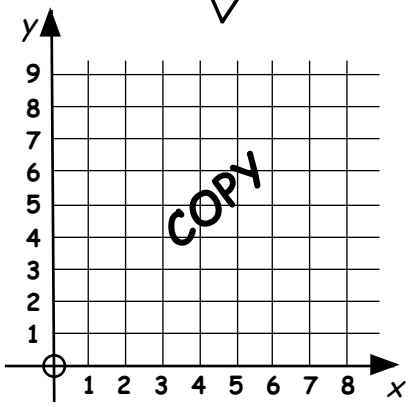
(c)



3. (a) Copy this coordinate diagram.

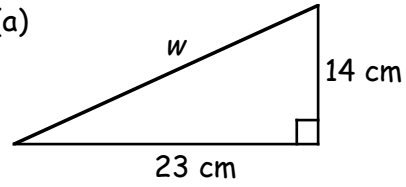
(b) Plot the 2 points A(2,9) and B(7,5).

(c) By creating a right angled triangle, calculate the length of the line AB.

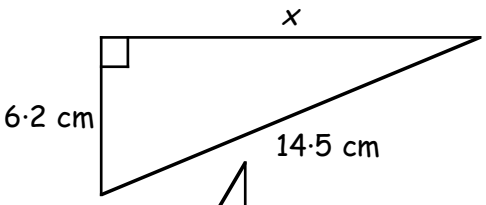


4. Decide whether to use $c^2 = a^2 + b^2$ or $a^2 = c^2 - b^2$ here and calculate the lengths of the sides marked *w*, *x*, *y* and *z*.

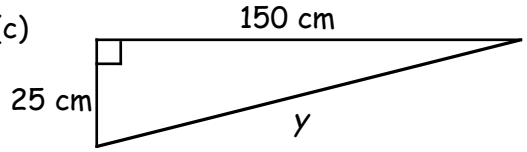
(a)



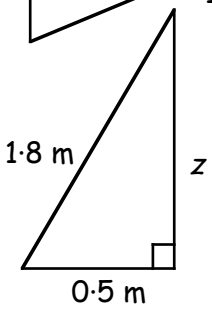
(b)



(c)

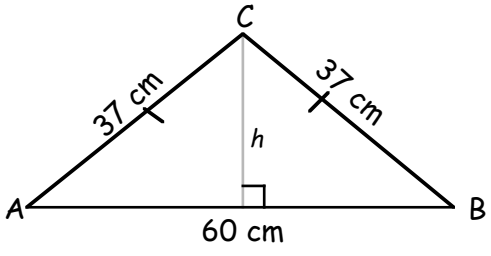


(d)



5. Look at this isosceles triangle.
The base, AB = 60 cm.
Each of the two sloping sides, AC and BC are 37 cm long.

Calculate the height of the triangle.



1. Simplify :-

(a)	$5a + 3a$	(b)	$9f - 2f$	(c)	$7t + 5t - 3t$
(d)	$6d + 3 + 7d$	(e)	$10w - 5 - 6w$	(f)	$4y + 7 - 2y + 4$
(g)	$6m + 3n + 7m + 5n$	(h)	$12u + 13v - 11u - 13v$	(i)	$9g + 8h - 7g - h$
(j)	$5a + 7 - a - 6$	(k)	$3t + s - 2t - s$	(l)	$2x^2 + 3x^2$
(m)	$5p^2 - 4p^2$	(n)	$7a^2 + 8a - 2a^2 - a$	(o)	$6h^3 + 2h^3 - 8h^3$

2. Multiply out the brackets :-

(a)	$5(x + 1)$	(b)	$6(x - 4)$	(c)	$3(x - 2)$
(d)	$7(x + 8)$	(e)	$2(a + b)$	(f)	$5(p - q)$
(g)	$2(3x + 4)$	(h)	$4(2w - 1)$	(i)	$10(x + y + 2z)$
(j)	$3(2a - 3b + c)$	(k)	$5(3p - 2q + 4r)$	(l)	$7(a + 2b - 5)$
(m)	$\frac{1}{2}(6t - 8s)$	(n)	$\frac{1}{2}(6a + 4b + 2c)$	(o)	$\frac{1}{3}(9a + 6b - 12c)$

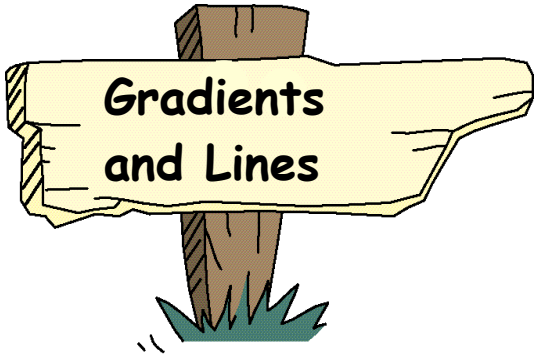
3. Multiply out the brackets and then simplify :-

(a)	$4(x + 1) + 6$	(b)	$7(y - 1) + 7$	(c)	$3(t + 2) + 5t$
(d)	$2(3m + 2n) - 3n$	(e)	$8 + 2(2x + 3)$	(f)	$4 + 3(x - 1)$
(g)	$2x + 5 + 4(x - 1)$	(h)	$2(x + y) + 3(3x + 2y)$	(i)	$4(2g - h) + 3(g + 2h)$

4. Solve (showing <u>all</u> your working) :-

(a)	$x + 4 = 11$	(b)	$y - 2 = 13$	(c)	$15 - a = 5$
(d)	$2m = 18$	(e)	$4p = 14$	(f)	$2c + 1 = 15$
(g)	$3k + 4 = 22$	(h)	$7d - 3 = 32$	(i)	$2(x + 3) = 16$
(j)	$3(y - 2) = 18$	(k)	$2(2x - 3) = 18$	(l)	$3(2x + 1) = 24$
(m)	$7x + 2 = 3x + 30$	(n)	$5a - 10 = 3a + 10$	(o)	$8t - 3 = 3t + 27$
(p)	$10t + 3 = t + 3$	(q)	$6g = 4g + 22$	(r)	$7y - 12 = 3y$

Chapter 6

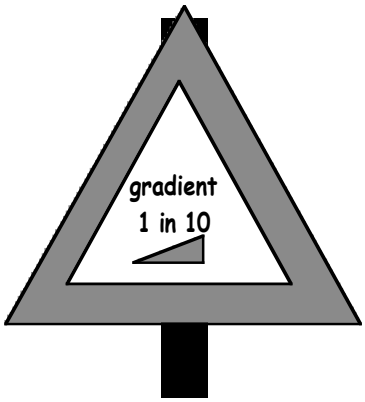


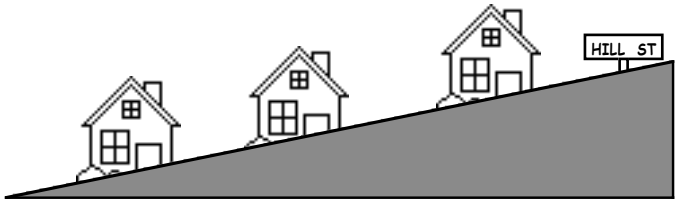
Gradients

We can measure how steep a hill or road is
or how steeply a ladder is resting against a wall.

This is called the slope or the **GRADIENT** of the hill or ladder.

The gradient of a hill is usually written as a fraction.
(*it can be given as a decimal or as a percentage*)

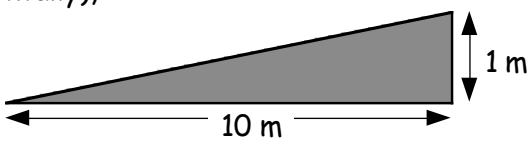




Hill Street has a gradient of 1 in 10.
This is written as

gradient = $\frac{1}{10}$

This means that for every 10 metres moved across (horizontally),
the road rises by 1 metre up the way (vertically).

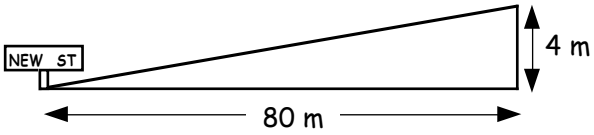


How to calculate the gradient of a hill.

Example :- New Street rises by 4 metres.
It is 80 metres (horizontally)
from the top end to the bottom.

Gradient = 4 metres in 80 metres

$= \frac{4}{80} \overset{\div 4}{} = \frac{1}{20}$



[Can you see that $\frac{1}{20}$ is **smaller** than $\frac{1}{10}$]

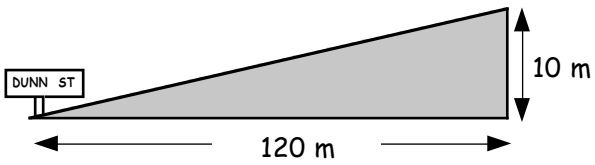
—> this means New Street is **less** steep than Hill Street.

Definition :- Gradient = $\frac{\text{vertical distance}}{\text{horizontal distance}}$

LEARN

Exercise 1 (You MAY use a calculator)

1. Look at this picture of Dunn Street.



(a) Calculate the gradient like this :-

Copy :-

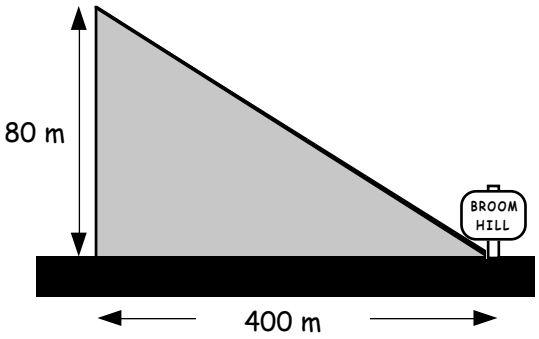
$$\text{Gradient} = \frac{\text{vertical distance}}{\text{horizontal distance}}$$

$$\Rightarrow \text{grad} = \frac{10}{120} \quad \Rightarrow \text{grad} = \boxed{\frac{?}{?}} \qquad \text{(simplify the fraction } \frac{10}{120}\text{)}$$

(b) Compare the gradient of Dunn Street with that of Hill Street and New Street (from the previous page).

Which is the :- (i) steepest ?
(ii) least steep ?

2.



Look at the sketch of Broom Hill.

Calculate the gradient of the hill.

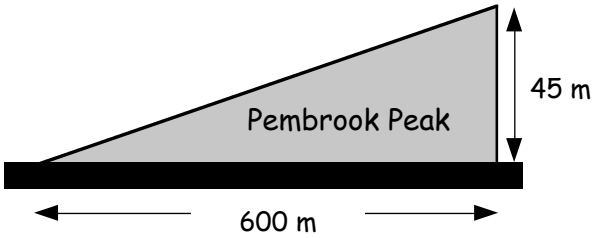
Copy :-

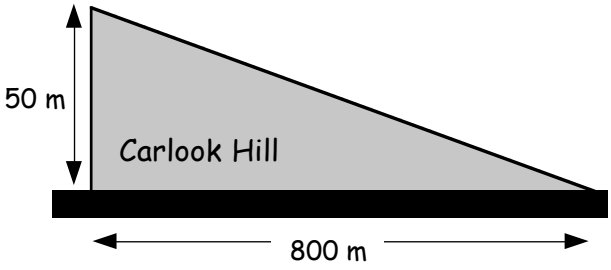
$$\text{Gradient} = \frac{\text{vertical distance}}{\text{horizontal distance}}$$

$$\Rightarrow \text{grad} = \frac{80}{\ldots\ldots} = \boxed{\frac{?}{?}}$$

(simplify the fraction)

3. Shown below are two small hills.





<u>Here is how we can find which one is steeper</u>.

Copy :-

(a) Pembrook Peak – $\text{Gradient} = \frac{\text{vert}}{\text{horiz}} = \frac{45}{600}$ (can this be simplified ?)

(b) Find the gradient of Carlook Hill the same way.

$$\text{Gradient} = \frac{\text{vert}}{\text{horiz}} = \frac{50}{800} = \boxed{\quad}$$

cont'd

(c) It is NOT very easy to look at these 2 fractions and say which one is bigger.
To do this you :-

CHANGE THE FRACTIONS —> DECIMALS

(i) Pembrook – Gradient = $\frac{45}{600}$ = 45 ÷ 600 (Remember) = 0·075

(ii) Carlook – Gradient = $\frac{50}{800}$ = 50 ÷ ..... = 0·.....

(iii) Which is the bigger ? (which hill is steeper ?)

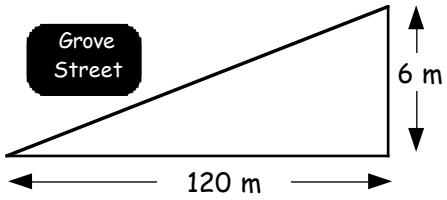
4. Shown below are the side views of 4 roads.

(i) Write down the gradient of each hill (as a fraction).

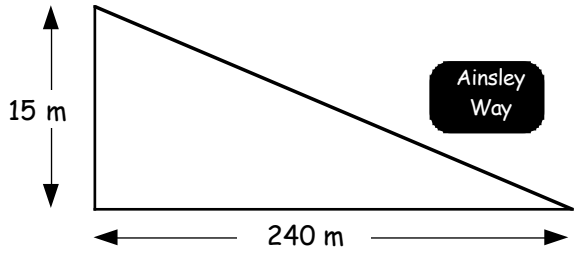
(ii) Change each fraction to a decimal (see question 3c).

(iii) Write the 4 hills in order, steepest first.

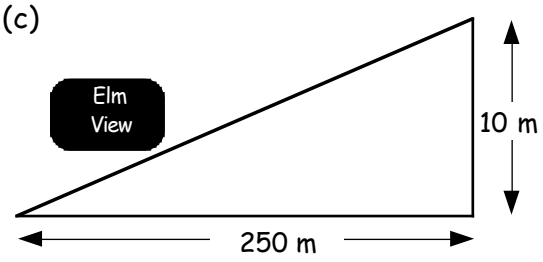
(a)



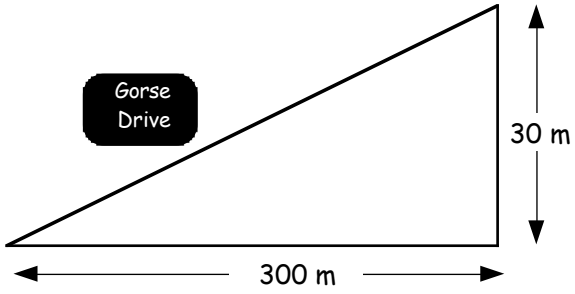
(b)



(c)



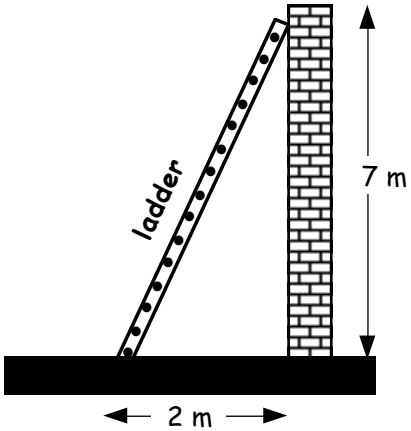
(d)



Set down like this :- Grove Street —> Grad = $\frac{\text{vert}}{\text{horiz}}$ = $\frac{6}{120}$ = (6 ÷ 120) = 0·.....

5. This picture shows a ladder placed against a wall.

You can measure how steep the ladder is (the gradient) in the same way you worked out the gradient of the hills and roads.



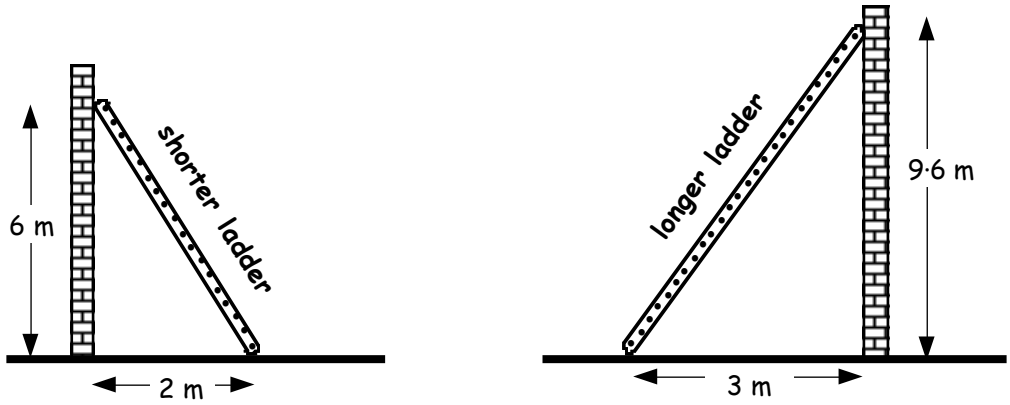
Copy :- Gradient = $\frac{\text{vert}}{\text{horiz}}$

=> Grad = $\frac{7}{2}$ = (7 ÷ 2) = 3·.... .

(This is a much bigger gradient (3·5) than any of the hills measured in Question 4).

This means the ladder is resting <u>quite steeply</u> against the wall.

6. A window cleaner uses two ladders in his job.



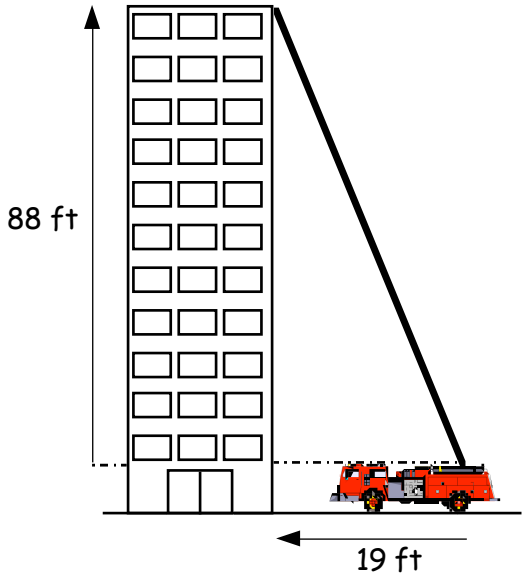
(a) Calculate the gradient of the shorter ladder.

Grad = $\frac{\text{vert}}{\text{horiz}} = \frac{6}{\ldots} = \boxed{\frac{?}{?}}$

(b) Calculate the gradient of the longer ladder.

(c) Which ladder lies at a steeper angle to the ground ?

7.

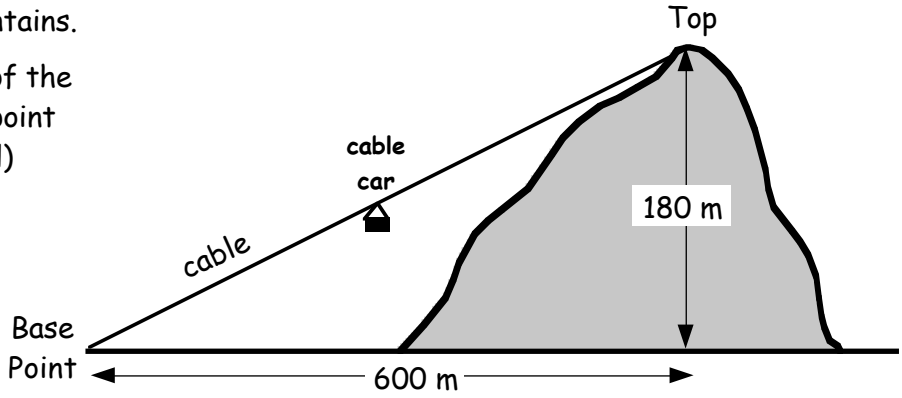


The fire engine used its extended ladder to rescue someone from the top of this building.

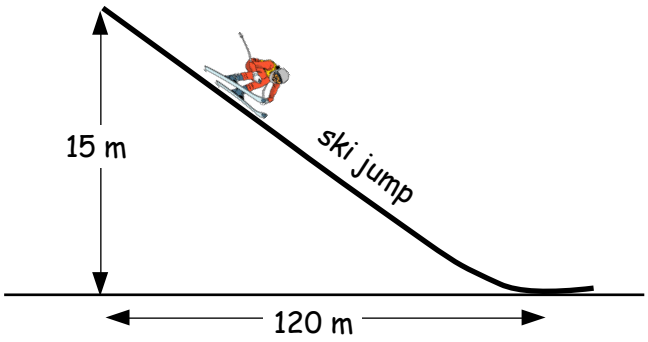
Calculate the gradient of the ladder. (as a decimal)

8. This is a picture of a cable car on the Craighorne mountains.

Calculate the gradient of the cable joining the base point to the top. (as a decimal)

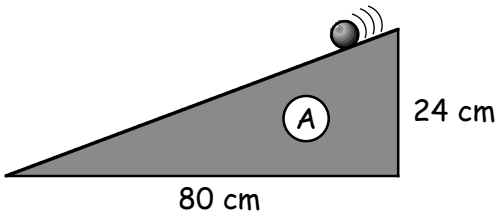


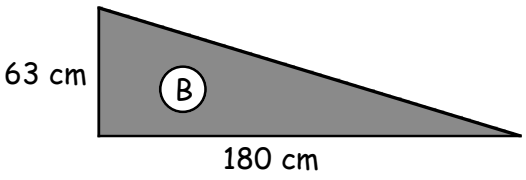
9. Calculate the gradient of this ski jump.

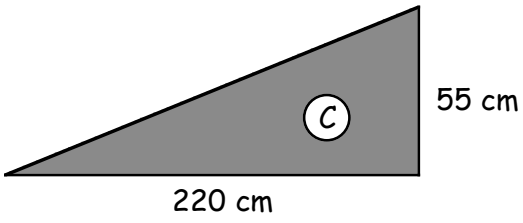


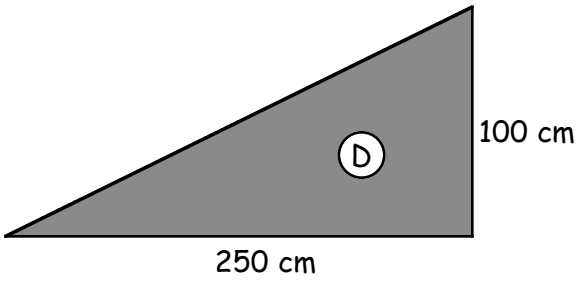
10. The steeper the slope – the faster a ball-bearing will run down it.

Calculate the gradient of each of the following slopes and say which is steepest and which is "shallowest".









Lines (Equations)

Reminder – coordinates

This is called a coordinate diagram.
(or a Cartesian Diagram)

The 2 main lines are called axes.

The horizontal one is the *x*-axis.
The vertical one is the *y*-axis.

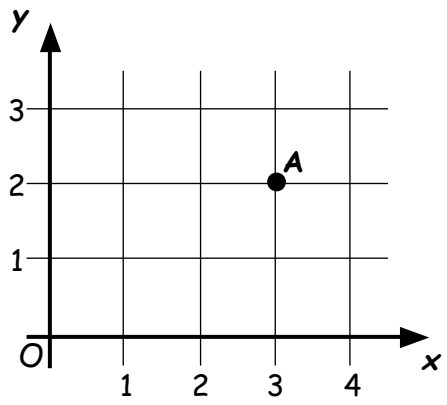
The point where they meet is the **ORIGIN**.

The point A is "3 to the right and 2 up" from the origin.

We say it has coordinates A (3 , 2)

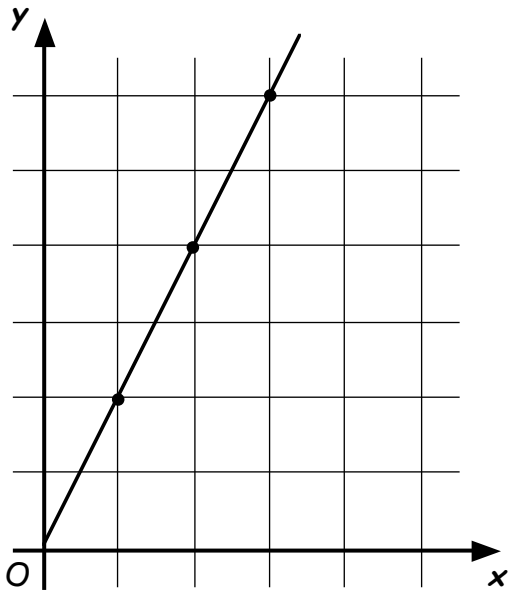
horizontal or *x*-coord

vertical or *y*-coord



Basic Lines

Exercise 2



1. A line is drawn in this diagram through the points :-

   (0, 0), (1, 2), (2, 4), (3, 6), (4, 8) .....

   (a) Can you see a connection between the pairs of coordinates at each point ?

   For each point the

   "*y* - coordinate" = ? × "*x* - coordinate"

   What is the missing value ?

   (b) Check this is true for every point on the line.

   (0, 0) — is it true that 0 = 2 × 0 ?
   (1, 2) — is it true that 2 = 2 × 1 ?
   (2, 4) — is it true that 4 = 2 × 2 ?
   (3, 6) — is it true that 6 = 2 × 3 ?
   (4, 8) — is it true that 8 = 2 × 4 ?

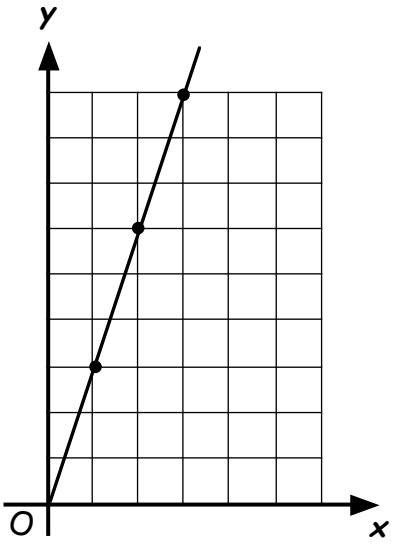
   (c) The line is known to pass through another point (5, *a*). What number does *a* stand for ?

   (d) Further up, it passes through (8, *b*). What number does *b* stand for this time ?

   We can shorten "*y* - coordinate = 2 × *x* - coordinate" to $y = 2 \times x$

   or $y = 2x$

   This equation $y = 2x$ is called the "equation of the line".



2. Here is a new line. (study it)

   (a) Write down the coordinates of the 4 points it is shown to pass through.

   (b) Can you see that :-

   (0, 0) 0 = * × 0
   (1, 3) 3 = * × 1
   (2, 6) 6 = * × 2
   (3, 9) 9 = * × 3

   What does * stand for ?

   (c) Next page .....

cont'd..

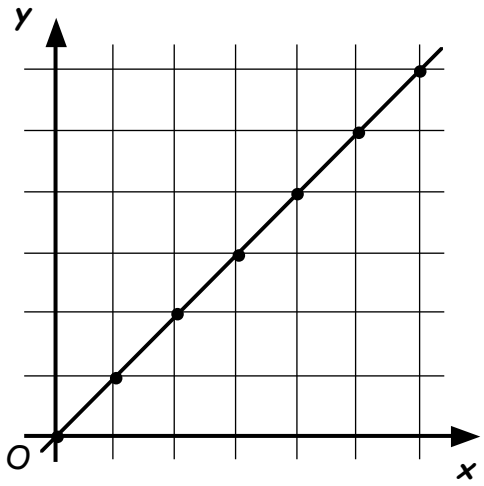
(c) Can you see that every point on the line has

"y - coordinate" = 3 × "x - coordinate" ?

Write this in a shorter way (See Question 2(e)).

(d) If the line passes through the point (4, *), what does * stand for ?

3. Another new line. (study it)



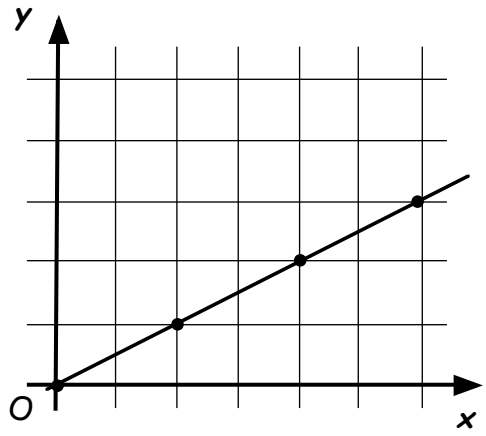
(a) Write down the coordinates of the 7 points on the line.

(b) Copy and complete this sentence which describes the connection between the x coordinate and the y coordinate of each point on the line.

For every point on the line,
the "y - coordinate" = [?] × "x - coordinate".

(c) Write down the equation of the line.

4. Another new line.



(a) Write down the coordinates of the 4 points drawn on the line.

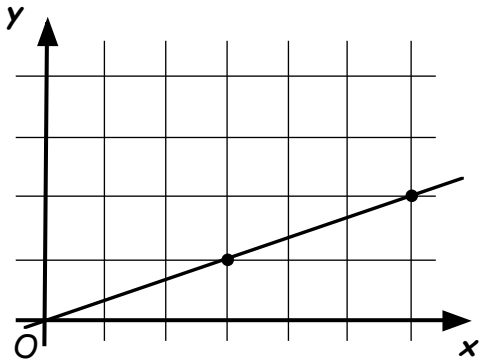
(b) Can you see that for every point on the line
"y - coordinate" = $\frac{1}{2}$ × "x - coordinate".

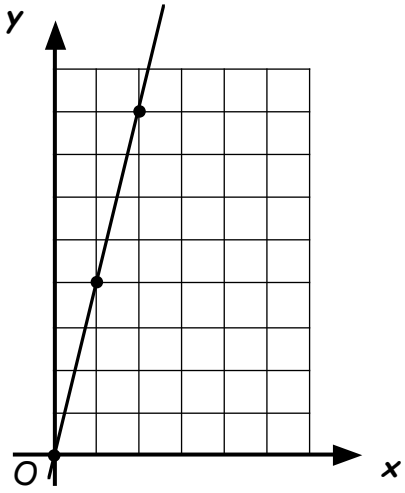
Check that this works.

(c) Write down the equation of this line

[y = ...x]

5. Shown below are two more lines.





(a) For each line, list the coordinates of the points on the line.

(b) Find a connection of the form "y - coordinate" = [?] × "x - coordinate".

(c) Write down the equation of each line.

From the last exercise, you should have come up with the following equations of lines :-

$y = 2x$, $y = 3x$, $y = \frac{1}{2}x$, $y = 1x$, $y = 4x$, $y = \frac{1}{3}x$

Can you see that an equation of the form

$y = ?\ x$ where ? represents a number, is the equation which determines a straight line.

How to draw a line of the form $y = 5x$

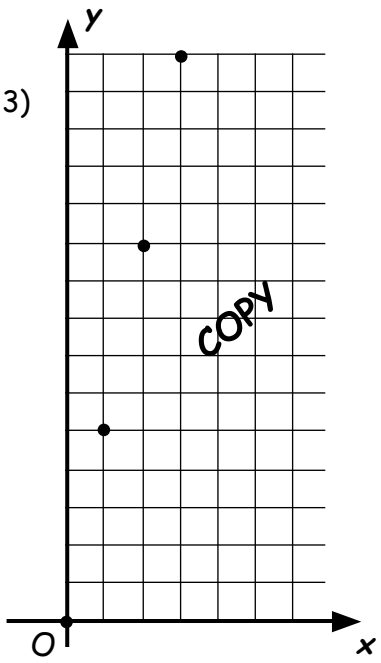
Example :- Draw the line $y = 5x$ by making up a table of values.

Step 1 Make up a table using any four x-values (0, 1, 2 and 3)

x	0	1	2	3
$y = 5 \times x$	0	5	10	15
	5×0	5×1	5×2	5×3

Step 2 Write these as coordinates :-
(0, 0) (1, 5) (2, 10) (3, 15)

Step 3 Plot these points on a coordinate diagram and join them up to form the line $y = 5x$.



Exercise 3

1. (a) Complete this table for the line $y = 2x$

x	0	1	2	3
$y = 2x$	0	2	....	....

(b) List the coordinates of the 4 points.

(c) Draw a coordinate diagram (with a ruler), plot the 4 points and join them up.

2. (a) Complete this table for the line $y = 1x$ (or $y = x$)

x	1	3	5	7
$y = 1x$	1	....	....	....

(b) List the coordinates of the 4 points.

(c) Draw a coordinate diagram (with a ruler), plot the 4 points and join them up.

3. (a) Complete this table for the line $y = \frac{1}{2}x$

x	0	2	4	6
$y = \frac{1}{2}x$	0	1	....	....

(b) List the coordinates of the 4 points.

(c) Draw a coordinate diagram, plot the 4 points and join them up.

4. (a) Complete this table for the line $y = 3x$

x	0	1	2	3
$y = 3x$				

(b) List the coordinates of the 4 points.

(c) Draw a coordinate diagram, plot the 4 points and join them up.

5. (a) Complete this table for the line $y = \frac{1}{4}x$

x	0	4	8	12
$y = \frac{1}{4}x$				

(b) List the coordinates of the 4 points.

(c) Draw a coordinate diagram, plot the 4 points and join them up.

6. (a) Complete this table for the line $y = 4x$

x	0	1	2	3
$y = 4x$				

(b) List the coordinates of the 4 points.

(c) Draw a coordinate diagram, plot the 4 points and join them up.

7. (a) Complete this table for the line $y = 6x$

x	0	1	2	3
$y = 6x$				

(b) List the coordinates of the 4 points.

(c) Draw a coordinate diagram, plot the 4 points and join them up.

8. (a) Complete this table for the line $y = \frac{3}{2}x$ ($\frac{3}{2}$ means $1\frac{1}{2}$ or 1·5)

x	0	2	4	6
$y = \frac{3}{2}x$				

1·5 × 0 1·5 × 2 1·5 × 4 1·5 × 6

(b) List the coordinates of the 4 points.

(c) Draw a coordinate diagram, plot the 4 points and join them up.

9. (a) Complete this table for the line $y = 10x$

x	0	1	2	3
$y = 10x$				

(b) List the coordinates of the 4 points.

(c) Draw a coordinate diagram, plot the 4 points and join them up.

Lines of the form $y = ax + b$

All of the lines drawn in the last exercise

$y = 2x$, $y = 3x$, $y = \frac{1}{2}x$, $y = 1x$, $y = 4x$, $y = 5x$, etc.

had one thing in common —> **They all passed through the origin O(0,0)**.

We will find that the equation $y = 2x + 1$ is also a line,

(i) parallel to the line $y = 2x$

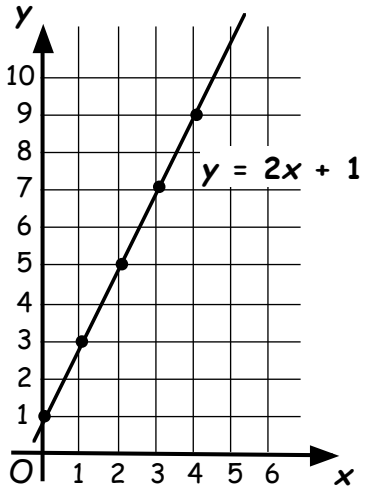
(ii) but a bit "higher up"

Drawing the line $y = 2x + 1$ using a table of values.

Let us complete the following table for $y = 2x + 1$

x	0	1	2	3	4
$y = 2x + 1$	2×0+1 = 1	2×1+1 = 3	2×2+1 = 5	2×3+1 = 7	2×4+1 = 9

Now plot the 5 points (0, 1) (1, 3) (2, 5) (3, 7) (4, 9)



Exercise 4

1. Draw the line $y = 2x + 3$ as follows :-

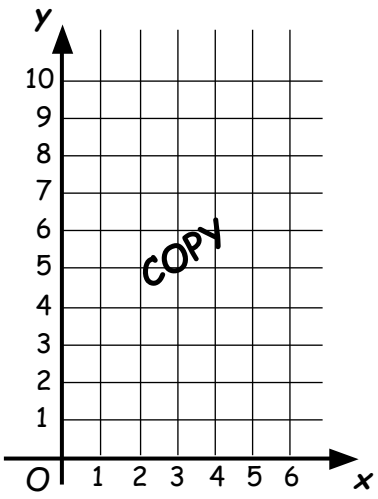
   (a) Copy and complete this table :-

x	0	1	2	3
$y = 2x + 3$	$2\times0+3$ $= 3$	$2\times1+3$ $= 5$	$2\times2+3$ $= \ldots$	$2\times\ldots\ldots$ $= \ldots$

   (b) List the coordinates of the 4 points
   (0, 3) (1, ...) (2, ...) (..., ...)

   (c) Draw a set of axes, plot the 4 points and join them up with a line.

   Label the line $y = 2x + 3$ on your diagram.



2. Draw the line $y = 3x + 2$ as follows.

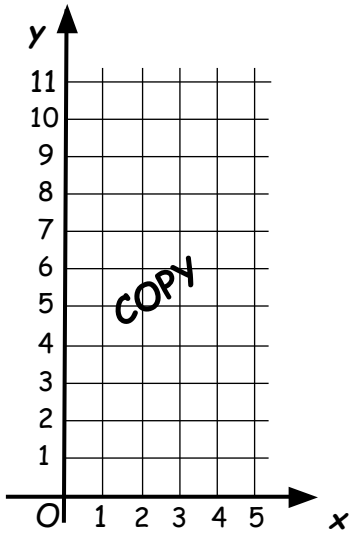
   (a) Copy and complete this table :-

x	0	1	2	3
$y = 3x + 2$	$3\times0+2$ $= 2$	$3\times1+2$ $= \ldots$	$= \ldots$	$= \ldots$

   (b) List the coordinates of the 4 points
   (0, 2) (1, ...) (..., ...) (..., ...)

   (c) Draw a set of axes, plot the 4 points and join them up with a line.

   Label the line $y = 3x + 2$ on your diagram.



3. Draw the line $y = 2x - 2$ as follows.

   (a) Copy and complete this table :-

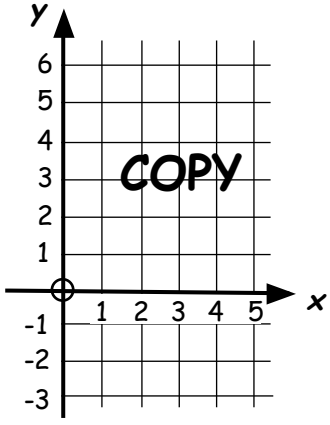
x	0	1	2	3
$y = 2x - 2$	$2\times0-2$ $= -2$	$2\times1-2$ $= 0$	$2\times2-2$ $= \ldots$	$2\times\ldots\ldots$ $= \ldots$

(note)

   (b) List the coordinates of the 4 points
   (0, –2) (1, ...) (2, ...) (..., ...)

   (c) Draw a set of axes, plot the 4 points and join them up with a line.

   Label the line $y = 2x - 2$ on your diagram.



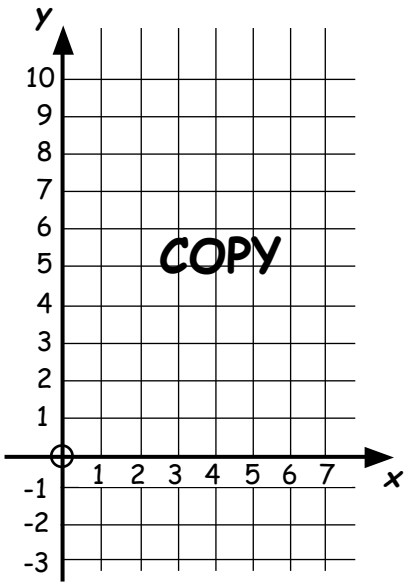
4. Draw the line $y = x + 3$ as follows.

(a) Copy and complete this table :-

x	1	3	5	7
$y = x + 3$	1+3 = 4	3+3 = ...	5+..... = ...	7+..... = ...

(b) List the coordinates of the 4 points
(1, 4) (3, ...) (5, ...) (..., ...)

(c) Draw a set of axes, plot the 4 points and join them up with a line.
Label the line $y = x + 3$ on your diagram.



5. For each of the following, copy and complete the given table, list the coordinates of the points, draw a set of axes and plot the points to produce the line :-

(a) $y = 3x - 1$

x	0	1	2	3
$y = 3x - 1$	3 x 0 - 1 = -1			

(b) $y = 4x + 1$

x	0	1	2	3
$y = 4x + 1$				

(c) $y = x - 2$

x	0	2	4	6
$y = x - 2$				

(d) $y = 5x - 3$

x	0	1	2	3
$y = 5x - 3$	5 x 0 - 3 =			

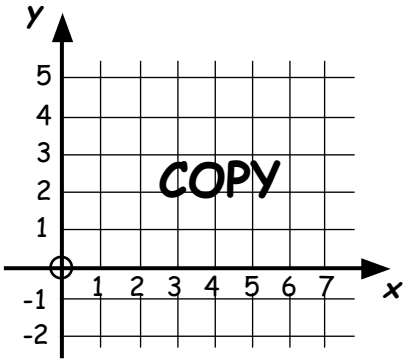
6. Draw the line $y = \frac{1}{2}x + 2$ as follows.

(a) Copy and complete this table :-

x	0	2	4	6
$y = \frac{1}{2}x + 2$	$\frac{1}{2}$ of 0 + 2 = 2	$\frac{1}{2}$ of 2 + 2 = 3	$\frac{1}{2}$ of 4 + 2 = ...	$\frac{1}{2}$ of ..... = ...

(b) List the coordinates of the 4 points
(0, 2) (2, ...) (4, ...) (..., ...)

(c) Draw a set of axes, plot the 4 points and join them up with a line.
Label the line $y = \frac{1}{2}x + 2$ on your diagram.



7. Sometimes, in exam questions, the points given in the table have **NEGATIVE** x - coordinates (minus numbers).

Practice — Find the answers to the following :-

(a) $2 \times (-3)$ (b) $3 \times (-4)$ (c) $5 \times (-1)$ (d) $4 \times (-5)$

(e) $2 \times (-1) + 3$ (f) $4 \times (-2) + 10$ (g) $3 \times (-4) + 6$ (h) $1 \times (-5) + 3$

(i) $4 \times (-2) - 3$ (j) $3 \times (-1) + 5$ (k) $2 \times (-3) - 1$ (l) $6 \times (-2) + 7$

8. Draw the line $y = 2x - 1$ as follows.

(a) Copy and complete this table :-

x	-2	-1	0	1	2
$y = 2x - 1$	$2 \times (-2) - 1$ = -5	$2 \times (-1) - 1$ = ...	$2 \times (0) - 1$ = ...	$2 \times$ ..... = ...	$2 \times$ ..... = ...

(b) List the coordinates of the above 5 points.

(c) Draw a set of axes and plot the 5 points.

(d) Check they actually **do** lie on a line. Join them up.
(If one or more points don't lie on the line – you have made a mistake in your table)

9. Draw the following lines by first of all completing the tables :-

(a) $y = 2x + 2$

x	-1	0	1	2
$y = 2x + 2$				

(b) $y = 3x + 1$

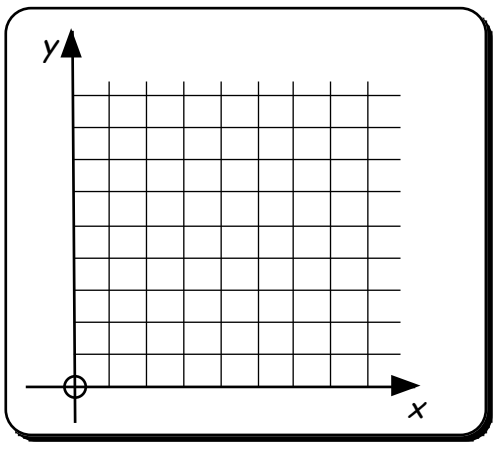
x	-1	1	3	5
$y = 3x + 1$				

(c) $y = x + 4$

x	-2	0	2	4
$y = x + 4$				

(d) $y = \frac{1}{2}x + 1$

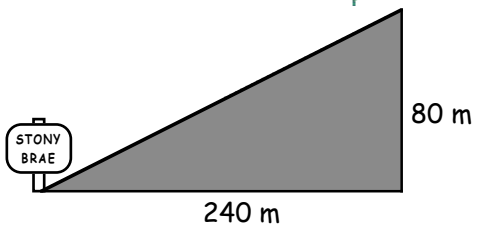
x	-4	-2	0	2
$y = \frac{1}{2}x + 1$				



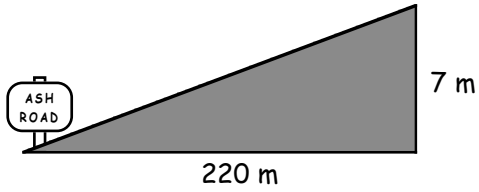
What have I learned ?

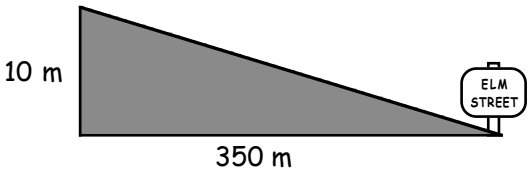
1. (a) Write down the gradient of Stony Brae as a fraction.

   (b) Simplify the fraction.



2. (a) Calculate the gradients of Ash Road and Elm Street.





   (b) Now change your answers to decimals (3 decimal places).

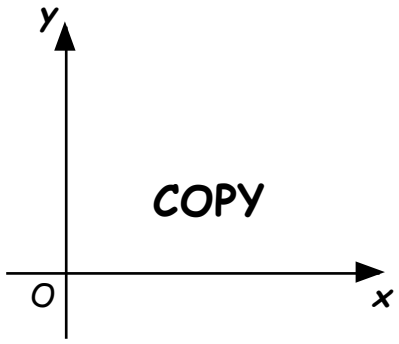
   (c) Which of the 2 streets is steeper ?

3. (a) Copy and complete the table for the line $y = 6x$.

x	0	$\frac{1}{2}$	1	$1\frac{1}{2}$	2
$y = 6x$					

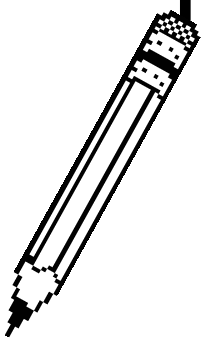
   (b) List the coordinates of the 5 points.

   (c) Draw a set of axes as shown, plot the 5 points and join them up to show the line $y = 6x$.



4. Copy the table below, list the coordinates of the points, draw a set of axes and draw the line $y = \frac{1}{3}x$ on it.

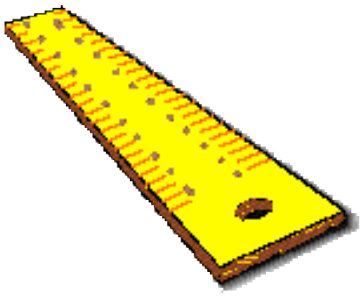
x	0	3	6	9
$y = \frac{1}{3}x$	**COPY THIS TABLE**			



What have I learned ?

5. (a) Complete the table for the line $y = 3x - 2$.

x	0	1	2	3
$y = 3x - 2$				



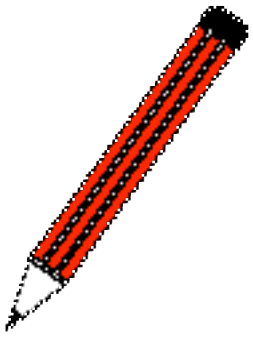
(b) List the coordinates of the 4 points.

(c) Draw a set of axes and show the line $y = 3x - 2$.

6. (a) Complete the table for the line $y = 4x - 1$.

x	-2	-1	0	1	2
$y = 4x - 1$					

(b) List the coordinates of the 5 points.



(c) Draw a set of axes and show the line $y = 4x - 1$.

7. (a) Complete the table for the line $y = \frac{1}{2}x - 4$.

x	0	2	4	6	8
$y = \frac{1}{2}x - 4$					

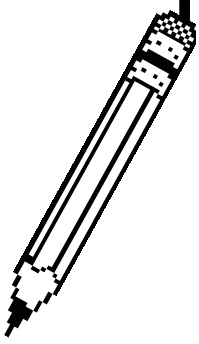
(b) List the coordinates of the 5 points.

(c) Draw a set of axes and show the line $y = \frac{1}{2}x - 4$.

8. (a) Complete the table for the line $y = 1{\cdot}5x + 2$.

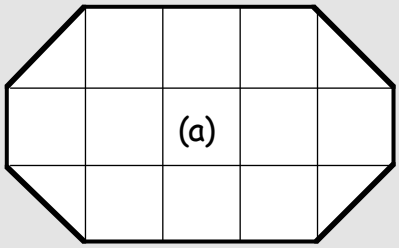
x	0	2	4	6	8
$y = 1{\cdot}5x + 2$					

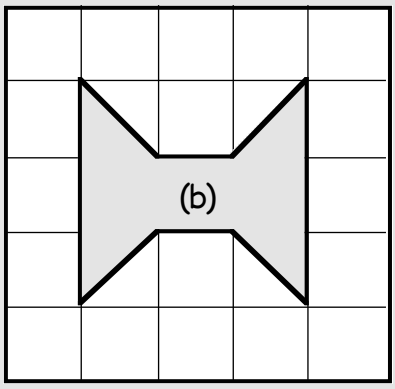
(b) List the coordinates of the 5 points.



(c) Draw a set of axes and show the line $y = 1{\cdot}5x + 2$.

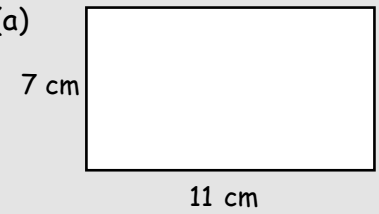
1. Write down the area of shape (a) and the area of the white part of shape (b).



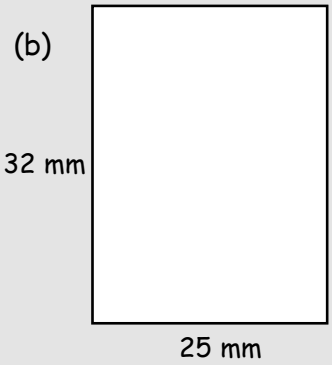


2. Calculate the areas of these rectangles :-
(*show your working*)

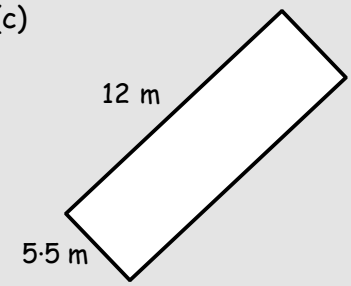
(a)



(b)



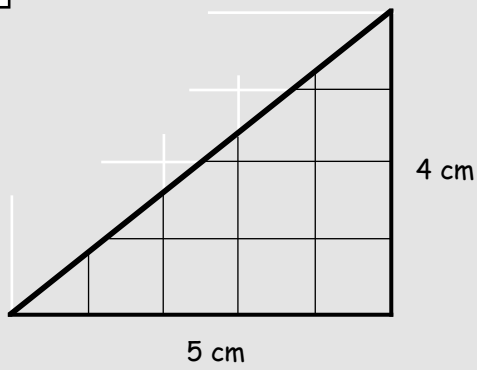
(c)



3. Write down the area of :-

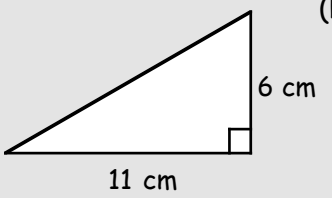
(a) the large surrounding rectangle.

(b) the right angled triangle.

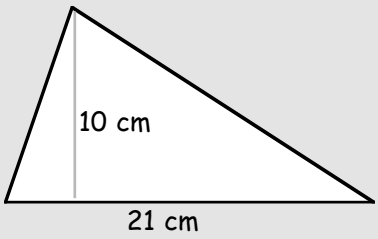


4. Calculate the areas of these triangles :-
(*show your working*)

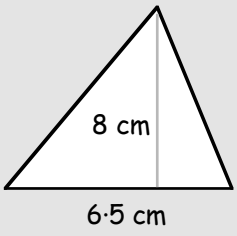
(a)



(b)

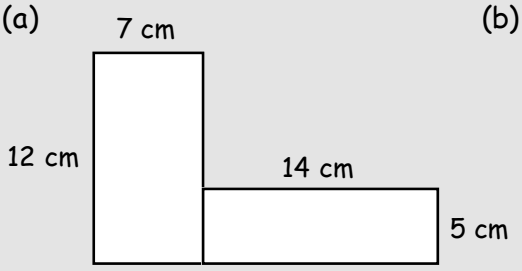


(c)

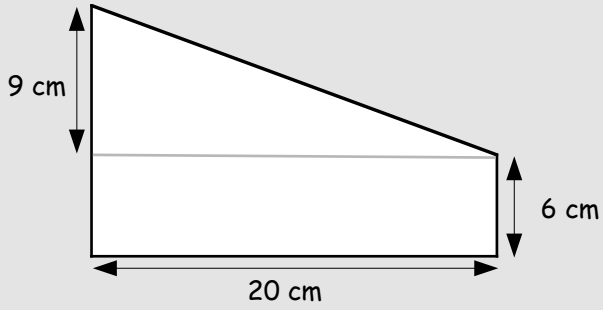


5. Calculate the areas of these two shapes :- (*show your working*)

(a)



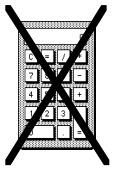
(b)



Non-Calculator

Number Three

Practice Exercise



1. Set down and find :-

   (a) $\begin{array}{r} 6825 \\ +\ 4309 \\ \hline \end{array}$ (b) $\begin{array}{r} 3602 \\ -\ 877 \\ \hline \end{array}$ (c) $\begin{array}{r} 2315 \\ \times\ 600 \\ \hline \end{array}$ (d) 82×36

   (e) $3600 \div 60$ (f) 9^2 (g) $6 + 10 \div 2$ (h) $\frac{325}{5}$

2. Set down and find :-

   (a) $\frac{8{\cdot}3}{2}$ (b) $\begin{array}{r} 44{\cdot}70 \\ +\ 9{\cdot}611 \\ \hline \end{array}$ (c) $34{\cdot}85 + 16{\cdot}5 - 7{\cdot}47$

   (d) $3 \times 19{\cdot}43$ (e) $51{\cdot}29 \times 200$ (f) $33{\cdot}66 \div 3000$

3. Change :- (a) 1 kg 85 g to kg (b) 236 cm to m (c) 9·65 litres to ml

4. How many :- (a) halves are in 6 (b) thirds are in 2 ?

5. Find :- (a) $3\frac{3}{4} + 2\frac{3}{4}$ (b) $6 \times \frac{3}{5}$ (c) $10 - 2\frac{3}{4}$

   (d) $2\frac{3}{5} \times 4$ (e) $\frac{2}{7}$ of 28 (f) $1\frac{3}{8} + 2\frac{1}{2} + 3\frac{1}{8}$

6. Simplify :- (a) $\frac{12}{20}$ (b) $\frac{60}{80}$ (c) $\frac{49}{56}$

7. Write as decimals :- (a) 86% (b) 4% (c) 17·2%

8. Find :- (a) 25% of £140 (b) 60% of 30 kg (c) $33\frac{1}{3}$% of 426

   (d) 1% of £60 (e) 3% of £12 (f) 20% of £1·95

9. In a pack of 40 wolves, 20% are females. How many <u>males</u> are there in the pack ?

10. Rewrite each group of numbers from smallest to largest :-

    (a) 7, –5, –1, 0, –10 (b) –42, 35, 44, –17

11. Find the value of :- (a) –7 + 22 (b) –6 + (–5) (c) 9 + (–15)

    (d) –13 × 5 (e) –17 – 10 (f) 6 – 19 (g) 3 – (–7)

    (h) –8 – (–6) (i) (–37) × 0 (j) –38 + (–2) (k) 19 + (–29)

12. My bank balance showed £30. I withdrew £45. What is my balance now ?

13. Write in 12 hour form (a) 1405 (b) 5 to mid-day (c) 10 past 2 (morning)

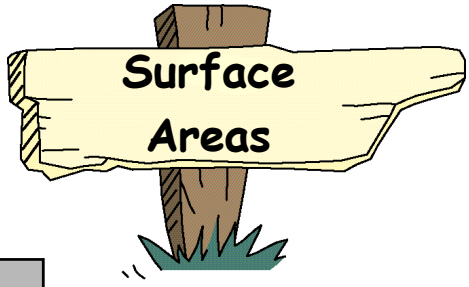
14. Change these to decimal fractions of an hour :-

    (a) 1 hour 30 minutes (b) 3 hours 15 minutes (c) 12 minutes

15. How many :- (a) days in June '02 (b) months in a year ?

16. Arrange in order, <u>fastest</u> time first :- 18·8 secs, 22·4 secs, 16·55 secs, 21·81 secs.

Chapter 7



Remember

Area of a Rectangle

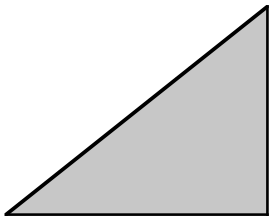
Area $= l \times b$

$= 6 \times 4$

$= 24\ cm^2$.

4 cm

6 cm



4 cm

5 cm

Area of a Triangle

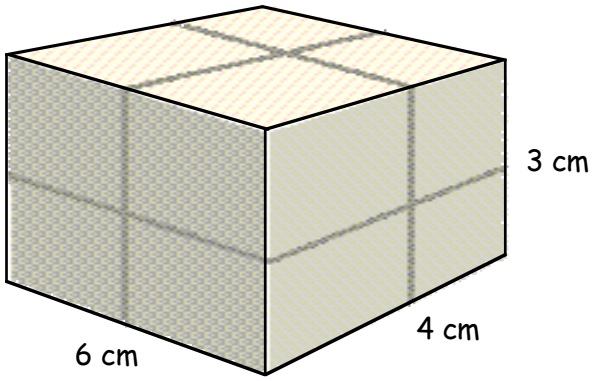
Area of triangle $= \frac{1}{2}$ of $(b \times h)$

$= \frac{1}{2}$ of (5×4)

$= 10\ cm^2$

Surface Area - This is the total area of all of the faces added together

Surface Area of a CUBOID



3 cm

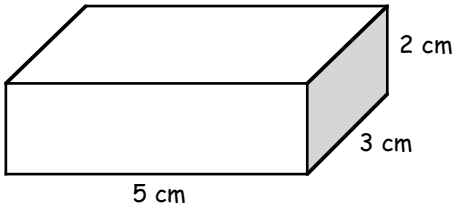
4 cm

6 cm

Set down like this :-

Area of front	$= l \times b$	$= 6 \times 3$	$= 18\ cm^2$
Area of back		= (same)	$= 18\ cm^2$
Area of top	$= l \times b$	$= 6 \times 4$	$= 24\ cm^2$
Area of bottom		= (same)	$= 24\ cm^2$
Area right side	$= l \times b$	$= 3 \times 4$	$= 12\ cm^2$
Area left side		= (same)	$= 12\ cm^2$
		Total Surface Area	$= \mathbf{108\ cm^2}$

Exercise 1



1. Copy each step here and calculate the **TOTAL** Surface Area (T.S.A.) of this cuboid.

Area of front = $l \times b$ = 5 × 2 = ? cm^2

Area of back = same = ? ...

Area of top = $l \times b$ = 5 × .....

Area of bottom

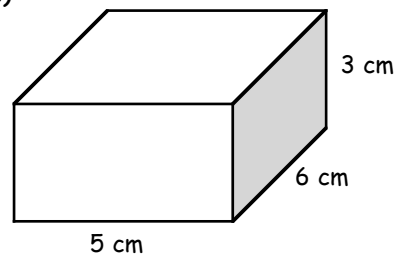
Area .....

Area .....

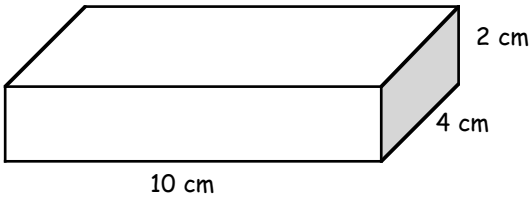
=> Total Surface Area= ? cm^2

2. Use the same method to calculate the total surface area of each of the following :-

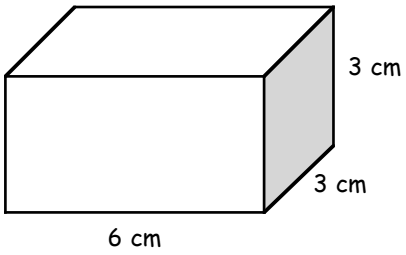
(a)



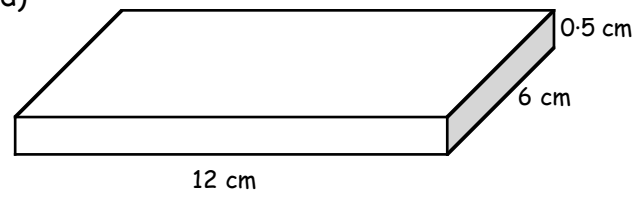
(b)



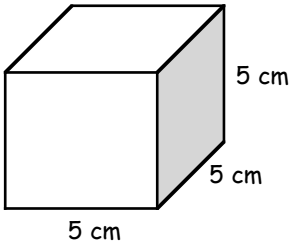
(c)



(d)



3. Surface Area of a CUBE – (can be done faster)



(a) What is true about <u>all</u> the six faces of a cube ?
(are they all the <u>same</u> – or are they different ?)

(b) To find the total surface area of a cube

=> Area of front face = $l \times b$ = 5 × 5 = ? cm^2

(c) Do you need to work out separately the areas of each of the other 5 faces or are they the same size as the front face ?

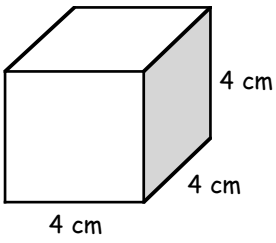
(d) To calculate the Total Surface Area

Area of all 6 faces = 6 × ? cm^2

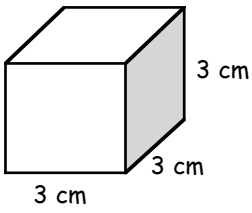
= ? cm^2

4. Calculate (i) the area of one face.
(ii) the total surface area of each cube.

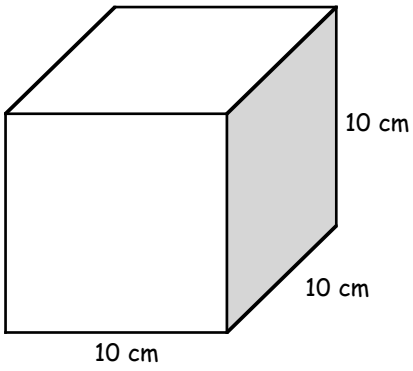
(a)



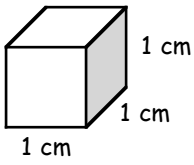
(b)



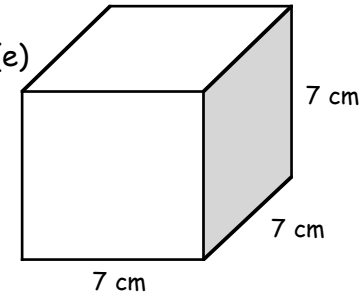
(c)



(d)

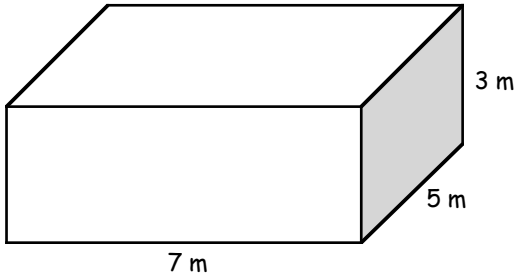


(e)

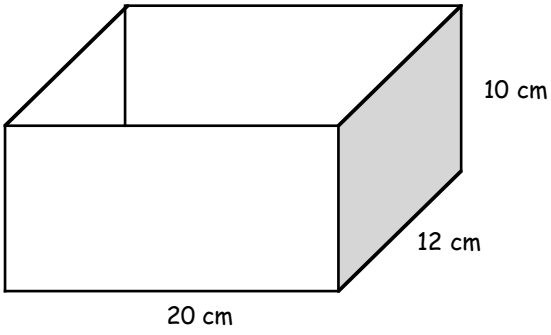


5. The surface area does not need to be in cm^2.

Calculate the total surface area of this concrete block (in m^2)



6.

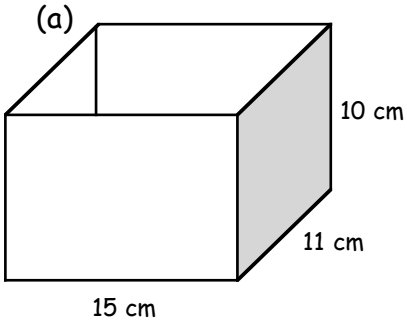


This cardboard box has no top.
It is made up of <u>5</u> faces.

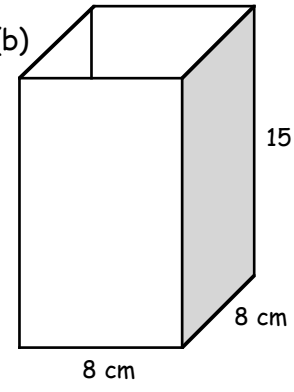
Calculate the total area of cardboard needed to make this box.

7. Calculate the area of card needed to make these <u>open top</u> boxes :-

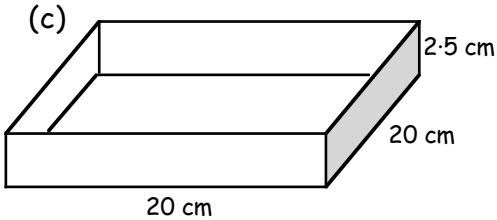
(a)



(b)

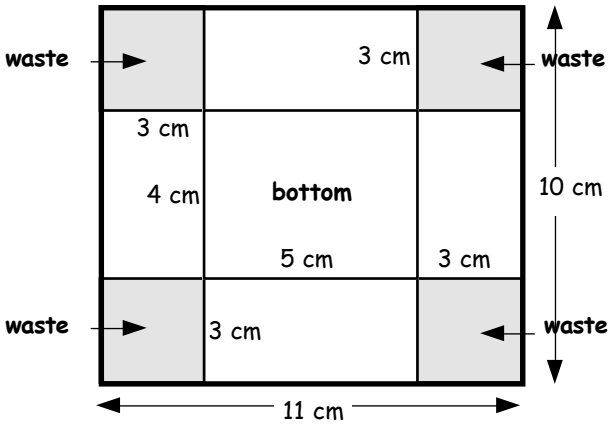


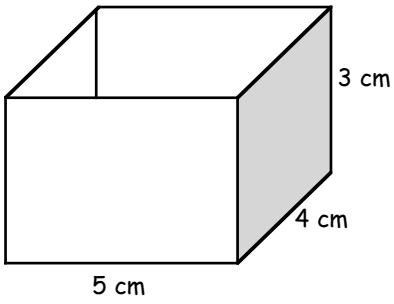
(c)



8. This open box is stamped out of a piece of card and folded.

The card looked like this :-





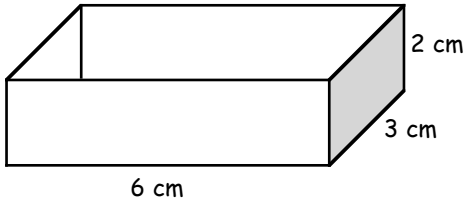
(a) Calculate the area of the whole piece of card.

(b) Calculate the area of each of the 4 waste bits.

(c) By subtracting, work out the area of the shape needed to make the open box.

(d) Now check if you get the same answer to (c) by calculating the total surface area of the open box.

9. Draw a similar net for this open box.



(a) Calculate the area of the surrounding rectangle.

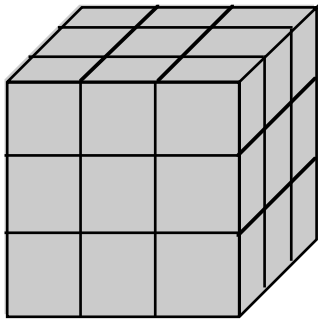
(b) Calculate the area of each of the 4 "waste" pieces.

(c) Use this to calculate the surface area of the open box.

10. **A Puzzle.** This big cube is made up of 27 small cubes stuck together.

Tony paints the outside of the cube with red paint and lets it dry. (all 6 faces)

He then takes all 27 cubes apart.



(a) How many of the 27 small cubes will have paint on just 1 of the six faces ?

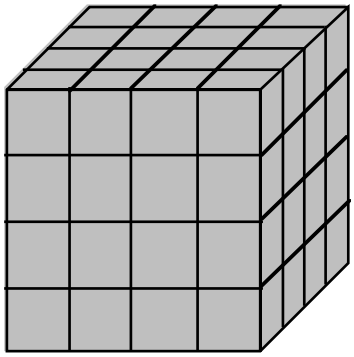
(b) How many of the 27 small cubes will have paint on just 2 of the six faces ?

(c) How many of the 27 small cubes will have paint on just 3 of the six faces ?

(d) How many of the 27 small cubes will have no paint on any face ?

(e) Check that when you add your answers from (a) to (d) you arrive at the original 27 cubes.

11. **Slighter Harder**



This time the big cube is made up of 64 small cubes stuck together. (4 x 4 x 4)

Tony paints the outside of the cube with yellow paint and lets it dry. (all 6 faces)

He then takes all 64 cubes apart.

(a) How many of the 64 small cubes will have paint on just 1 of the 6 faces ?

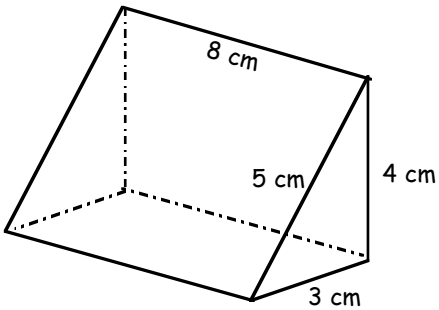
(b) How many of the 64 small cubes will have paint on just 2 of the 6 faces ?

(c) How many of the 64 small cubes will have paint on just 3 of the 6 faces ?

(d) How many of the 64 small cubes will have no paint on any face ?

(e) Check that when you add your answers you arrive at the original 64 cubes.

12. **Extension question**.



The surface area of a triangular prism.

A triangular prism consists of

3 rectangular faces and
2 (identical) triangular faces

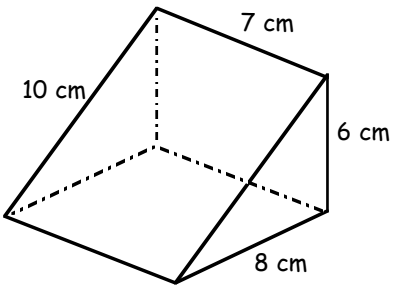
Copy and complete :-

Area of bottom rectangle	$= l \times b$	$= 3 \times 8$	$=$? cm^2
Area of back rectangle	$= l \times b$	$= 4 \times 8$	$=$? cm^2
Area of big front rectangle	$= l \times b$	$= 5 \times$	$=$? cm^2
Area of (right) triangular face	$= \frac{1}{2}$ of $b \times h$	$= \frac{1}{2}$ of 3×4	$=$? cm^2
Area of (left) triangular face	=	(same)	$=$? cm^2
		Total Surface Area	$=$? cm^2

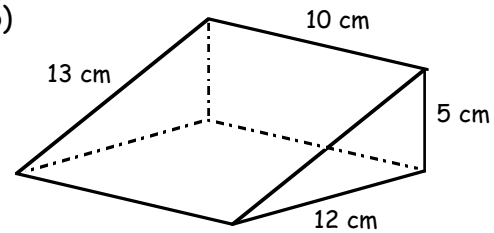
13. Try to do the same here.

Calculate the total surface area :-

(a)

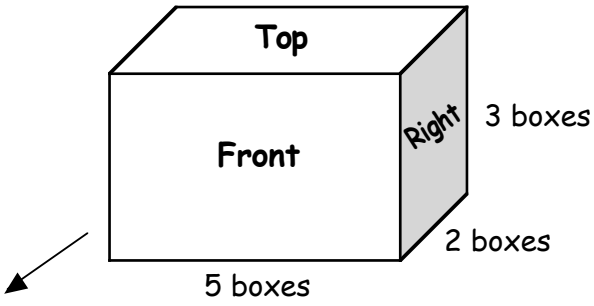


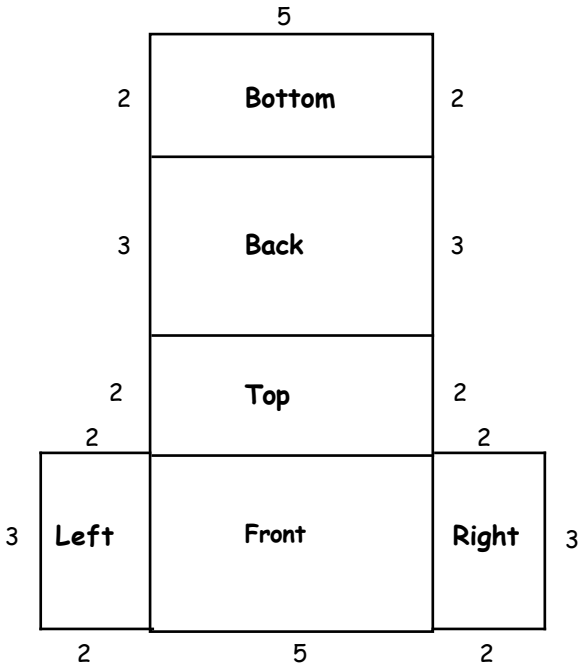
(b)



Nets of Solids

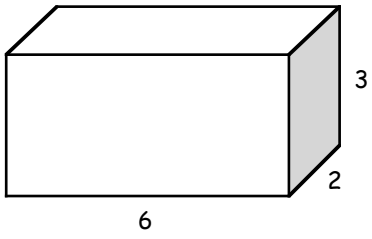
The **NET** of a solid shape is simply what you get when the shape is "flattened out".





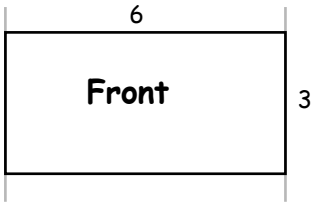
– a possible net

Exercise 2 ($\frac{1}{2}$ cm paper is ideal here)



1. This box measures 6 boxes by 2 boxes by 3 boxes.

   (a) Use a ruler to draw a net.
   (it helps to do it on $\frac{1}{2}$ cm squared paper)
   Start with :–

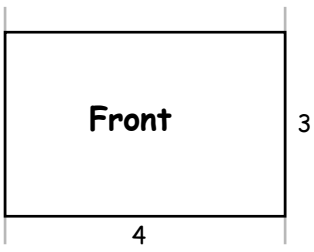


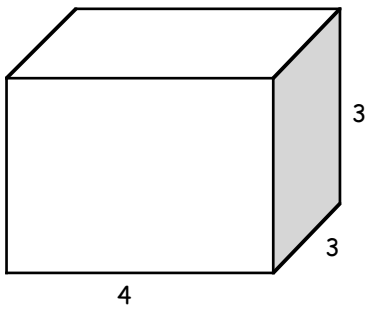
   (b) Calculate the area of each of the 6 rectangular faces (in boxes).

   (c) Calculate the total surface area of the cuboid (the net).

2. (a) Draw a net of this cuboid.

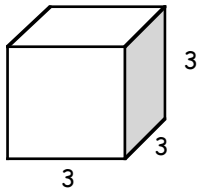
   Start with :–





   (b) Calculate the area of each face and the total surface area of the cuboid.

3. The net of this cube consists of 6 identical squares.



(a) Draw its net.

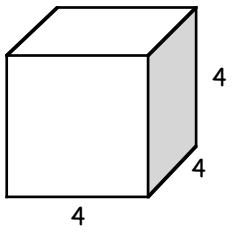
(b) Calculate the total surface area of the cube by using the net to help.

4. For each of the following cuboids :-

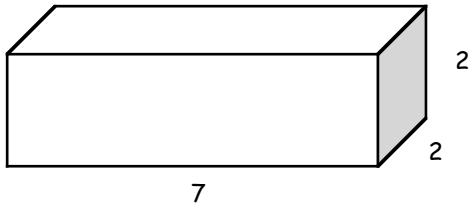
(i) Draw its net.

(ii) Calculate the total surface area of the cube by using the net to help.

(a)

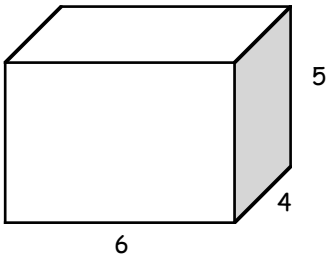


(b)



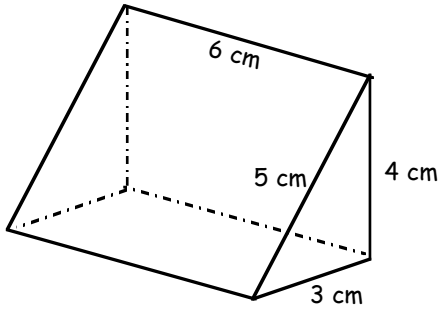
(c)

(d)

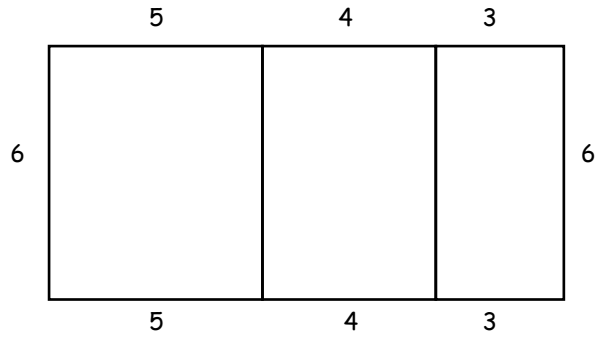


5. This is a "**triangular prism**".

Its net consists of a strip of 3 rectangles joined (6 by 5), (6 by 4) and (6 by 3) with 2 right angled triangles



(a) Copy this "part" of the net.



(b) Now decide where to "draw" the 2 triangles to complete the net.

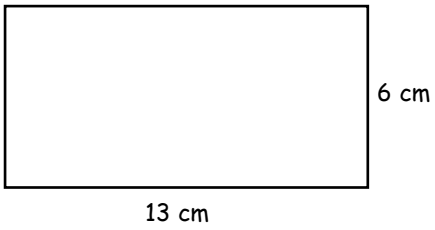
(c) Calculate the area of each of the 5 faces.

(d) Now find the total surface area of the prism.

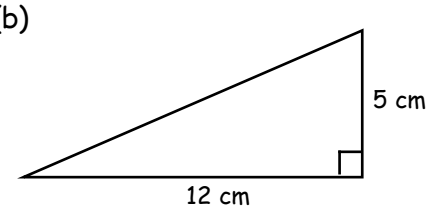
What have I learned ?

1. Calculate the area of each shape :-

(a)

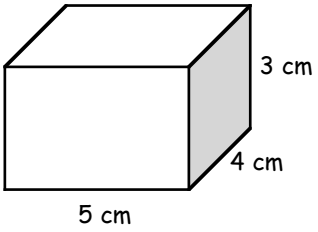


(b)

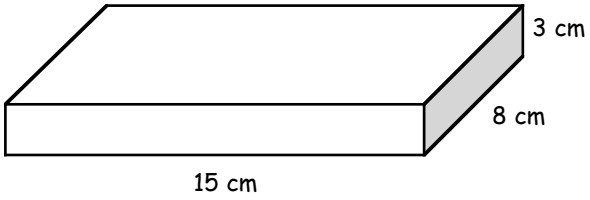


2. (a) Calculate the area of each of the 6 faces of this cuboid.

(b) Now calculate the total surface area of the cuboid.



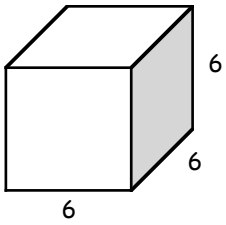
3.



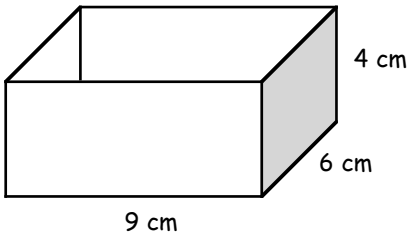
(a) Calculate the area of each of the 6 faces of this cuboid.

(b) Now calculate the total surface area of the cuboid.

4. Calculate the total surface area of this cube.



5.

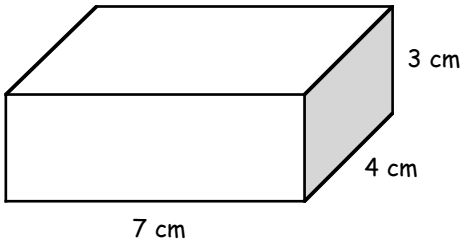


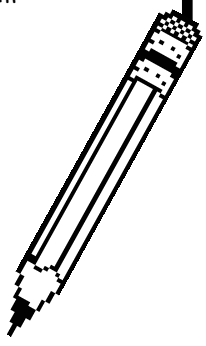
What area of card is needed in total to make this **open** box ?

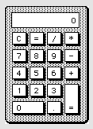
6. (a) Make a neat drawing of a net of this cuboid (in boxes).

(b) Calculate the area of each of its faces.

(c) Calculate the total surface area of the cuboid.







1. Stefan is paid £1675·40 per month. Calculate his **annual** pay.

2. Nicola is paid £6·25 per hour as a dental technician.
   How much did she earn last week in which she worked for 36 hours ?

3. Bramwells, the Fencing Contractor, pays its workers a basic rate of £6·20 per hour.
   (a) What would the OVERTIME hourly rate be at "**double time**" ?
   (b) What would the OVERTIME hourly rate be at "**time and a half**" ?

4. Natalia works for Bramwells. On Sunday she worked 6 hours overtime at "double time". How much overtime pay did Natalia receive ?

5. Cedric works in a florist shop. Mr Rose pays him a basic rate of £5·40 per hour. Last week Cedric worked his normal basic 34 hours.
   He also did 4 hours overtime at "time and a half".
   (a) Calculate Cedric's basic pay. (b) Calculate his overtime pay.
   (c) Calculate the total amount Cedric was paid last week.

6. Last year Tanya's salary was £16 500. This year she received a 3% pay rise.
   (a) Calculate the actual pay rise due to Tanya.
   (b) Now calculate Tanya's new annual salary.

7. Sam sells cars for Milton's Motors. He receives 2% **commission** on any car he sells. He sold a new Rover car for £12 600. How much commission is he due ?

8. Jackie's hourly rate of pay is £6·30. Last week he worked his normal 40 hours. He also received a company Xmas bonus of £105·40. Calculate his **gross** pay for the week.

9. Shown is Billy Jones' pay slip. Calculate his **NET** pay for the week.

SHEPHARDS PLUMBING MERCHANTS

Name :- William Jones Works No. :- 16905 Week No :- 22

Income	Basic -	£704·42	O/time -	£95·86	Bonus -	—	Total -	£ ?
Deducts	I.T. -	£137·61	Superan -	£35·21	Nat Ins -	£44·87	Total -	£ ?
				Net Pay				£ ?

Chapter 8

Volumes by Counting

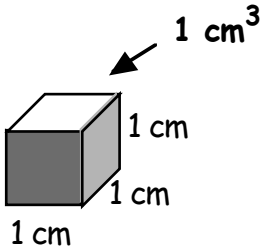
The volume of a shape is simply the "**amount of space**" it takes up.

One Unit of volume is the "**cubic centimetre**".

This small cube measures 1 cm by 1 cm by 1 cm.

It has a volume of **1 cubic centimetre**.

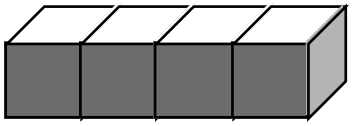
or for short :- $1\ cm^3$



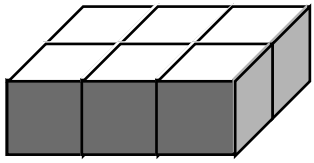
Exercise 1

1. Write down the volume of each of the following shapes in cubic centimetres (cm^3) :-
(*i.e. how many cubic centimetres are used to make each one*)

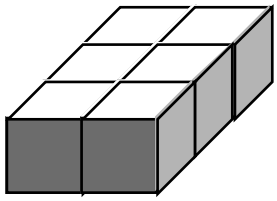
(a)



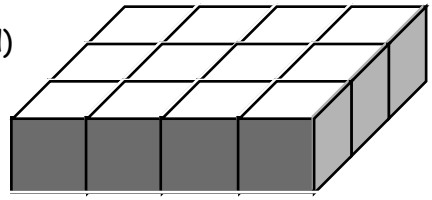
(b)



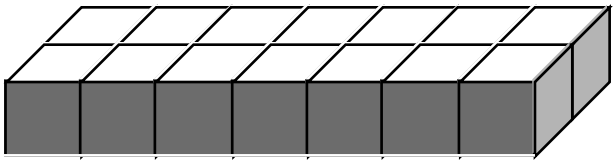
(c)



(d)



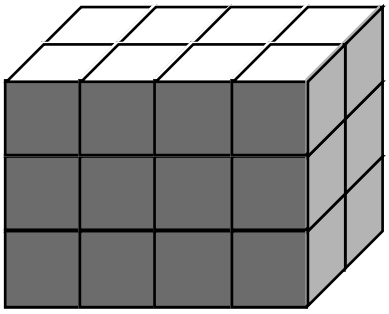
(e)



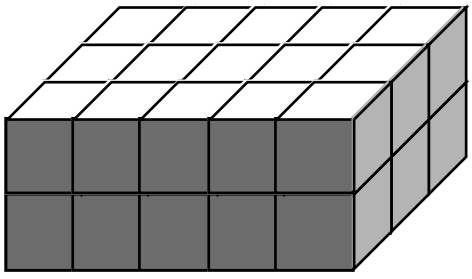
2. (a) How many cubes are on the top layer of this shape ?

(b) How many layers does it have ?

(c) What is its total volume ?



3.



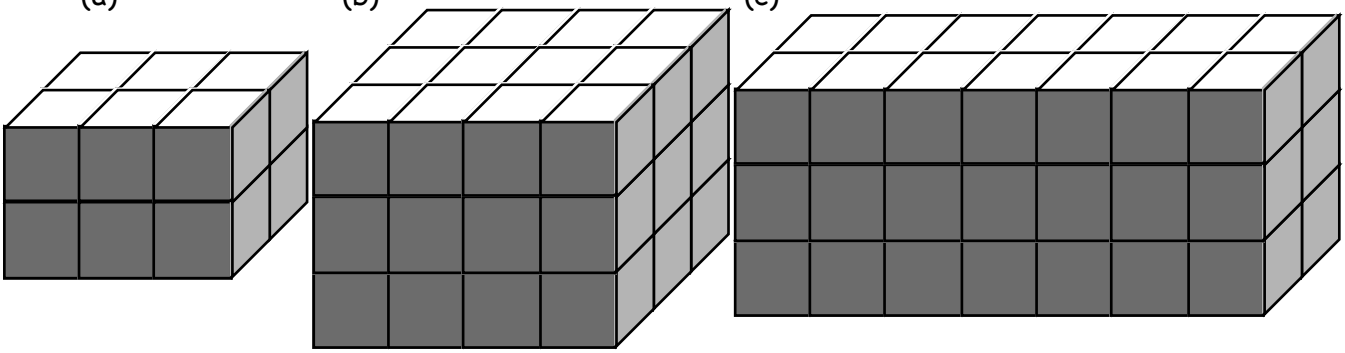
(a) How many cubes are on the top layer ?

(b) How many layers does it have ?

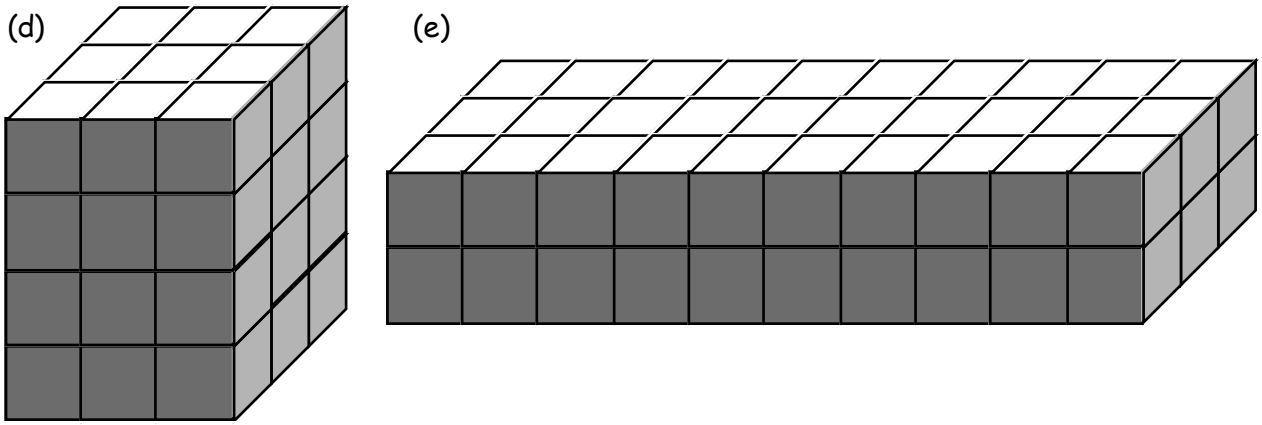
(c) What is its total volume ?

4. By working out the volume of the top layer first, calculate the total volume (in cm^3) of each of the following shapes :-

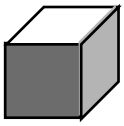
(a) (b) (c)



(d) (e)

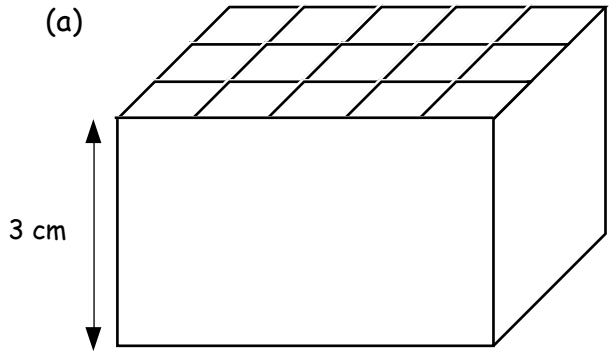


5. Calculate the volume of each cuboid :-
(show how you got your answers)

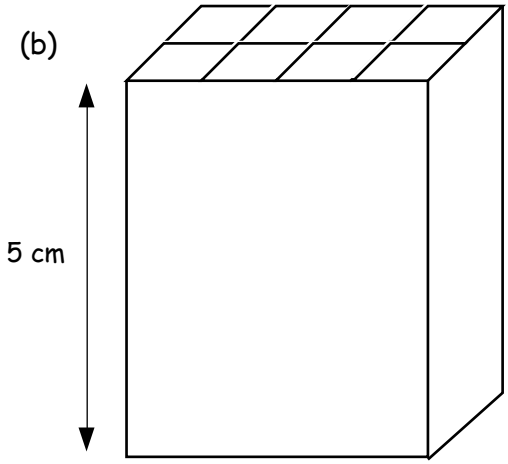


= **1 cm^3**

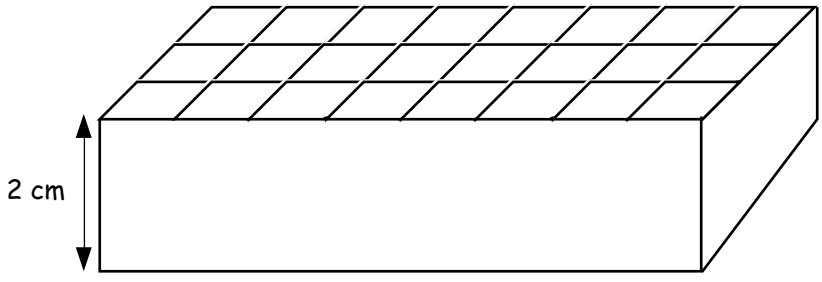
(a)



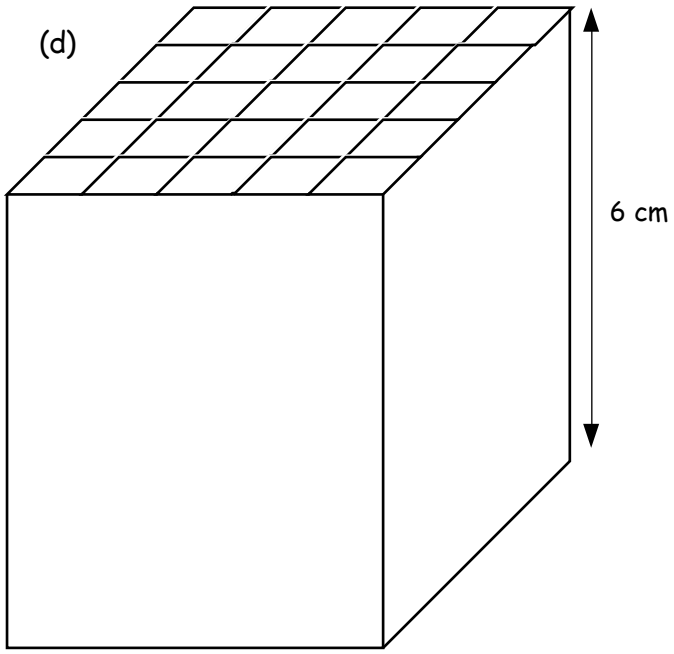
(b)



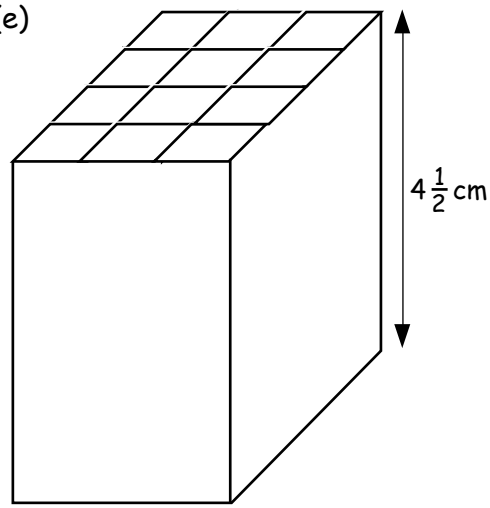
(c)



(d)

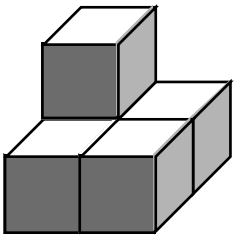


(e)

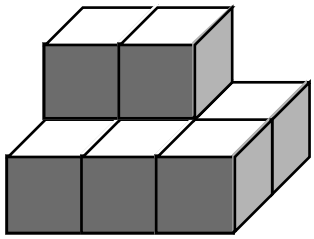


6. Calculate the volume of each the following shapes by counting the cubes :-

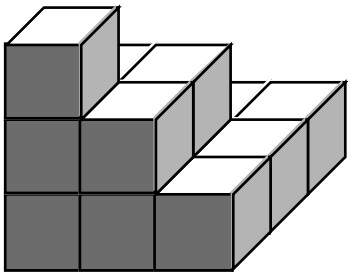
(a)



(b)



(c)



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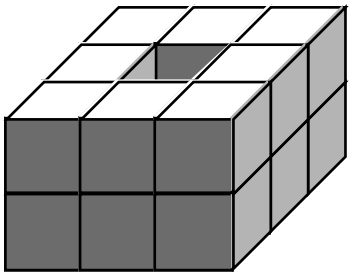
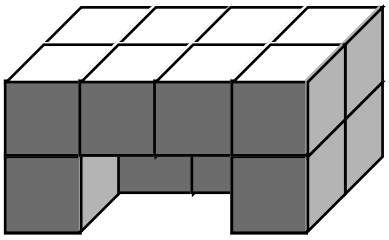


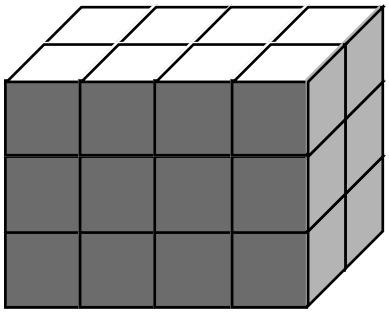
(e)



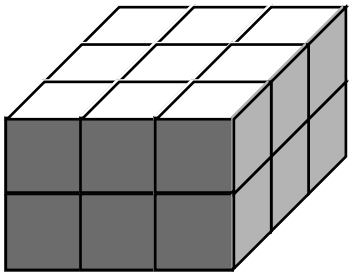
7. (a) Use a ruler and squared paper to sketch each of the following :-

(b) Calculate their volumes.

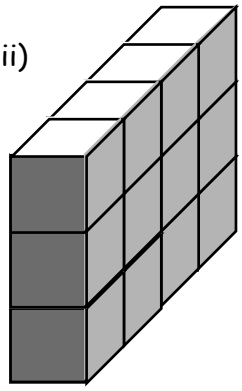
(i)



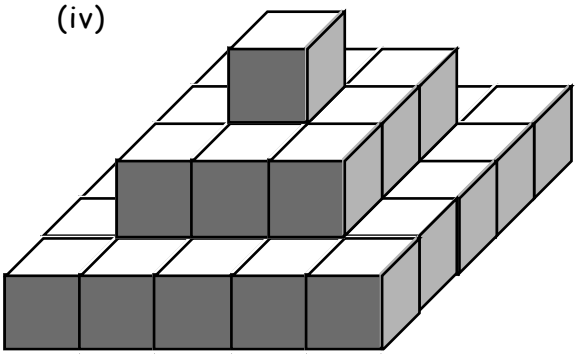
(ii)



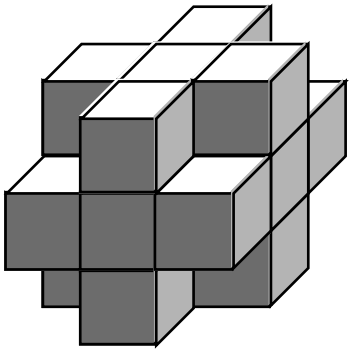
(iii)



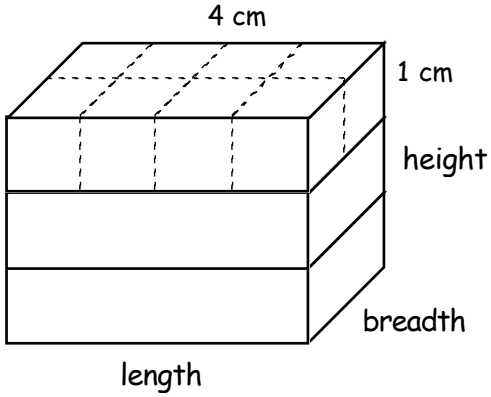
(iv)



(v)



The Volume of a Cuboid – (A formula)



(i) Can you see that the top layer of this cuboid is made up of

$(2 \times 4) = 8\ cm^3$?

(ii) Can you also see that there are 3 layers ? This means

Volume = $(2 \times 4) \times 3 = 24\ cm^3$?

To find the volume of a cuboid, you can do so by simply multiplying

length x breadth x height

Formula :- Volume = $l \times b \times h$

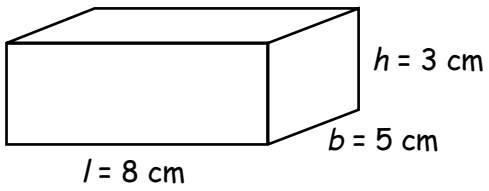
Exercise 2

1. Copy and complete for this cuboid :-

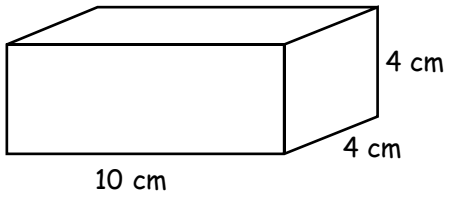
$V = l \times b \times h$

$V = 8 \times 5 \times 3$

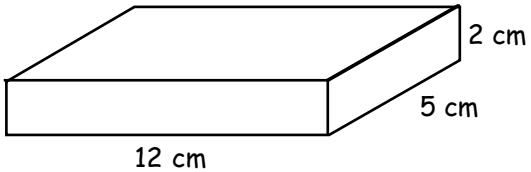
$V =$ ..... cm^3



2. Use the formula $V = l \times b \times h$ to calculate the volume of this cuboid. (*show your working*).



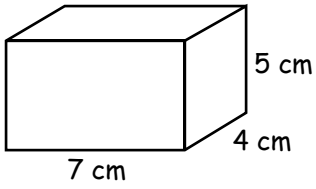
3.



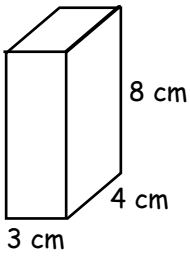
Use the formula again to calculate the volume of this cuboid.

4. Calculate the volume of each of the following cuboids (*show your working*) :-

(a)



(b)



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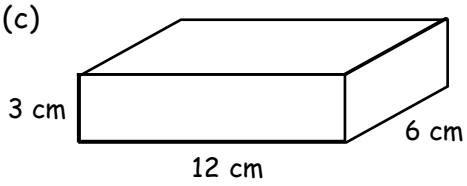
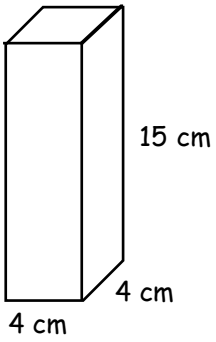
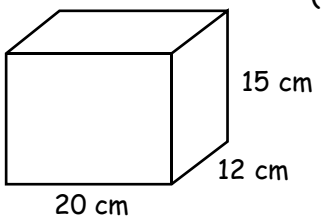


(d)



(e)



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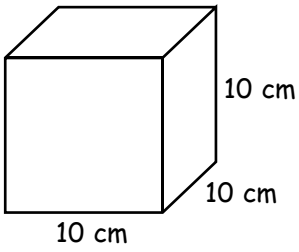
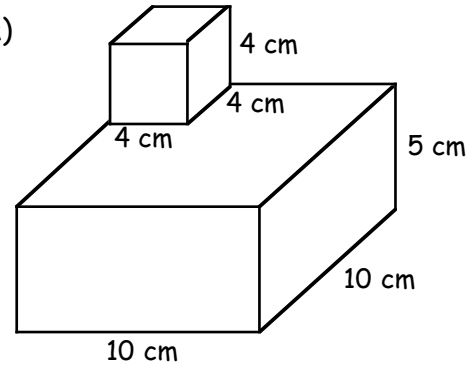
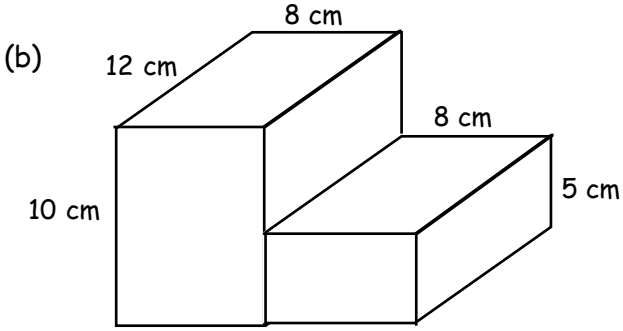


5. By calculating the volume of each "block" in the shape, find the total volume each time here :-

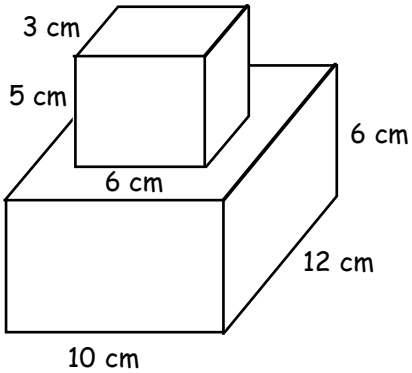
(a)



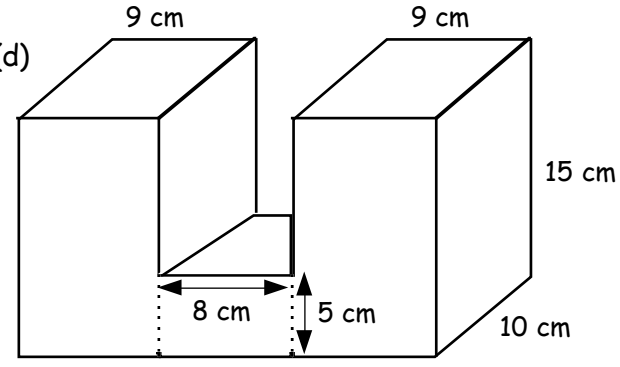
(b)



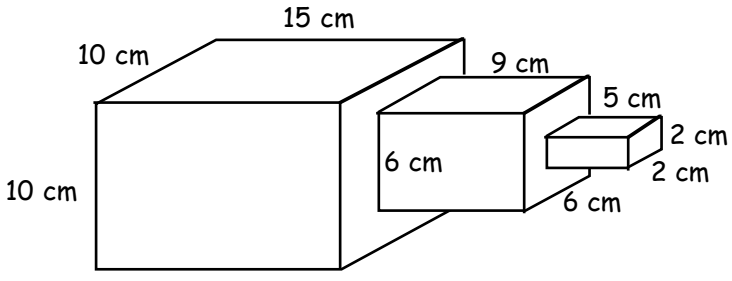
(c)



(d)

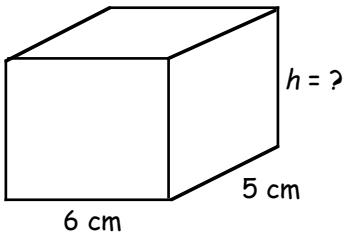


(e)



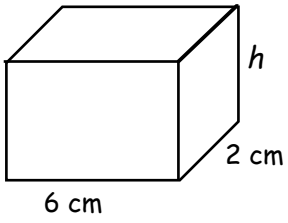
6. The volume of this cuboid is 120 cm^3.

Calculate its height.



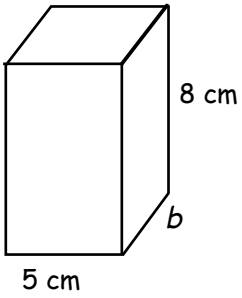
7. Calculate the length of the missing edge in each of the following cuboids :-

(a)



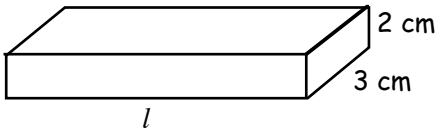
(Vol = 48 cm^3)

(b)



(Vol = 120 cm^3)

(c)



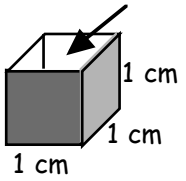
(Vol = 60 cm^3)

Liquid Volumes

If you take a hollow cube whose sides are all 1 centimetre, and fill it with water, we say it holds 1 millilitre of liquid.

Volume = 1 cm^3

= 1 ml



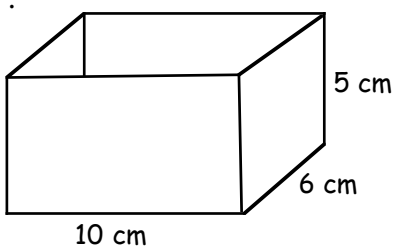
1 cm^3 = 1 ml

Can you see that **1000 cm^3 = 1000 ml = 1 litre** ?

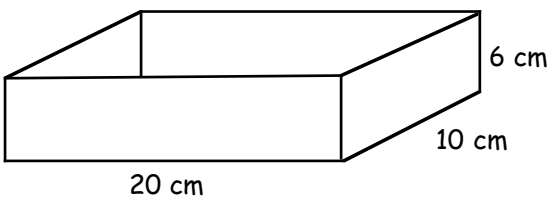
Exercise 3 (you may use a calculator here)

1. (a) Calculate the volume of this rectangular container, in cm^3.

(b) How many millilitres of liquid will it hold ?



2.

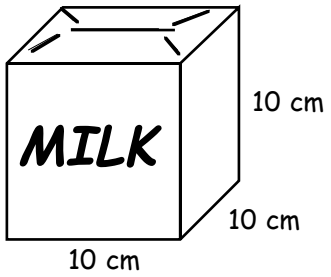


(a) Calculate the volume of this rectangular container in cm^3.

(b) How many millilitres of liquid will it hold ?

3. A new milk carton is designed.
It is a cube measuring :-

10 cm by 10 cm by 10 cm.



(a) Calculate its volume in cm^3.

(b) Write down its volume in millilitres.

(c) How many litres will it hold ?

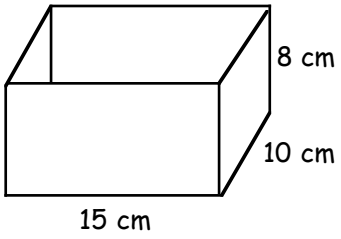
4. **Remember : to change from millilitres —> litres you simply ÷ 1000.**

Change each of the following to litres :-

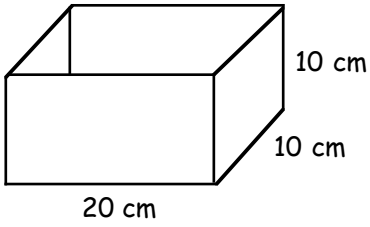
(a)	3000 ml	(b)	5000 ml	(c)	17000 ml
(d)	2500 ml	(e)	1600 ml	(f)	14750 ml
(g)	800 ml	(h)	500 ml	(i)	250 ml

5. Calculate how many litres of liquid each of the following containers could hold :-
(hint : use $V = l \times b \times h$ to find the answer in cm^3 —> ml —> litres)

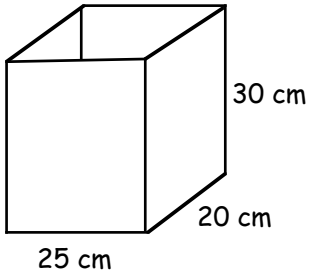
(a)



(b)



(c)

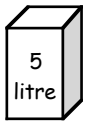


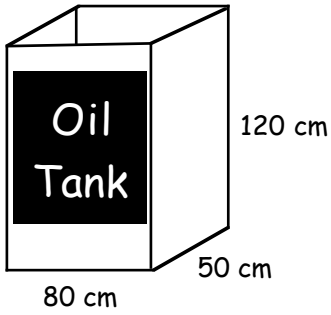
6. A tank, in the shape of a cuboid, holds oil.

(a) Calculate its volume in cm^3.

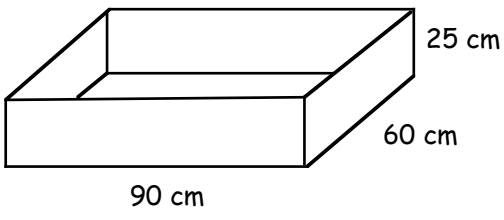
(b) How many litres can it hold ?

(c) How many 5 litre oil cans can be filled from the tank when it is full ?





7. This tray collects rainwater from a roof.

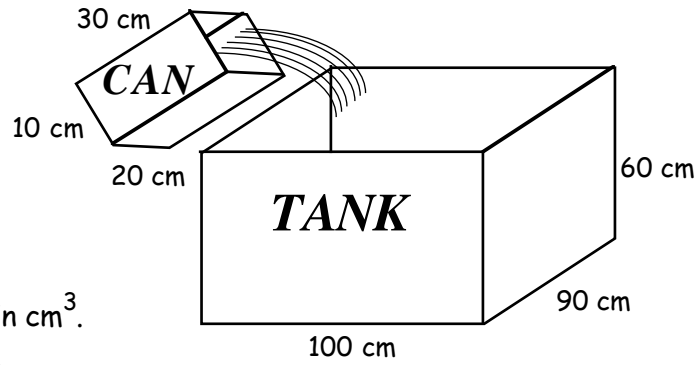


(a) Calculate its volume in cm^3.

(b) How many millilitres will it hold when full ?

(c) Write its volume in litres.

8. A can is in the shape of a cuboid and measures 20 cm by 30 cm by 10 cm.



(a) Calculate its volume in cm^3.

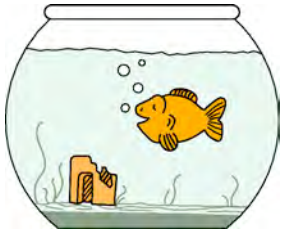
(b) How many litres can it hold ?

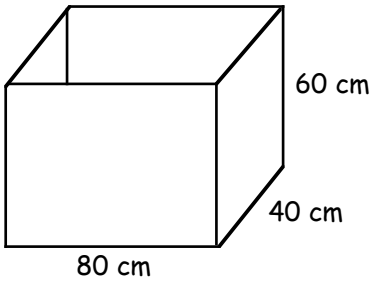
The can is used to fill this water tank.

(c) Calculate the volume of the tank in cm^3.

(d) How many litres can the tank hold ?

(e) How many times must the can be used to fill the tank ?



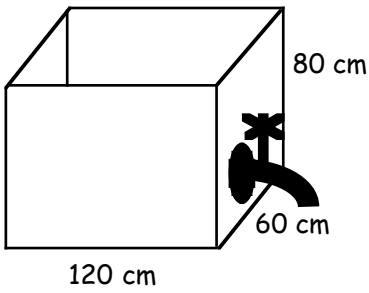
9. 

Calculate how many <u>litres</u> of water this tank can hold if it is :-

(a) full (b) $^1/_2$ full

(c) $^1/_3$ full (d) $^3/_4$ full

10. This tank is full of water.



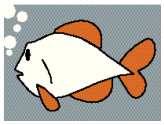
(a) Calculate its volume in cm^3.

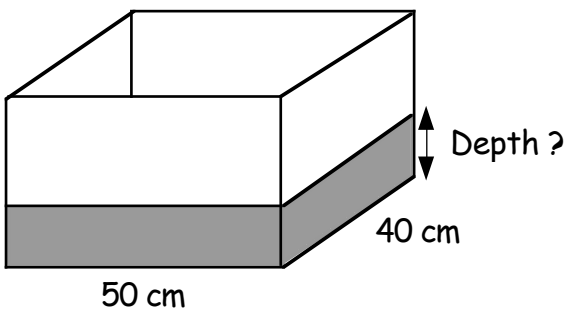
(b) How many litres can it hold ?

The tap is opened and water pours out at a rate of 3 litres/minute.

(c) How long will it take for the tank to empty ?

11. **Harder !!**





The base of this tank measures 40 cm by 50 cm.

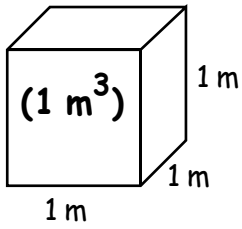
30 litres of water is poured into the tank.

(a) How many millilitres is this ?

(b) What will the depth of the water be in the tank ?

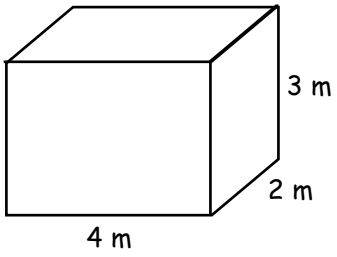
12. Ready mixed cement is measured in cubic metres.

The diagram shows $1\ m^3$

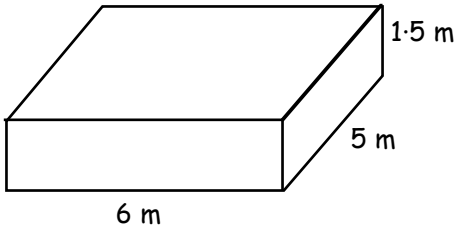


Calculate the volumes of the following concrete blocks (in m^3).

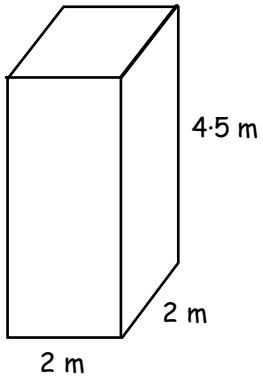
(a)



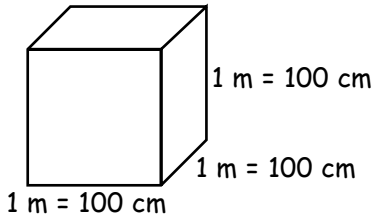
(b)



(c)



13.



This is a cube of side 1 metre.

(a) What is its volume in cubic metres ?

(b) What is its volume in cubic centimetres ?

(c) Write down and complete

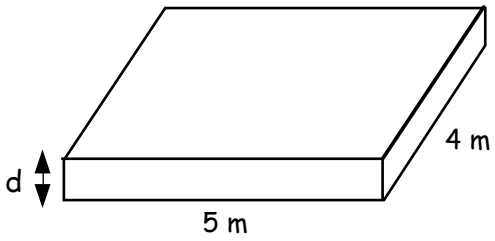
$1\ m^3 =$ ..... cm^3

14. A concrete base is laid in the shape of a cuboid.

The volume of concrete used is $6\ m^3$.

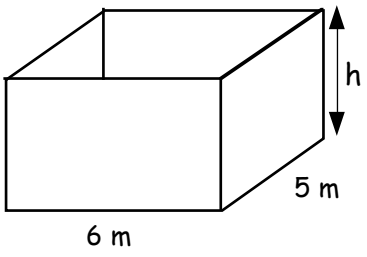
(a) Use your calculator to find the depth of the concrete in metres. (the answer is a decimal)

(b) Now write the depth in centimetres.



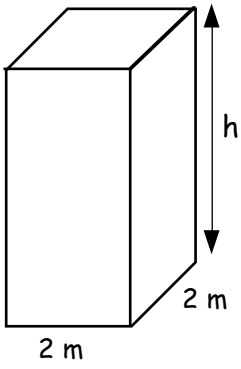
15. Calculate the heights of these concrete blocks :-

(a)



(Vol = $75\ m^3$)

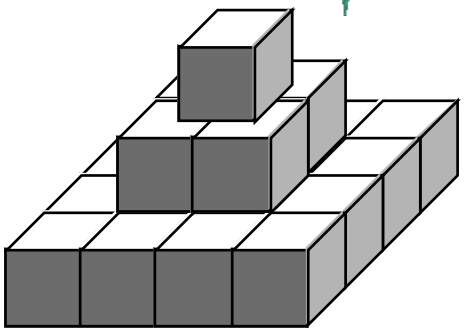
(b)



(Vol = $14\ m^3$)

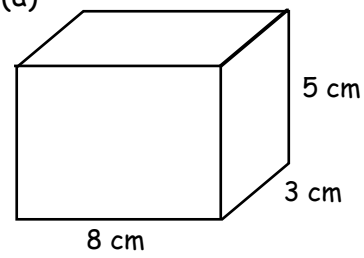
What have I learned ?

1. Write down the volume of the shape shown opposite, in cubic centimetres.

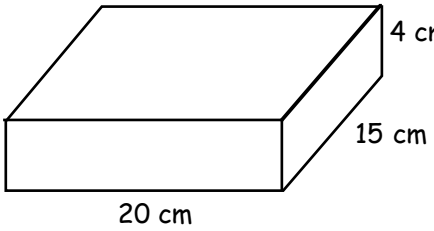


2. Use the formula to calculate the volume of each of these cuboids :-

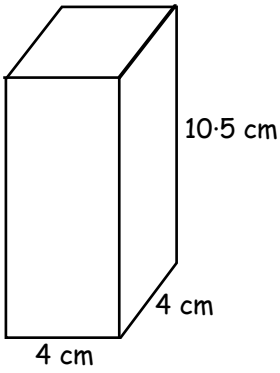
(a)



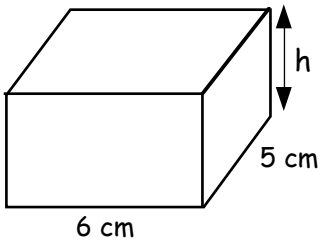
(b)



(c)



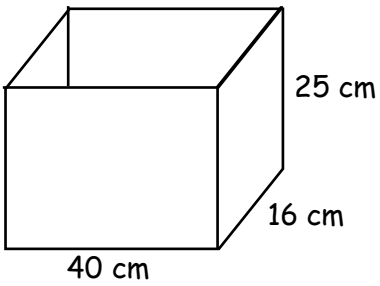
3.



The volume of this cuboid is 120 cm^3.
Calculate its height.

4. Change to litres :- (a) 6000 ml (b) 3400 ml (c) 500 ml.

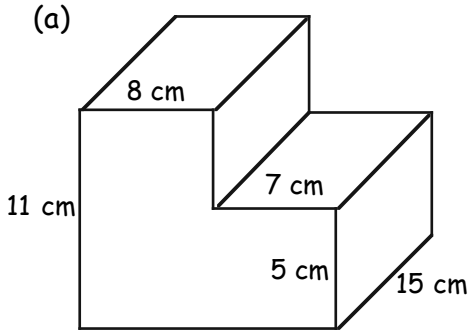
5. (a) Calculate the volume of this tank. (in cm^3).
   (b) How many millilitres of water can it hold ?
   (c) Change your answer to litres.



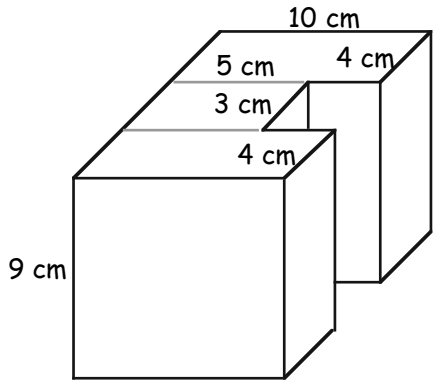
What have I learned ?

6. Calculate the volumes of these shapes (in cm^3) :-

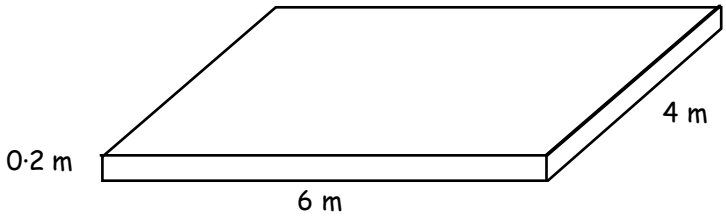
(a)



(b)



7. Calculate the volume of this rectangular patio in cubic metres.

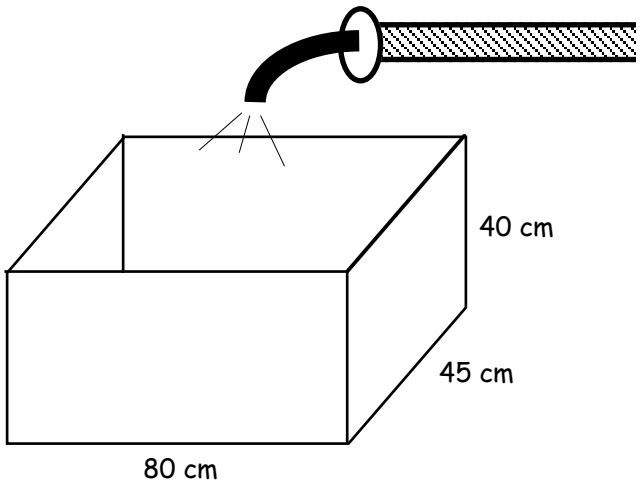


8. Water pours into this tank at a rate of 12 litres per minute.

(a) Calculate the volume of the tank (in millilitres).

(b) Change your answer into litres.

(c) Calculate how long it will take to fill the tank.



1. One reason why you should deposit any large sum of money you have in a bank or building society, rather than put it in a box under your bed, is it is safer.
   Give a 2nd important reason for doing so.

2. Alliance Bank pays an annual rate of interest of 3·5%.

   The McKinnons put their savings of £24000 into Alliance and leave it there for 1 year.

   (a) Calculate how much interest they will receive.

   (b) How much will their savings then be worth ?

3. Natasha won £5600 in the lottery.
   She decided to put it into the Alliance Bank for 1 year.

   (a) How much interest would she expect at the end of the year ?

   (b) If she withdrew her money after 1 month, how much interest would she receive ?

   (c) In fact, Natasha lifted the money from her account after **5 months**.
   How much interest did the bank have to pay her ?

4. V.A.T. is charged at $17\frac{1}{2}\%$. How much V.A.T. would you expect to pay when you buy a 28 inch TV priced £560 ?

5. Lorna gets her living room redecorated by Paddy.

   Make a copy of the bill and calculate the final overall cost of decorating Lorna's living room (Show <u>all</u> working).

"PADDY THE PAINTER"

Paper	=	£28·50
Paint	=	£22·75
Labour (8 hrs at £12·60)	=	£ ?
Sub Total	=	?
+ VAT ($17\frac{1}{2}\%$)	=	?
Total Bill		?

6. The Davidson's electricity bill arrived for the period May to July 2002.

   Copy the bill out neatly and calculate the final amount due.

WEST & CENTRAL ELECTRICITY BOARD (WCEB)

Householder :- Mr T Davidson	**Period :- May 31st – July 11th (2002)**
Units	Charges
Present Reading :- 18763	? units at 12·5p/unit = £ ?
Previous Reading :- 18351	+ VAT (8%) = £ ?
Units used :- ?	Amount due = £ ?

7. Write down the answer to each of the following (no calculator) :-

(a) 10% of £17 (b) 50% of £220 (c) 25% of £1·60

(d) $33\frac{1}{3}$% of £120 (e) 5% of 60p (f) 20% of £75

<u>You may use a calculator for the remainder of this exercise.</u>

8. Tony's pay in 2001 was £24 000. He received a pay rise of 3·5% in 2002.
How much did Tony earn in 2002 ?

9. A car dealer buys a car for £8 975.
He sells it for £10 225.

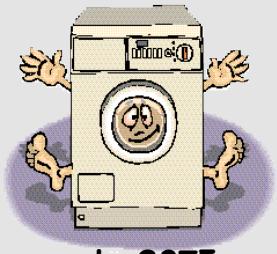
How much profit does he make on the car ?

10. PASCO's buys in boxes of 12 Easter eggs for £27·95.
Each egg sells for £2·75.

How much profit is made when a whole box of 12 eggs is sold ?

11. I bought a CLEANAWAY washing machine priced at £375, using a Hire Purchase agreement.

I left a deposit of £37·50 and agreed to make 12 monthly payments of £35·20.



(a) How much did it cost me altogether for the washing machine using the H.P. terms ?

(b) How much could I have saved by paying cash ?

12. (a) My bungalow is valued at £110 000.
How much would it cost me to insure it each year with COVERALL ?

(b) The value of the contents of my house are £25 000.
How much would it cost to insure the contents with COVERALL for a year ?

13. Jack is 34 and a non-smoker. He wishes to take out an Endowment policy for £15 000.

Use the table to calculate his monthly premium.

Premium rate per £1000		
Age	Smoker	Non-Smoker
33	£3·85	£2·95
34	£3·99	£3·05
35	£4·15	£3·20

14. The "Exchange Rate" is shown opposite :-

(a) If I change £350 to euros, how many will I receive ?

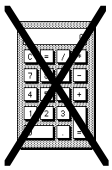
(b) If I change $612 back to £'s, how much will I receive ?

Exchange Rate
£1 = 1·56 euros
£1 = $1·63

Non-Calculator

Number Four

Practice Exercise



1. Set down and find :-

   (a) 3577 + 806 – 328 (b) $\frac{32+16}{6}$ (c) 850 ÷ 50 (d) $\frac{8\times 9}{3\times 4}$

   (e) 12^2 – 44 (f) (34 + 15) ÷ 7 (g) 24 × 4000 (h) 36 × 25

2. Set down and find :-

   (a) 19 – 11·683 (b) $30\overline{)86{\cdot}4}$ (c) $6\overline{)63}$ (d) 19·2 ÷ 4

   (e) (4·2 + 9·3) × 5 (f) 37 ÷ 1000 (g) 21·61 × 8 (h) 0·0023 × 1000

3. I have £175·75 saved. How much more do I need to pay for a computer costing £649·99 ?

4. Change to mixed numbers :-

   (a) $\frac{28}{6}$ (b) $\frac{22}{9}$ (c) $\frac{76}{10}$ (d) $\frac{15}{6}$

5. Find :- (a) $\frac{2}{5}$ of 45 (b) $\frac{3}{8}$ of 48 (c) $\frac{2}{3}$ of 33

6. Find :- (a) $4\frac{7}{10}+\frac{1}{5}$ (b) $7\frac{1}{2}-3\frac{3}{4}$ (c) $6\times\frac{4}{5}$

   (d) $5\frac{3}{7}+3\frac{4}{7}-1\frac{6}{7}$ (e) $2\times 3\frac{5}{8}$ (f) $\frac{2}{5}\times\frac{5}{6}$

7. I video a T.V. film lasting $2\frac{3}{4}$ hours, then another lasting $\frac{1}{2}$ an hour. How much time is left on a 4 hour tape ?

8. Express as a fraction (a) 15% (b) 36% (c) 2%

9. Find the value of :- (a) $33\frac{1}{3}$% of £18 (b) 3% of 6000 (c) 25% of 444

   (d) 5% of 600 m (e) 7% of £8 (f) $66\frac{2}{3}$% of 126 ml

10. Nicki spent 40% of his £700 savings on a new bike. How much did he have left ?

11. Draw a set of axis from –6 to 6 on each axis and show these four points :-

    P(–5,4) Q(0,–6) R(–2,–5) S(1,–3)

12. Find the value of :- (a) –30 – (–10) (b) 18 + (–19) (c) –9 × 8

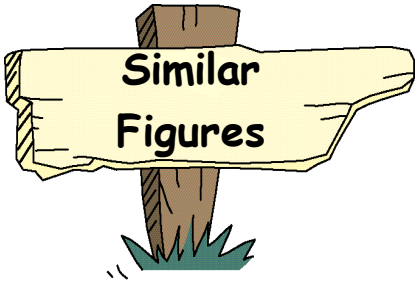
    (d) 0 – (–14) (e) –6 + (–3) + (–9) (f) –6 – (–3) – (–9)

    (g) 14 + (–1) + 6 + (–11) (h) –109 – 31 (i) 8 × –11

13. What time is :- (a) 20 minutes earlier than 11·00 am (b) 35 minutes later than 5·45 pm ?

14. How many days is it from 22nd August till 5th September, including these dates ?

Chapter 9

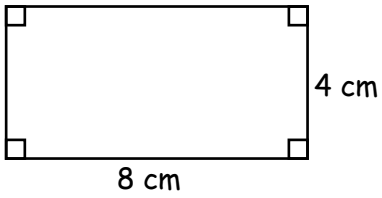


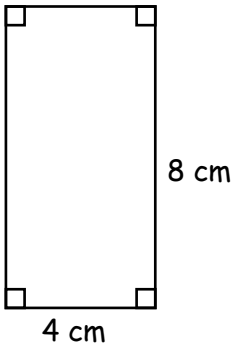
Similar Figures

Two figures are said to be **CONGRUENT** in Maths if they are "exactly the same".

(One figure should be able to be lifted and placed on top of the other exactly)

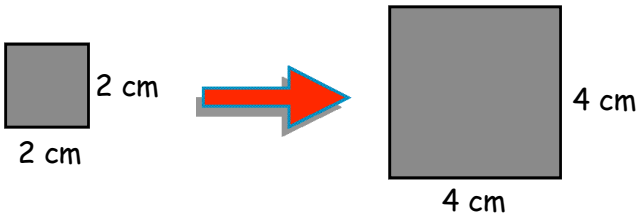
These 2 rectangles are congruent



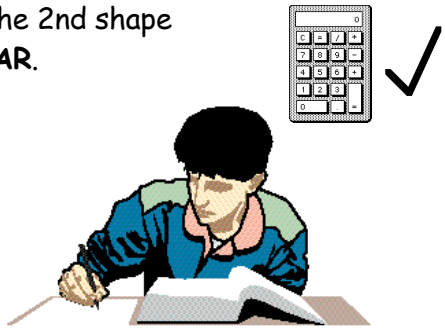


Two figures are said to be **SIMILAR** if :-

they are basically "the same shape" but
one is an **enlargement** (or reduction) of the other.

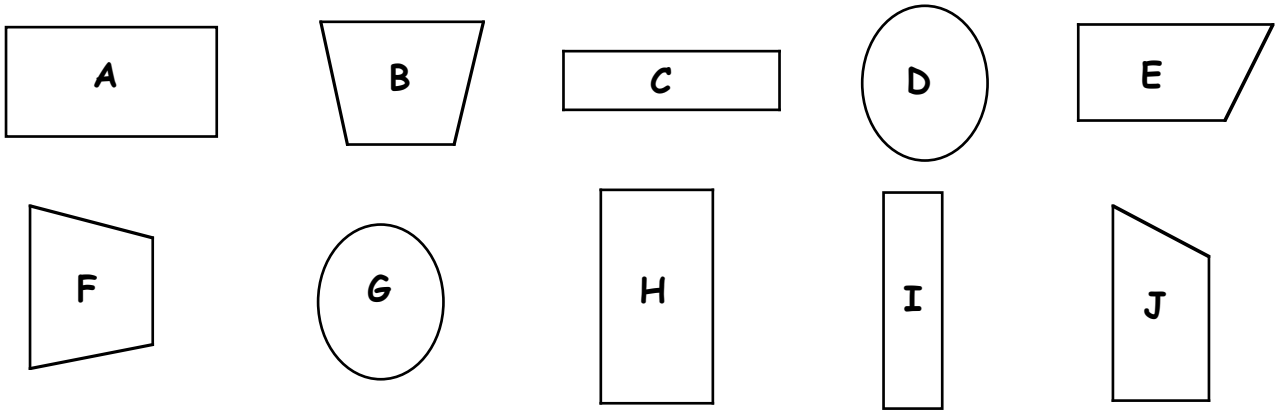


Since the above 2 squares are the same basic shape, but the 2nd shape is "2 times" as big as the first, they are said to be **SIMILAR**.

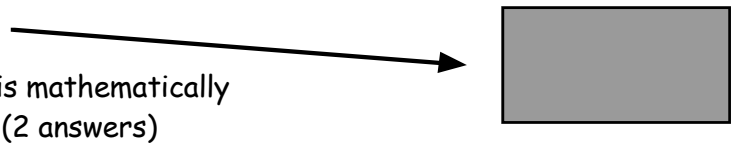


Exercise 1

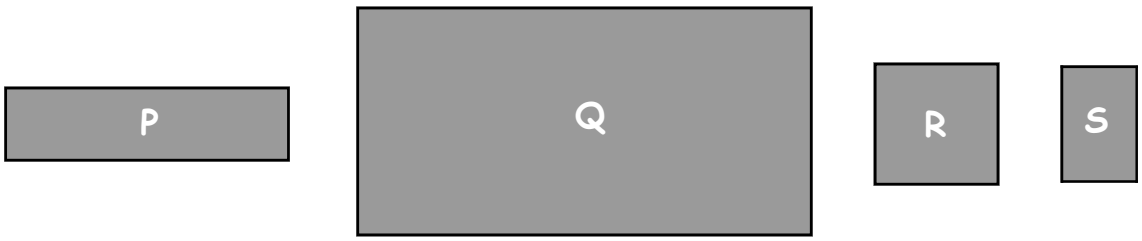
1. Look at the following 10 shapes.
   Match up **CONGRUENT** pairs :-



2. Look at this rectangle.

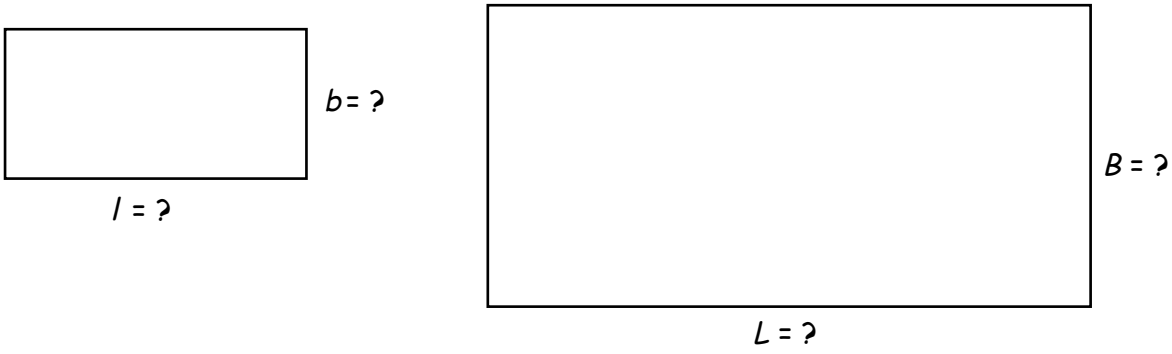


Which of these 4 shapes is mathematically **SIMILAR** to this shape ? (2 answers)



3. **You need a ruler here** !!
Look at the 2 rectangles shown below.

(a) Measure the length of both the small and large rectangle.



(b) Now divide the big length (*L*) by the small length (*l*) and write down the value of $L \div l = ?$

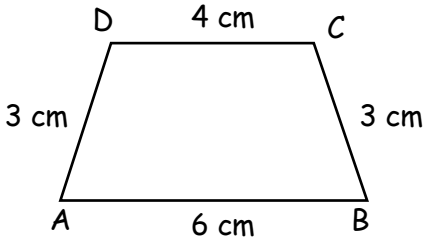
(c) Measure the breadth of the small and large rectangles.

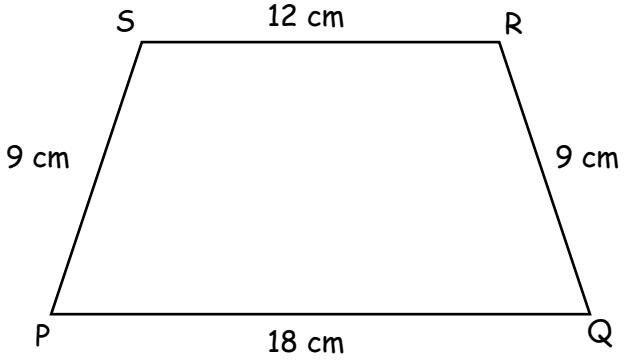
(d) Write down the value of $B \div b = ?$

(e) The answers to (b) and (d) should be the same. Were they ?

This is called the **SCALE FACTOR** (or the magnification factor).

4. These are sketches of figures.





(a) Compare the 2 sides AB and PQ and divide to find the **scale factor**.

=> PQ ÷ AB = 18 ÷ 6 = ?

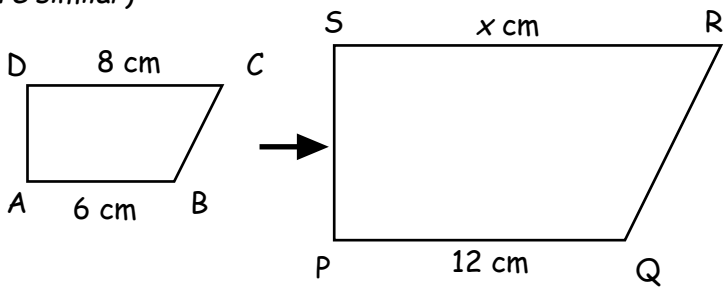
cont'd...

(b) Do the same for the other pairs of sides :-

(i) Find PS ÷ AD (ii) Find QR ÷ BC (iii) Find SR ÷ DC.

(c) You should have obtained the same answer in all 4 cases.
(*This proves that the 2 shapes are similar*)

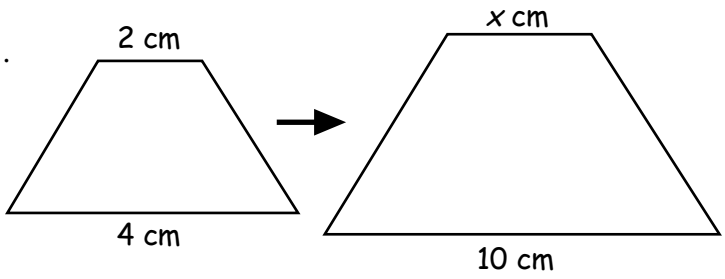
5. These 2 shapes are similar.



(a) Calculate the scale factor.
(*can you see that this is done by dividing 12 ÷ 6 ?*)

(b) Use this scale factor to calculate the size of the line SR. (*multiply*)

6.



These 2 shapes are trapezia.

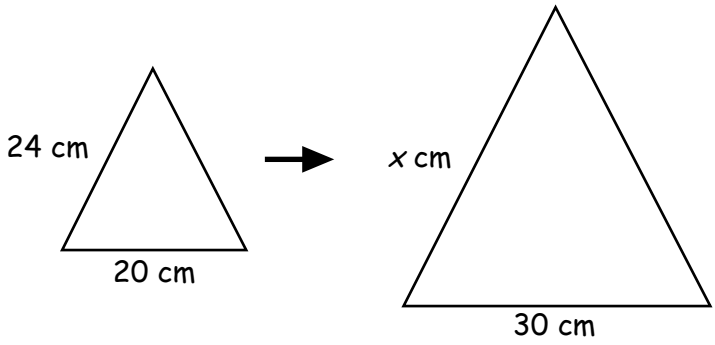
(a) Calculate the scale factor for the enlargement.

(b) Use this to calculate the length of the side marked *x*.

7. These 2 triangles are similar.

(a) Calculate the scale factor.

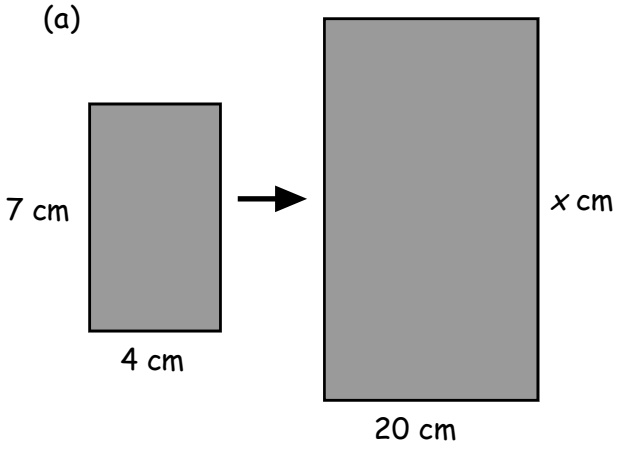
(b) Calculate the value of *x*.



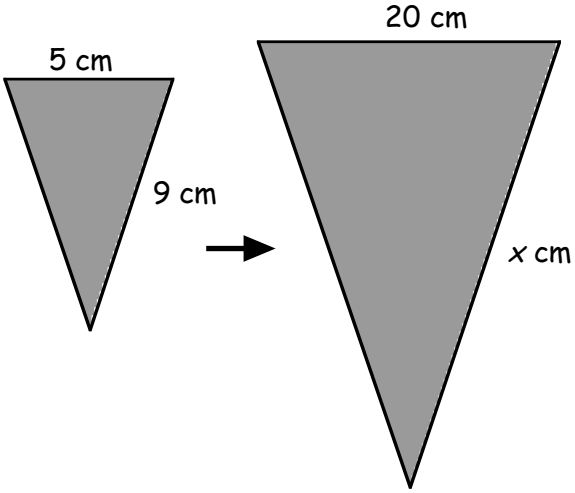
8. In each of the following pairs of SIMILAR figures, calculate

(i) the scale factor (ii) the length of the side marked *x*.

(a)

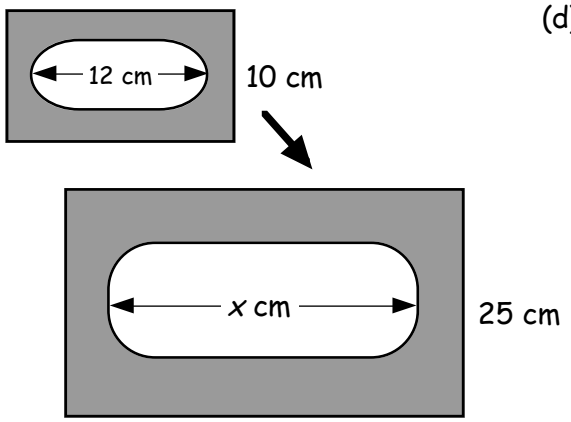


(b)

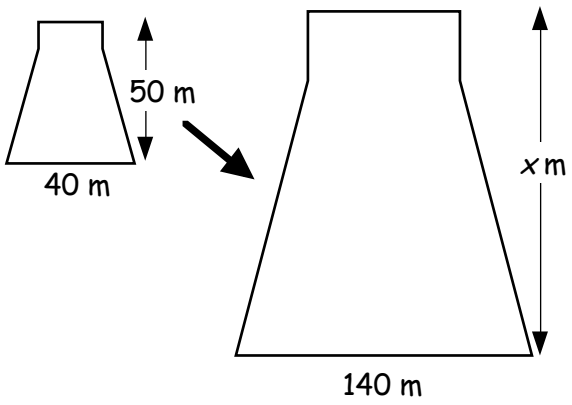


cont'd...

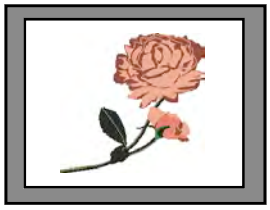
(c)

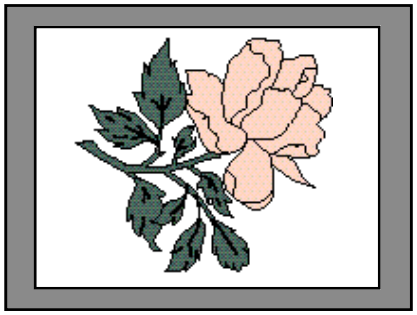


(d)



9. The 2 picture <u>frames</u> are mathematically **SIMILAR**.





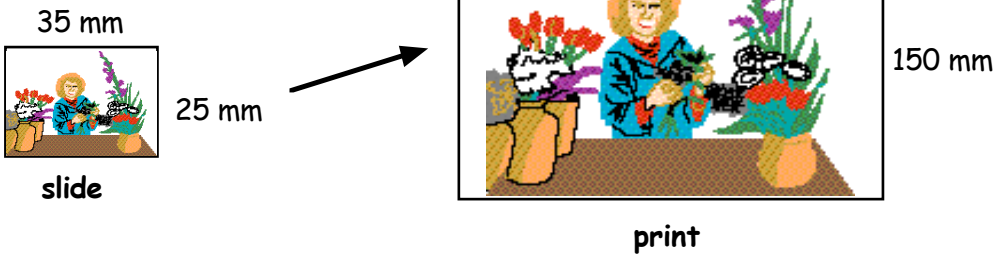
(a) Calculate the enlargement scale factor.

(b) Calculate the height of the larger frame.

10. A large print is made from a picture slide.

(a) Calculate the enlargement scale factor.

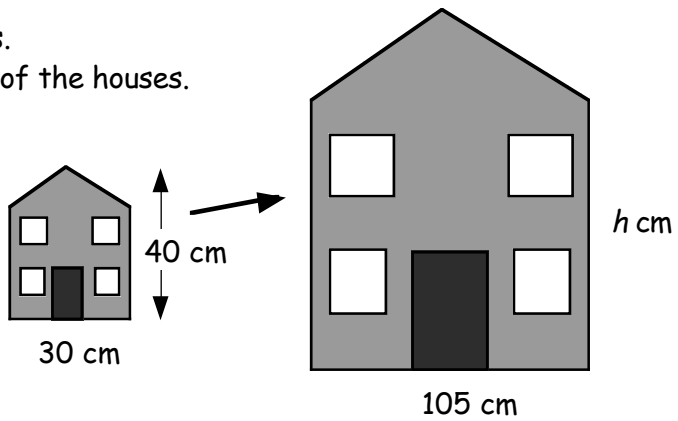
(b) Calculate the length of the print.



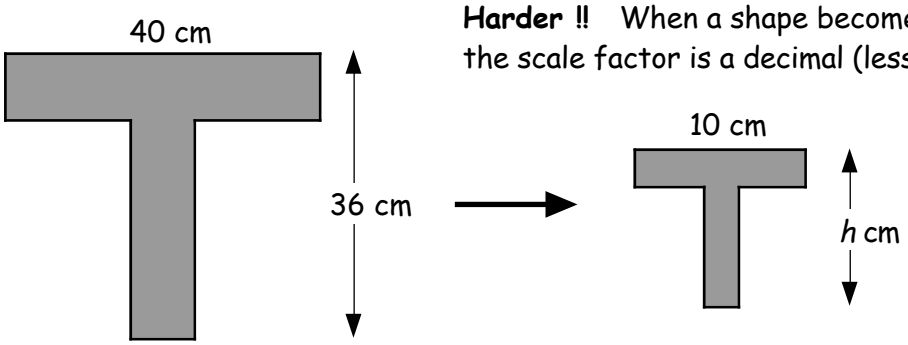
11. Similar doll's houses are made in 2 sizes.
Shown here are the front faces of both of the houses.

(a) Calculate the enlargement factor.

(b) Calculate the height of the larger house.



12.



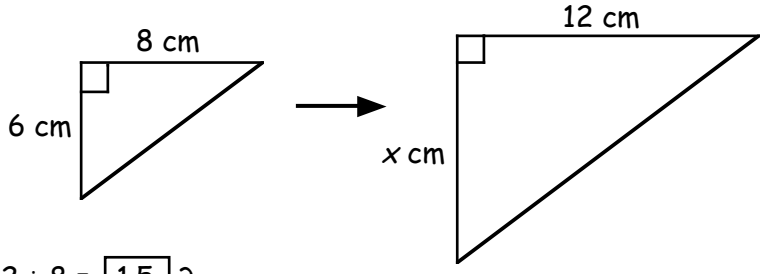
Harder !! When a shape becomes **SMALLER** the scale factor is a decimal (less than 1).

(a) Calculate the **REDUCTION** scale factor. (*not 40 ÷ 10*)

(b) Use this to calculate the height of the smaller figure.

Similar Triangles

There are many situations when you come across pairs of similar right angled triangles.

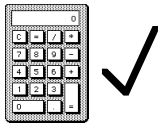


Can you see that the scale here is 12 ÷ 8 = 1·5 ?

Can you also see that to find "*x*", you must multiply => *x* = 1·5 x 6 = 9 cm ?

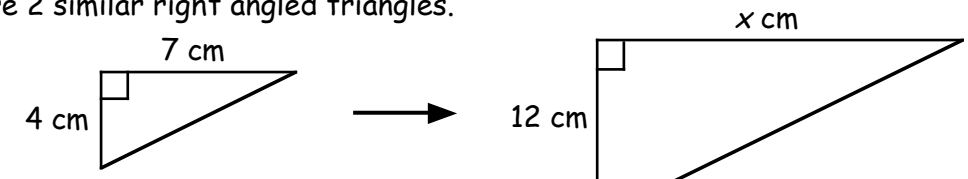
Rule :- **DIVIDE** —> to get the scale factor

MULTIPLY —> to find the other length



Exercise 2

1. Shown are 2 similar right angled triangles.



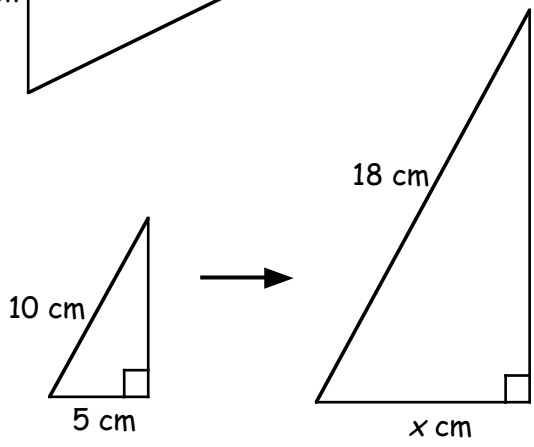
(a) Calculate the scale factor. (DIVIDE).

(b) Calculate the value of *x*. (MULTIPLY).

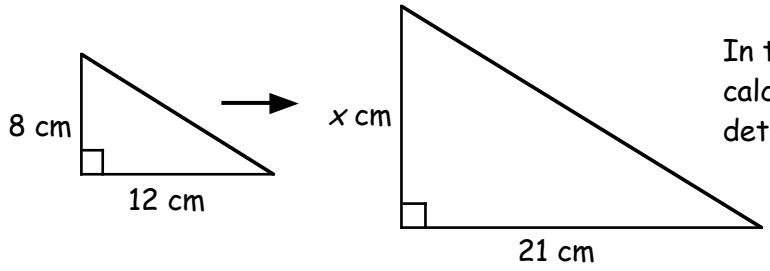
2. Again we have 2 similar right angled triangles.

(a) Calculate the scale factor. (DIVIDE).

(b) Calculate the value of *x*.

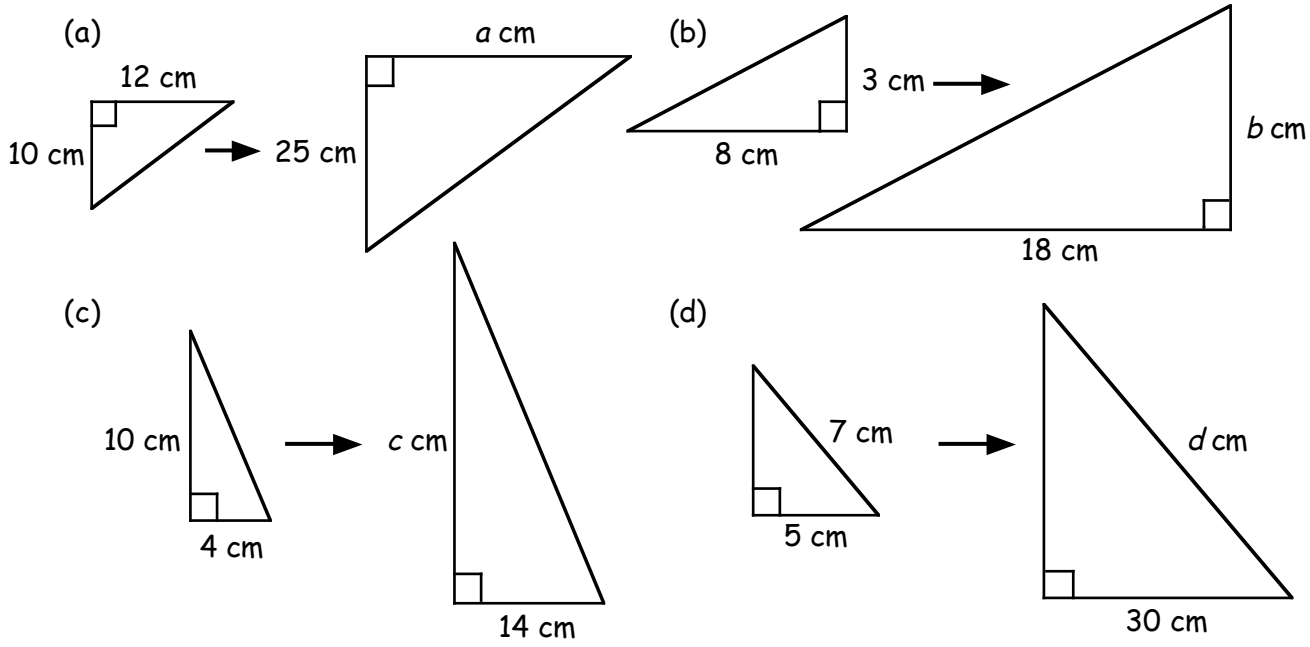


3.



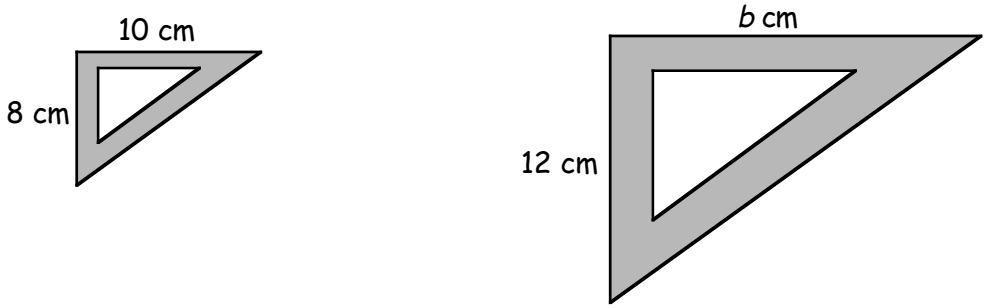
In these 2 similar right angled triangles, calculate the scale factor and use it to determine the value of *x*.

4. In each of the following, the pairs of right angled triangles are similar.
In each case, find the scale factor and then calculate the value of *a*, *b*, *c* and *d*.

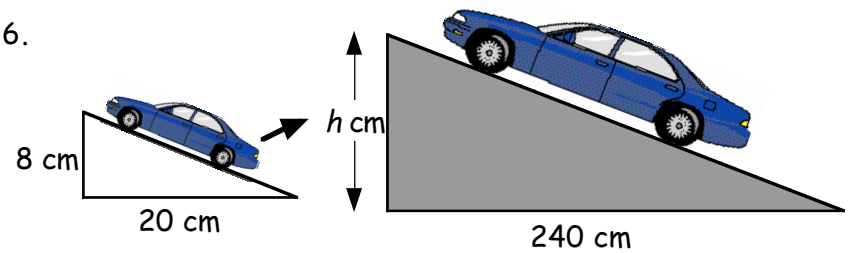


5. Shelf brackets are made in two sizes. They are similar right angled triangles.

By calculating the enlargement scale factor, find the length of the edge marked *b*.



6.



A model is made of a car on a ramp in a showroom.

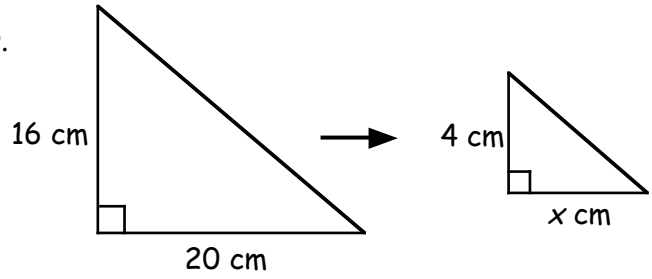
Both the model ramp and the real ramp are similar.

By calculating the enlargement scale factor, find the height of the real ramp.

7. **Harder !!** These 2 triangles are similar.

(a) Calculate the (reduction) scale factor.
(*it is not 16 ÷ 4*)
(*it is a decimal this time*)

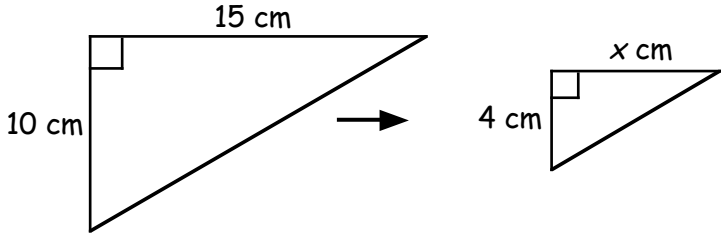
(b) Use this to calculate the length (*x*) of the smaller triangle.



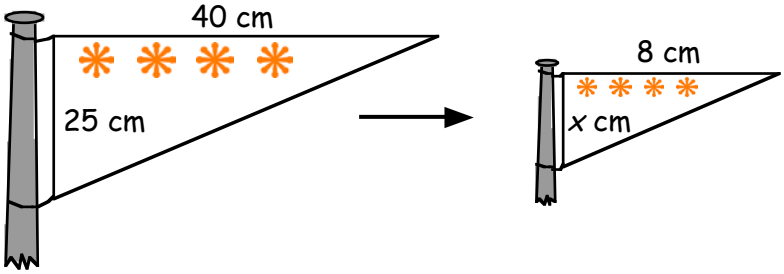
note :- <u>when shapes get smaller —> the scale factor is a decimal (smaller than 1).</u>

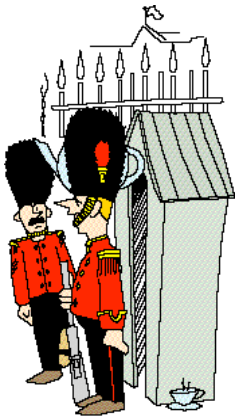
8. (a) Calculate the (reduction) scale factor here.

   (b) Calculate the length (x) of the smaller triangle.



9. These 2 flags, each in the shape of a right angled triangle, are similar.

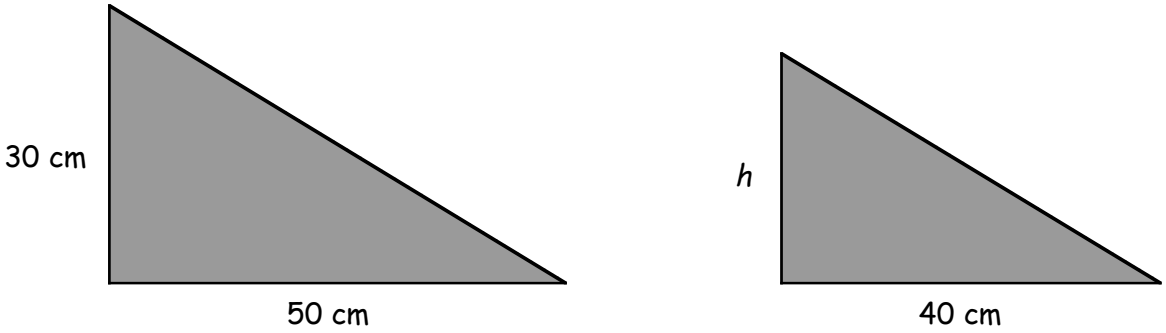




   (a) Calculate the scale factor (from the big —> small flag).

   (b) Calculate the height (x) of the smaller flag.

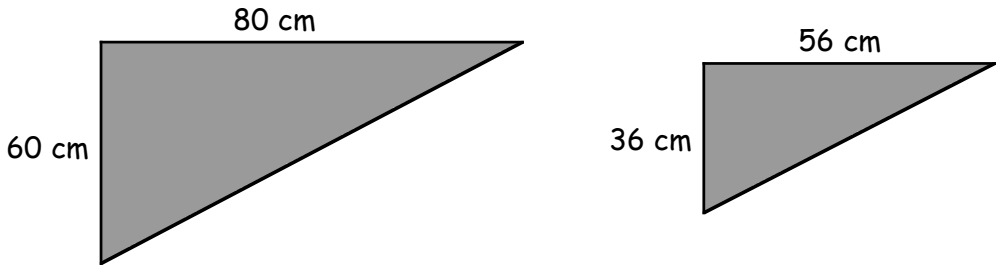
10. The 2 shapes shown below are similar right angled triangles.



   (a) Calculate the reduction scale factor.

   (b) Calculate the height of the smaller triangle.

11. I think that these 2 right angled triangles are similar, but I am not certain.



   (a) Calculate the "LENGTH" scale factor.

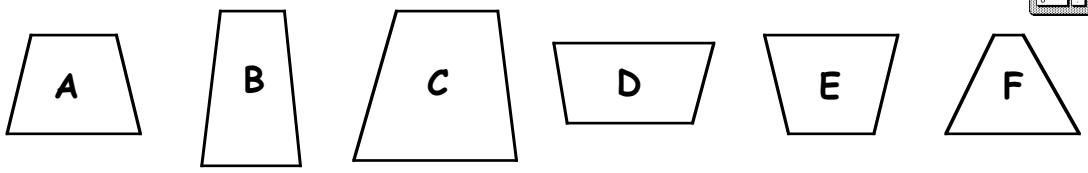
   (b) Calculate the "HEIGHT" scale factor.

   (c) Are they the same ?

   (d) What does this tell you about the 2 triangles ?

What have I learned ?

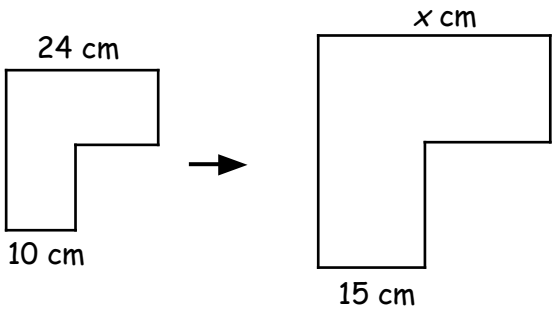
1. Which 2 shapes are CONGRUENT ?



2. The 2 shapes here are similar.

   (a) Calculate the magnification scale factor.

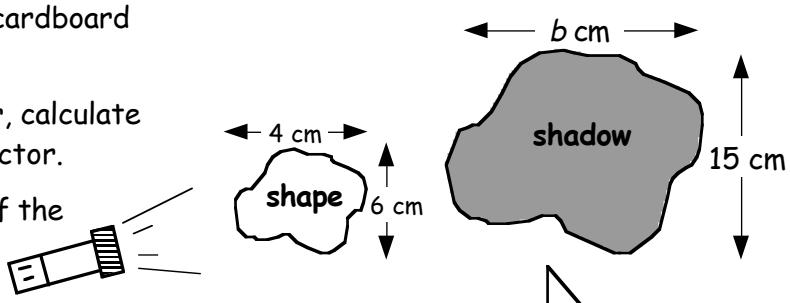
   (b) Calculate the value of x.



3. A torch is shone on a piece of cardboard and a shadow is cast on a wall.

   (a) If the 2 shapes are similar, calculate the magnification scale factor.

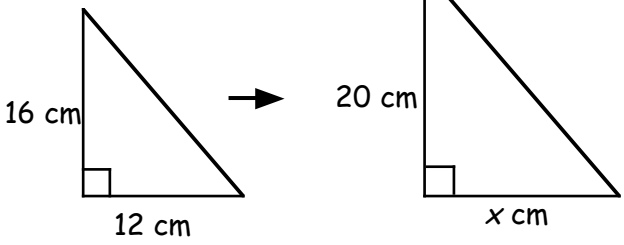
   (b) Calculate the breadth (b) of the shadow.



4. These 2 triangles are similar.

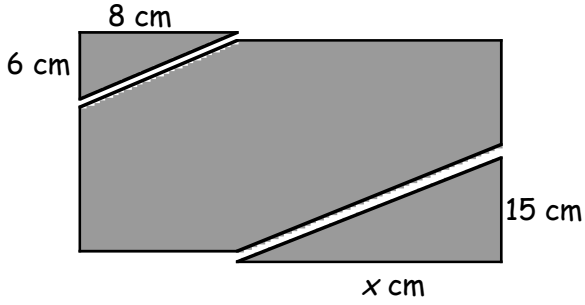
   (a) Calculate the scale factor of the enlargement.

   (b) Calculate the length (x) of the triangle.



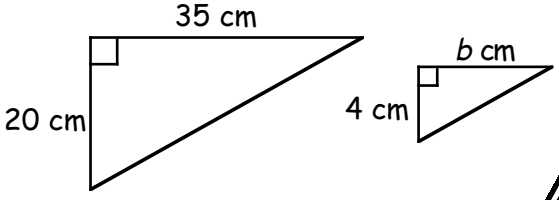
5. Two right angled triangles are cut from opposite corners of a rectangle. The triangles are similar.

   By calculating the enlargement scale factor, calculate the length of the side marked x.



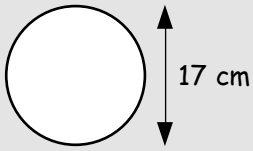
6. (a) Calculate the "reduction" scale factor from the big to the small triangle.

   (b) Use this to calculate the breadth (b) of the small triangle.



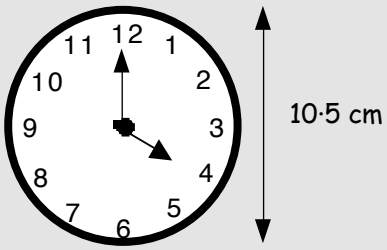
REVIEW (Circumference)

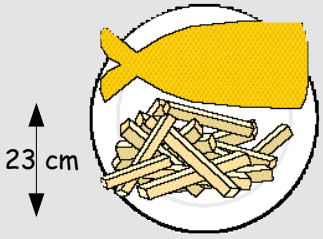
1. The diameter of this circle is 17 centimetres.
   Write down the length of its radius.



2. I can picture a circle in my head. It has a radius of 7·3 centimetres.
   What must its diameter be ?

3. Calculate the <u>circumference</u> of this clock face.



4. 

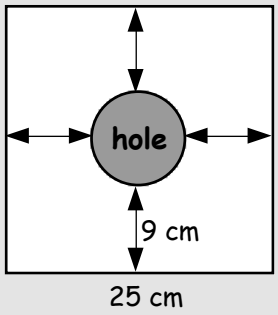
   The **radius** of this plate is 23 centimetres.

   Calculate the circumference of the plate.

5. A hole is drilled in the centre of a square plate.
   The square has each side 25 centimetres.

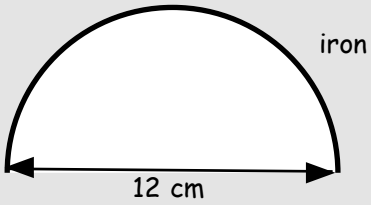
   (a) Write down the diameter of the hole.

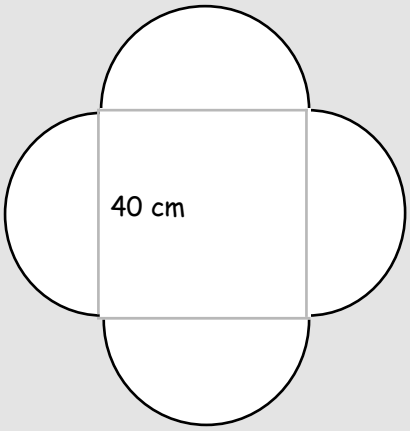
   (b) Calculate the circumference of the hole.



6. A piece of wrought iron is bent in the shape
   of a semi-circle as part of a fence top.

   Calculate the length of the piece of wrought iron.



7. 

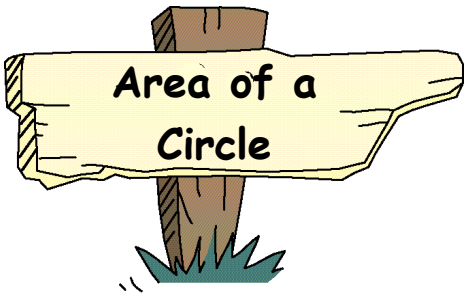
   Shown is a square with four semi-circles, one drawn on each side.

   (a) What is the diameter of each semi-circle ?

   (b) Calculate the length of each semi-circle.

   (c) Calculate the perimeter of the shape.
   (*the distance round the outside*)

Chapter 10

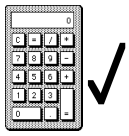


In Book 3, you discovered that you could calculate the CIRCUMFERENCE of a circle using the formula shown below.

Circumference

$$C = \pi d$$

Circumference = 3·14 × Diameter



Exercise 1

In this exercise, give your answers to 2 decimal places where necessary.

1. Calculate the circumference of the two objects :-

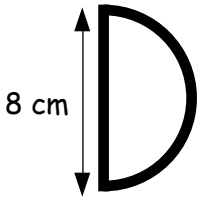
(a)

diameter = 30 cm

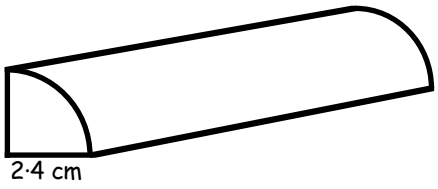
(b)

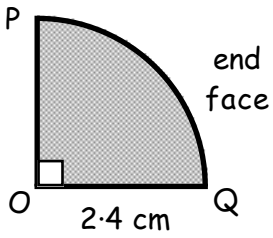
radius = 17·5 cm

2. The diameter of this letter "D" is 8 centimetres.
Find the length of the curved part of the D.



3. The end of this strip of edging is in the shape of a quarter-circle POQ.





(a) Calculate the circumference of a circle with radius 2·4 cm.

(b) Now find the length of the curved part PQ.

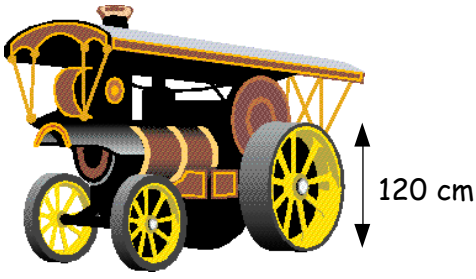
(c) Finally, calculate the total distance round the edge of the end face.

4. The rear wheel of this vehicle has a diameter of 120 cm.

(a) How far would the vehicle travel
in one complete turn of the wheel ?
(give your answer in metres)

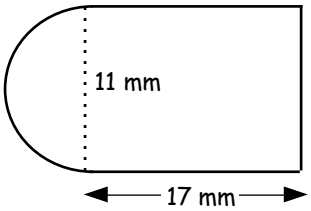
(b) How far would it travel in 200 turns (in metres) ?

(c) How many full turns would a wheel need to make
if the vehicle travelled a distance of 1884 metres ?

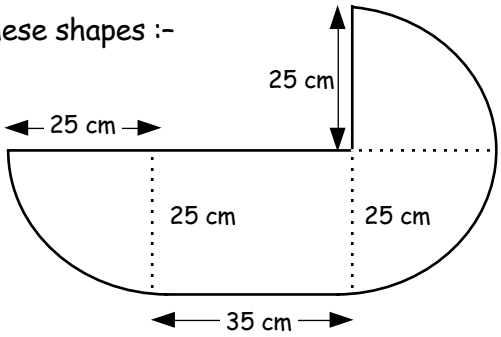


5. Calculate the <u>total distance</u> around the outsides of these shapes :-

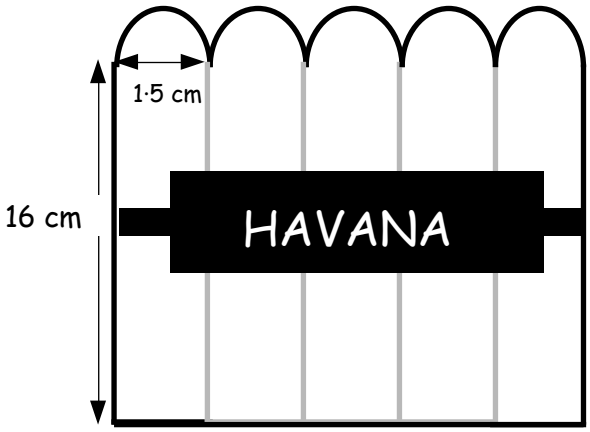
(a)



(b)



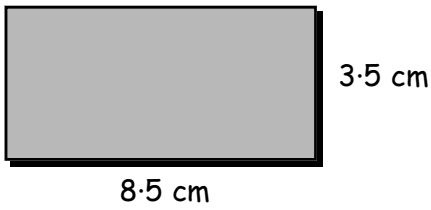
6.

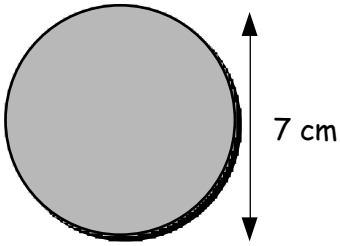


The diagram shows a picture of an aluminium cigar case.

Calculate the total perimeter of the shape shown.

7. "Scotties" oatcakes come in 2 different shapes.

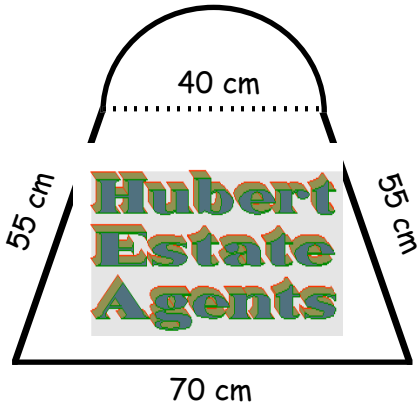




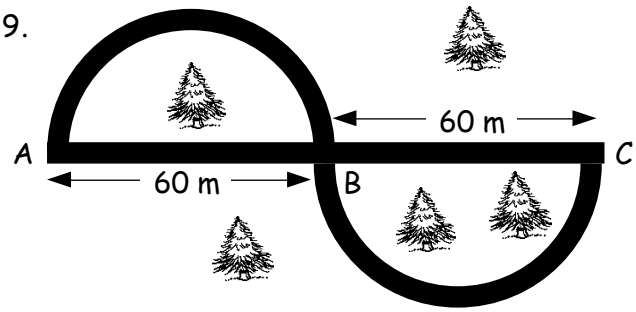
Which of the two biscuits has the larger perimeter ?
(*show all your working*).

8. A wooden sign, advertising "Hubert Estate Agents" consists of a $\frac{1}{2}$ circle on top of a trapezium, as shown.

Calculate the perimeter of the sign.



9.



This diagram shows 2 paths through a forest. There is a straight road A —> B —> C and a path consisting of 2 semicircles.

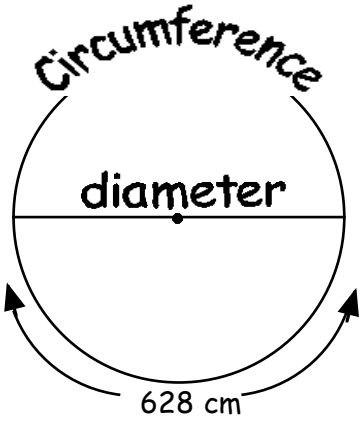
(a) Calculate the length of the curved route from A round to B then round to C.

(b) How much longer is this route than the straight route ?

Finding the Diameter

You learned from book 3G that the way to find the circumference of a circle, given the diameter, was to use the formula :-

$$C = \pi d$$



Example 1 :- Find the diameter of the circle.

$C = \pi d$

$628 = 3{\cdot}14 \times d$

$d = 200$ cm (as $\frac{628}{3{\cdot}14} = 200$)

Can you see that the formula needed to calculate the diameter is :-

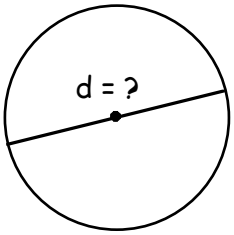
Diameter → $d = \frac{C}{\pi}$ ← Circumference, 3·14

Example 2 :- Find the diameter of the circle with circumference 15·7 centimetres.

$d = \frac{C}{\pi}$

$d = \frac{15{\cdot}7}{3{\cdot}14}$

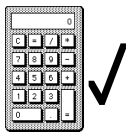
$d = 5$ cm



circum = 15·7 cm

Exercise 2

In this exercise, use the formula $d = C \div \pi$ to find the diameters of the circles and give your answers to 2 decimal places where necessary.

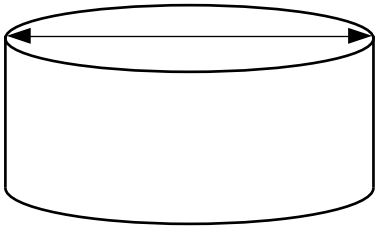


1. Find the diameter (d) when the circumference (C) is :-

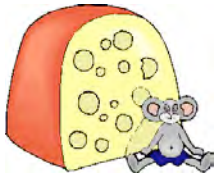
   (a) 314 cm (b) 9·42 m (c) 1884 mm

2. Find the diameter of each of these rounds of cheese. (to 1 decimal place)

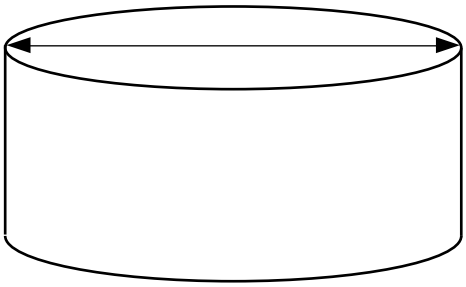
   (a)



   circumference = 45 cm



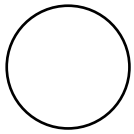
   (b)



   circumference = 82 cm

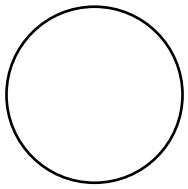
3. Calculate, showing all the steps, the diameters of these circles :-

(a)



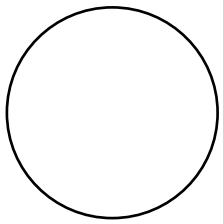
C = 34·54 cm

(b)



C = 39·25 cm

(c)



C = 3768 cm

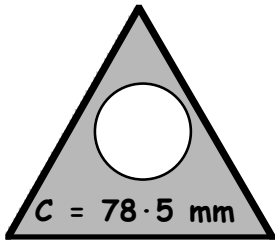
4. 

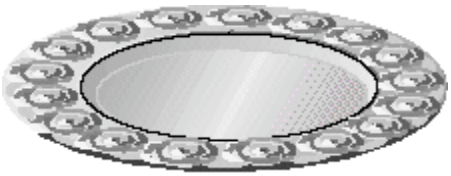
The circumference of this "happy face" is 20·41 cm.

Find its diameter.

5. The circumference of this hole, drilled through the piece of wood, is 78·5 mm.

Calculate the diameter of the hole.

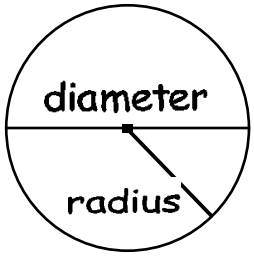


6. 

This silver plate has a circumference of 132 cm.

Find its diameter.

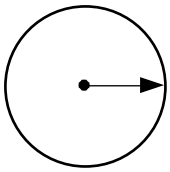
7. Do you remember the link between the diameter and a radius ?



RADIUS = $\frac{1}{2}$ of Diameter

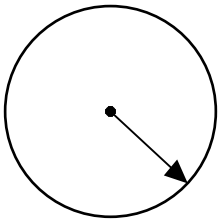
Calculate the diameter of each of these circles and then write down the length of each radius.

(a)



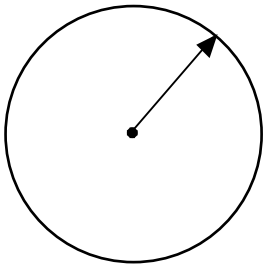
C = 80 m

(b)

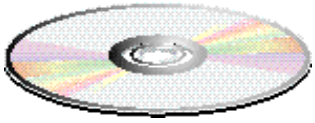


C = 120 m

(c)



C = 200 m

8. 

This C.D. has a circumference of 40 centimetres.

Find its radius.

9. A lemon is sliced through its middle.
The circumference of the lemon is 17 centimetres.

Calculate its diameter.

Area of a Circle

"Finding r^2 " (Finding "r squared")

*Squaring a number means multiplying the number by itself.

Example :- $4^2 = 4 \times 4 = 16$, $7^2 = 7 \times 7 = 49$.

Introductory Exercise

Example :- If the radius of a circle is 8 cm,
find the value of the "**radius squared**" (r^2).

Answer :- $r = 8$ (cm) = $r^2 = 8 \times 8 = 64$ (cm^2)

Find the value of r^2 given that :-

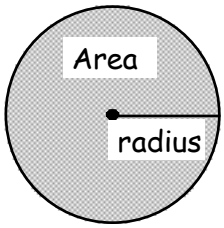
(a) r = 3 (b) r = 2 (c) r = 10 (d) r = 9 (e) r = 5

(f) r = 12 (g) r = 25 (h) r = 17 (i) r = 40 (j) r = 120

The Formula for the Area of a Circle is

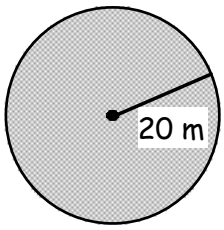
$$A = \pi \times r^2$$

Area 3·14 r × r



where A is the area, π is Pi (= 3·14), and r is the radius.

Example :- Find the area of this circle with a radius 20 metres.



$A = \pi r^2$

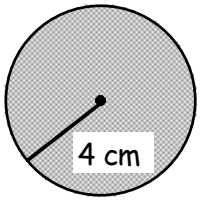
=> $A = 3{\cdot}14 \times 20 \times 20$

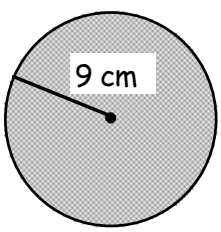
=> $A = \underline{\underline{1256\ m^2}}$ (square metres)

Exercise 3

Give your answers to 2 decimal places where necessary.

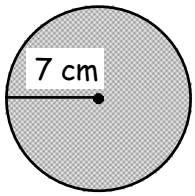
1. Calculate the area of this circle with radius 4 cm.



2. 

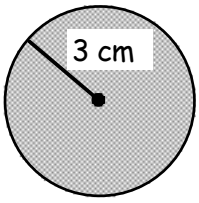
Calculate the area of this circle which has radius 9 cm.

3. Calculate the area of this circle.

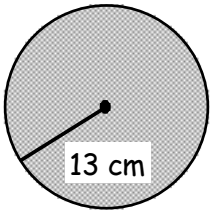


4. For each of the following circles, set down the three lines of working and calculate their areas :-

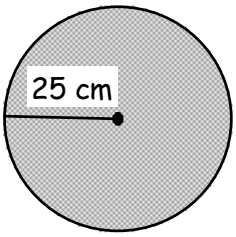
(a)



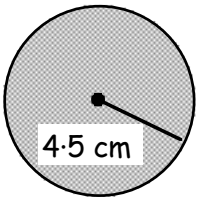
(b)



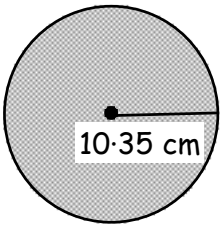
(c)



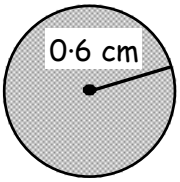
(d)



(e)



(f)



5. **Careful !!**

In this question, you are given the **DIAMETER** (not the radius).

To calculate the area :-

Step 1 :- radius = $\frac{1}{2}$ of diameter

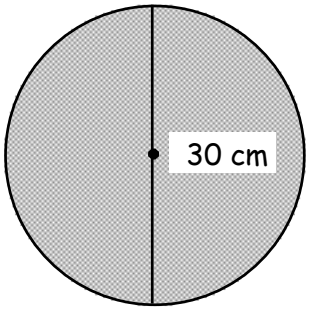
= $\frac{1}{2}$ of 30 cm

= ? cm

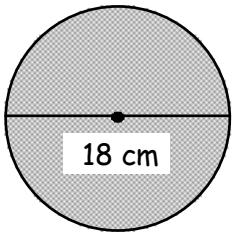
Step 2 :- area = $\pi \times r^2$

=> A = 3·14 × r × r

=> A = ? cm^2



6.

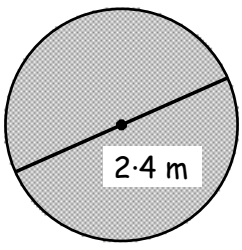


For this circle :-

(a) Halve the diameter to get the radius.

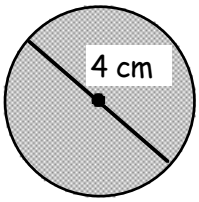
(b) Use this to calculate its area (set down !)

7. Calculate the area of this circle.

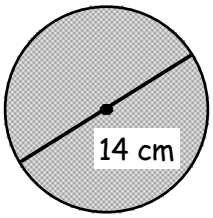


8. For each of the following circles, write down the radius, then set down the three lines of working needed to calculate their areas :-

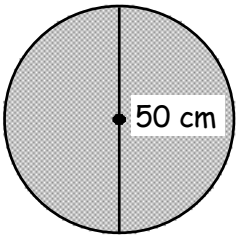
(a)



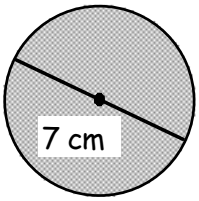
(b)



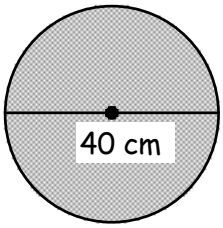
(c)



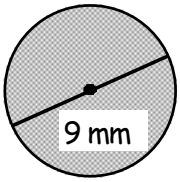
(d)



(e)

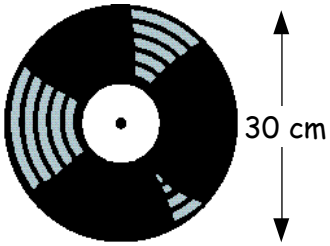


(f)



9. The diameter of an old Vinyl L. P. record is 30 centimetres.

Calculate its area.



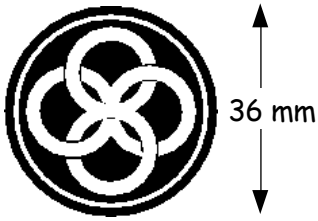
10. 

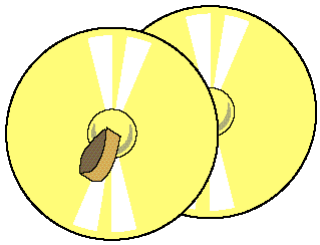
The top of a tin of beans has a <u>diameter</u> of 9·2 cm.

Calculate the area of the top of the tin.

11. This design has a <u>diameter</u> of 36 mm.

What is its area ?



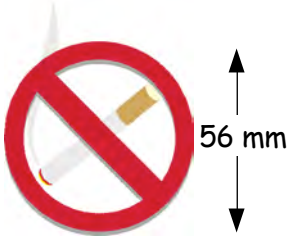
12. 

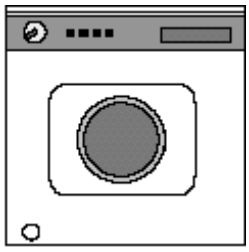
The <u>radius</u> of both of these metal symbols is 17·5 cm.

Calculate the area of metal needed to make **BOTH** symbols.

13. This no smoking sign has a <u>diameter</u> of 56 mm.

Calculate its area.



14. 

The glass see-through door on the washing machine has a <u>radius</u> of 19 centimetres.

Calculate the area of the glass door.

Semi-circles, Quarter-circles & other shapes with Part Circles

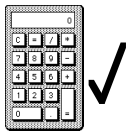
A Semi-circle is simply a half-circle.

To find its area, simply "**find the area of the Whole Circle – then halve your answer**".

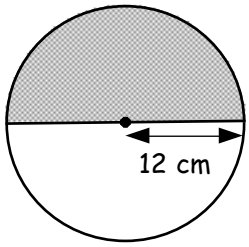
A Quarter-circle

To find its area, simply "**find the area of the Whole Circle – then divide this by 4**".

Exercise 4



Give your answers to 2 decimal places where necessary.

1. 

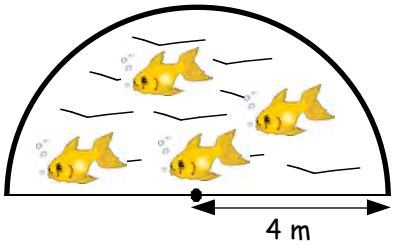
Shown is a circle with radius 12 cm.

(a) Calculate the area of the whole circle.

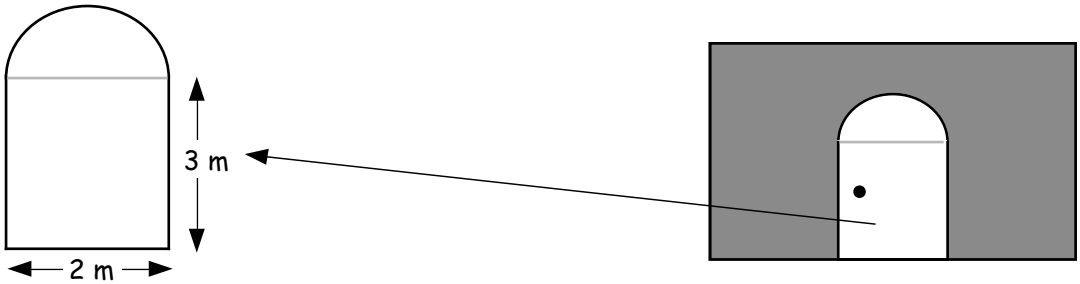
(b) Now halve your answer to obtain the shaded area. (*the semi-circle*)

2. Shown is a semi-circular garden pond where goldfish are being bred.
The semi-circular pond has radius 4 metres.

Calculate the area of the pond.



3. Shown below is a doorway, consisting of a rectangle with a semi-circle on top.



(a) Calculate the area of the rectangle.

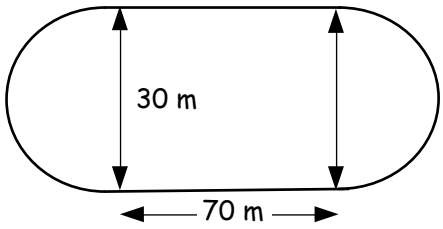
(b) Write down the diameter of the semi-circle and its radius.

(c) Calculate the area of the whole circle and then the area of the semi-circle.

(d) Now calculate the area of the whole doorway.

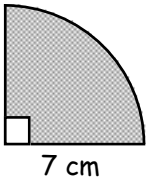
4. Calculate the area of this shape.

Decide how many parts you want to break it into first.



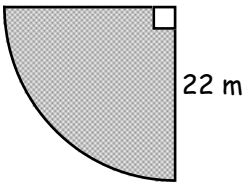
(Hint : A rectangle and a circle)

5. Here is a quarter-circle with radius 7 cm.



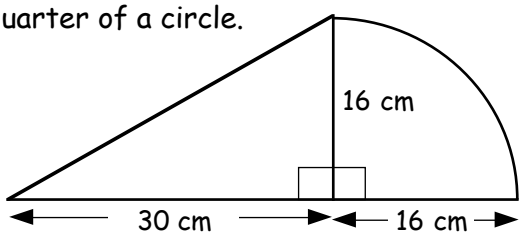
(a) Find the area of the whole circle which has a radius 7 cm.

(b) Now (÷ 4), to find the area of the quarter-circle.

6. 

Calculate the shaded area shown here.

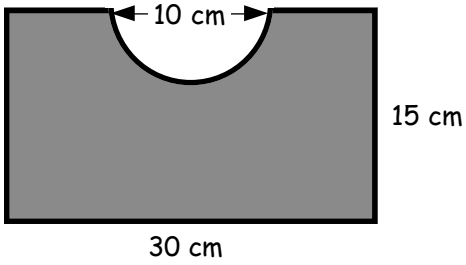
7. This shape consists of a right angled triangle and a quarter of a circle.



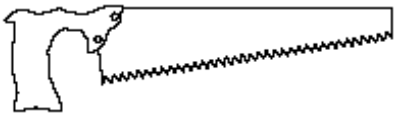
(a) Calculate the area of the triangle.

(b) Calculate the area of the quarter circle.

(c) Calculate the area of the whole shape.

8. 

A semi-circular hole is cut from the edge of this rectangular piece of wood to fit around a circular pipe.

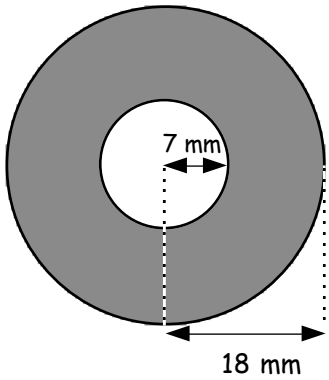


(a) Calculate the area of the rectangular piece of wood.

(b) Calculate the area of the semi-circle.

(c) Calculate the area of the remaining piece of wood.

9. This metal washer consists of a circular piece of steel with a circular hole in its centre.

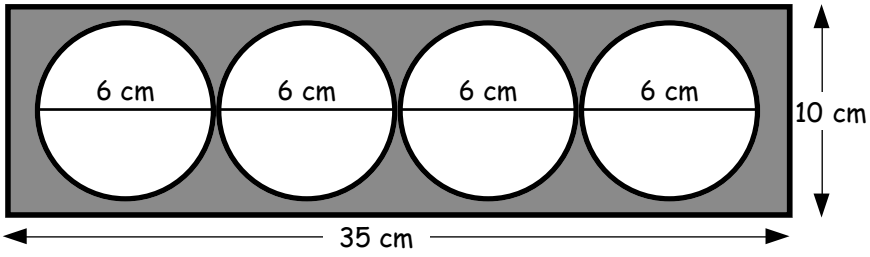


(a) Calculate the area of the large circle. (radius 18 mm)

(b) Calculate the area of the smaller circle.

(c) Calculate the shaded area representing the area of one face of the washer.

10. 4 holes are drilled out of a thin piece of wood.



(a) Calculate the area of the original rectangular piece of wood.

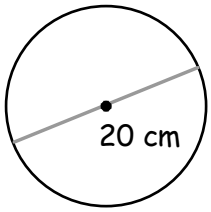
(b) Calculate the area of one of the holes and then write down the area of all 4 holes.

(c) Calculate the shaded area.

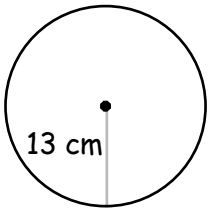
What have I learned ?

1. Calculate the CIRCUMFERENCE of these 2 circles :-

(a)



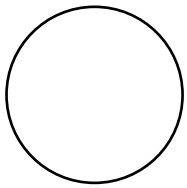
(b)



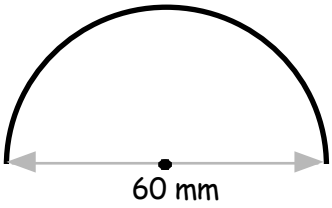
2. The circumference of this circle is 942 cm.

(a) Calculate its DIAMETER.

(b) Now write down its radius.



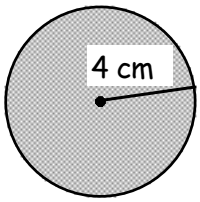
3.



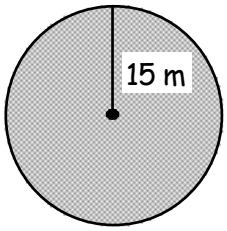
Calculate the perimeter of this semi-circle which has a diameter of 60 mm.

4. Calculate the AREA of these 2 circles :-

(a)



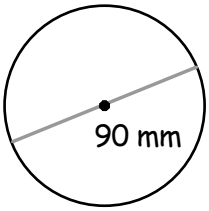
(b)



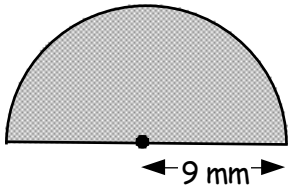
5. The diameter of this circle is 90 mm.

(a) Write down its radius.

(b) Calculate its AREA.

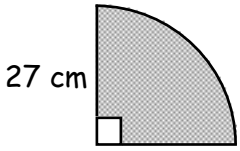


6.

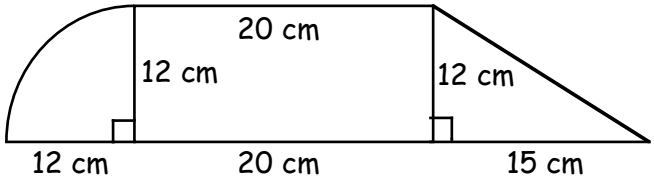


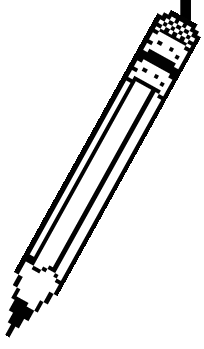
Calculate the area of this semi-circle.

7. Calculate the area of this quarter-circle.



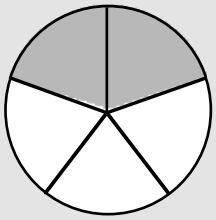
8. By breaking this shape down into various "bits", calculate the area of each "bit" and find the area of the whole shape.

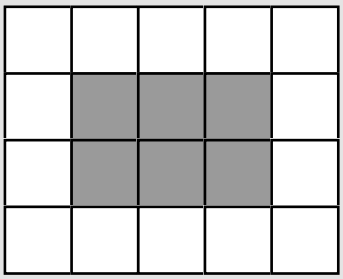




NO calculator allowed !

1. What fraction of these two shapes is shaded ?

(a) 

(b) 

2. (a) Draw a circle and shade in $\frac{3}{4}$ of it.

   (b) Draw a rectangle and shade in $\frac{5}{8}$ of it.

3. (a) Find one other fraction equivalent to the fraction $\frac{4}{9}$.

   (b) Find any two fractions equivalent to $\frac{3}{10}$.

4. Simplify the following fractions :-

   (a) $\frac{12}{15}$ (b) $\frac{15}{25}$ (c) $\frac{28}{35}$ (d) $\frac{26}{39}$

5. Find (a) $\frac{1}{2}$ of 26 (b) $\frac{1}{3}$ of 42 (c) $\frac{1}{5}$ of 105 (d) $\frac{1}{8}$ of £4

6. Find (a) $\frac{3}{5}$ of 40 (b) $\frac{3}{4}$ of 24 (c) $\frac{5}{8}$ of 32 (d) $\frac{7}{10}$ of £800

7. I bought a bag containing 45 apples from a farmer.

   $\frac{2}{9}$ were bad. How many of the apples were o.k. to eat ?

8. What <u>fraction</u> is equivalent to :-

   (a) 20% (b) 75% (c) 30% (d) 5% ?

9. Do the following **mentally** :-

   (a) 50% of 160 (b) 25% of £36

   (c) 10% of 330 (d) 1% of £240

   (e) 30% of £200 (f) $33\frac{1}{3}$% of £90

   (g) 5% of £70 (h) 75% of 80p

   (i) 100% of £2·37 (j) $66\frac{2}{3}$% of £1·80

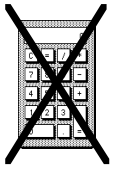
10. My last maths test was out of 40 and I scored 80% in it.

    What was my actual score out of 40 ?

11. Of the distance from Glasgow to Edinburgh, I reckoned I had driven $\frac{1}{3}$ of it.

    If I had actually driven 20 kilometres, how far had I still to travel ?

Non-Calculator Practice Exercise



Number Five

1. Set down and find :-

   (a) 64×32 (b) $8\overline{)2592}$ (c) $17 - 5 \times 3$ (d) $6 \times (9 - 4) + 7$

   (e) 215×40 (f) $4200 \div 600$ (g) 13^2 (h) $\frac{9 \times 4}{6}$

2. Set down and find :-

   (a) $25{\cdot}68 + 39{\cdot}54$ (b) $32{\cdot}34 \times 6$ (c) $29{\cdot}4 \div 7$ (d) $\frac{4 \times 4{\cdot}32}{100}$

3. Five people equally share winnings of £220·75. How much does each person receive ?

4. Change :- (a) 4020 kg to tonnes (b) 75 m to km (c) 1200 cm^3 to litres

5. Simplify the following (a) $\frac{16}{24}$ (b) $\frac{5}{20}$ (c) $\frac{16}{28}$

6. Find the value of :- (a) $\frac{4}{5}$ of 30 (b) $6\frac{3}{4} - 3\frac{1}{2}$ (c) $\frac{3}{4} - \frac{1}{8}$

   (d) $\frac{1}{7} \times \frac{1}{4}$ (e) $5 \times 1\frac{3}{4}$ (f) $8 - 3\frac{5}{6}$

7. I had 15 marbles and lost 9 of them. What fraction of my marbles did I lose ?

8. Find :- (a) 10% of £725 (b) 50% of £7·20 (c) 3% of 240

   (d) 70% of 220 ml (e) 25% of £16·84 (f) 80% of 7

9. I bought a scooter for £2600. I paid a deposit of 20%. How much have I still to pay ?

10. Copy the following and use "$>$" or "$<$" to make each statement true :-

    (a) -5 ..... 6 (b) 6 ..... -9 (c) -11 ..... -9 (d) 0 ..... -4

11. Find :- (a) $13 - 17$ (b) $(-28) + (-2)$ (c) $(-5) + (-4) + 6$

    (d) $(-13) - (-17)$ (e) $18 - (-5)$ (f) $0 - (-99)$ (g) $6 \times (-9)$

    (h) $(-4) + (-10) + (-12)$ (i) $(-5) \times 8$ (j) $(-9) + (-16)$ (k) $(-8) \times 10$

12. Write in 24 hour notation :-

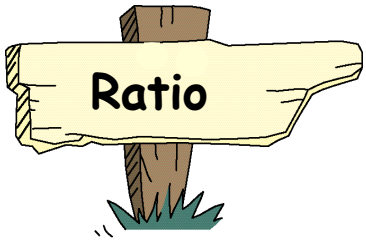
    (a) noon (b) quarter to 1 after lunch (c) 11·55 pm

13. Calculate the length of time from :-

    (a) 7·30 am to 1·15 pm (b) 11·35 pm to 2·05 am (c) 0455 to 0745

14. Liam gets the 1240 train to Edinburgh. The train takes 50 minutes. He then takes 25 minutes to walk to his work. At what time does he arrive there ?

Chapter 11



Ratio

We can use "ratios" to compare two different quantities.

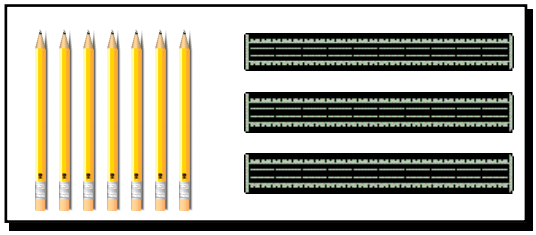
Example :-

This group consists of 3 girls and 2 boys.

We say that "the ratio of girls to boys " is 3 to 2.
or for short :-

girls : boys = 3 : 2.
(: is the symbol for ratio)

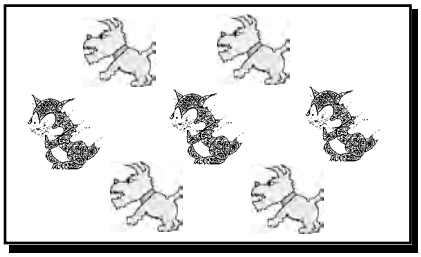
Exercise 1 (RULER REQUIRED)



1. Look at this picture.

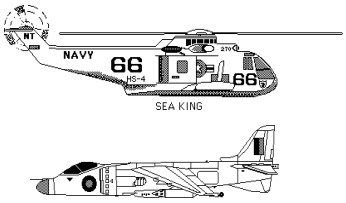
   Write down the ratio :- (a) pencils : rulers.

   (b) rulers : pencils.

2. 

   (a) Write down the ratio, cats : dogs.

   (b) Write down the ratio, dogs : cats.

3. 

   In an aircraft hanger there are 17 Helicopters and 22 Fighter Jets.

   Write down the ratio of :-

   (a) Helicopters to Jets.

   (b) Jets to Helicopters.

4. In a car park near to a police station there are 9 police cars and 5 sports cars.

   What is the ratio of :-

   (a) police cars to sports cars ?

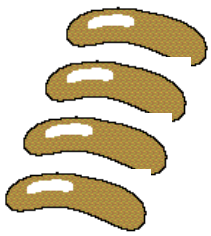
   (b) sports cars to police cars ?

5. In a meat factory the workers produce 400 sausages, 117 black puddings, 500 slices of dumpling and 77 steak pies per hour.

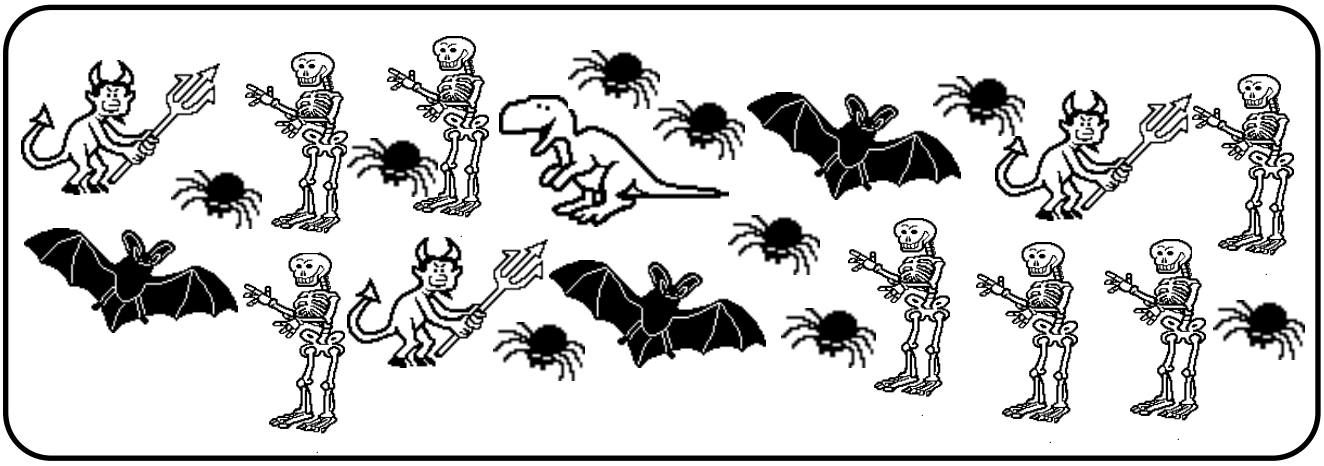
   Write down the ratios of :-

   (a) sausages : black puddings (b) dumplings : steak pies.

   (c) dumplings : sausages (d) steak pies : black puddings.



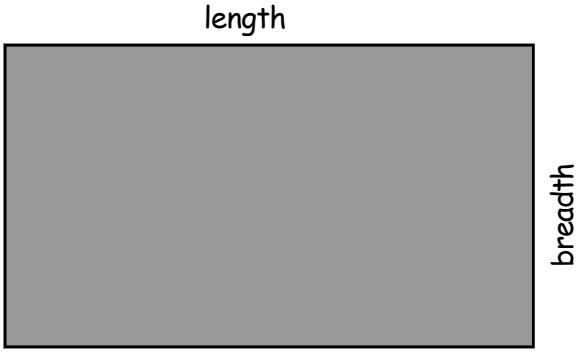
6. In a creepy house, there are devils, spiders, skeletons, bats and a dinosaur.



What is the ratio of :-

(a) Devils : Dinosaurs ?
(b) Bats : Skeletons ?
(c) Devils : Spiders ?
(d) Dinosaurs : Bats ?
(e) Skeletons : Devils ?
(f) Bats : Spiders ?
(g) Dinosaurs : Skeletons ?

7. (a) Measure the length and breadth of this rectangle.



(b) Write down the ratio, length : breadth.
(c) Write down the ratio, breadth : length.
(d) Write down the ratio, length : perimeter.
(e) Write down the ratio, perimeter : area.
(area = $l \times b$)

8. 

It is 60 kilometres between Bray and Kyle.
I drove 43 kilometres from Bray heading for Kyle and stopped for lunch.

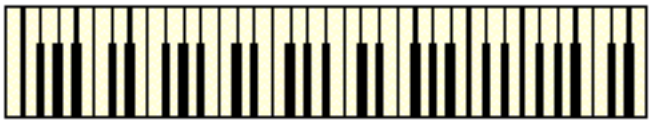
Write down :-

(a) the ratio of the distance travelled : distance to go.
(b) the ratio of the distance travelled : total distance.

9. This keyboard has 61 keys of which 36 are white and the rest black.

Write down the ratio :-

(a) white : total.
(b) white : black.
(c) black : total.



Simplifying Ratios

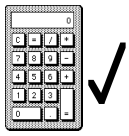
In Book 3G, you learned how to "**simplify**" fractions.

Example :- $\frac{4}{6}$ can be simplified, since 4 and 6 are part of the "2 times" table.

$$\frac{4}{6} \Rightarrow \frac{4}{6}\ {}^{(\div 2)}_{(\div 2)} = \frac{2}{3}$$

Similarly, the ratio 4 : 6 simplifies to 2 : 3 (can you see this ?)

Exercise 2



1. By dividing both numbers by 3, simplify the ratio 9 : 6.

2. By dividing both numbers by 5, simplify the ratio 25 : 35.

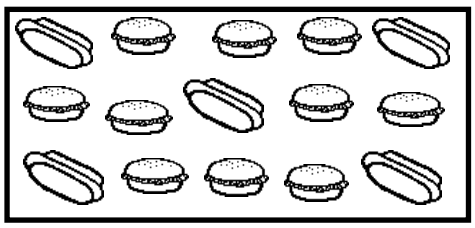
3. Copy each of the following ratios and simplify each as far as possible :-

(a)	6:10	(b)	9:15	(c)	7:35	(d)	10:28	(e)	7:7	(f)	18:6
(g)	12:9	(h)	36:20	(i)	24:12	(j)	21:56	(k)	28:35	(l)	40:70
(m)	80:50	(n)	55:15	(o)	72:6	(p)	11:55	(q)	5:500	(r)	700:7
(s)	23:46	(t)	48:24	(u)	9:9000	(v)	4:8 000 000 000 000 000				

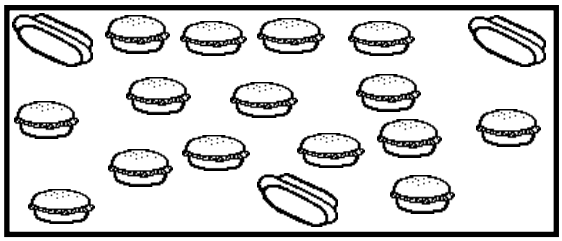
4. What is the ratio of hamburgers to hot dogs in each picture below ?

   Write each ratio in its simplest form.

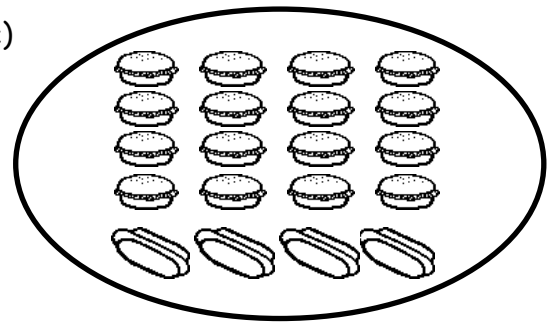
(a)



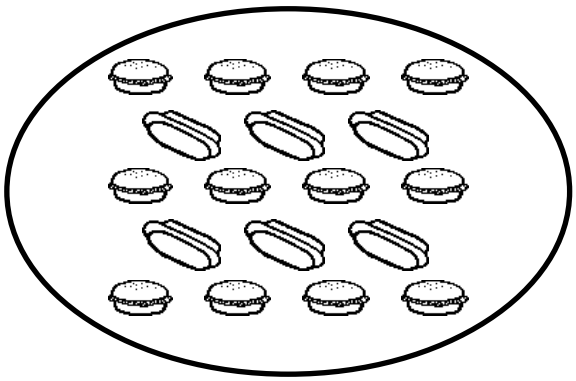
(b)



(c)



(d)



5. A shepherd uses 5 dogs to look after his 100 sheep.

   (a) What is the ratio of dogs to sheep ?

   (b) Give this ratio in its simplest form.

6. There are 18 girls and 6 boys at a birthday party.

(a) Write down the ratio of girls : boys.

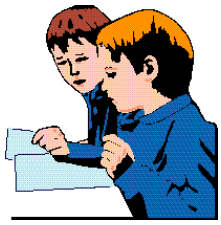
(a) Simplify this as far as possible.

7. 

In a classroom, there are 30 children and 3 adults.
Write, **in its simplest form**, the ratio of :-

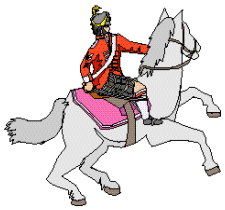
(a) children : adults (b) adults : children.

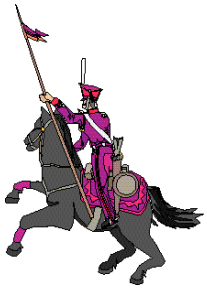
8. David is 180 centimetres tall and Bobby is 150 centimetres.



(a) Write down the ratio of David's height : Bobby's height.

(b) Simplify this as far as possible.

9. 



During the 16th Century, two armies faced each other on the battlefield.

One army consisted of 30 000 soldiers whilst the other had only 18 000 soldiers.

(a) Write down the ratio, larger army : smaller army.

(b) Simplify this as far as possible.

10. Tanya earns £960 per month as a secretary and Sophie earns £880 as a shop assistant.


Tanya

Sophie 

(a) Write down the ratio of their wages, Tanya : Sophie.

(b) Simplify this as far as possible.

11. 

On a penny-farthing bicycle, the diameter of the large wheel is 120 centimetres and the diameter of the small wheel is 24 centimetres.

(a) Write down the ratio of the diameters large : small.

(b) Simplify this as far as possible.

12. A large rectangle measures 5 cm by 8 cm and a smaller rectangle measures 4 cm by 7 cm.

(a) Write down the ratio of their **AREAS**, big : small.

(b) Simplify this ratio as far as possible.

.

Ratio Calculations (this is the opposite of "simplifying" ratios)

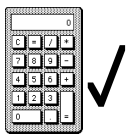
Example :- To obtain a particular shade of green paint, B & Q have to mix yellow and blue paint in the ratio

yellow : blue = 2 : 3.

For a large order, B & Q use 10 tins of yellow paint. How much blue is required ?

Set down like this :- since 10 = 5 x 2
then blue = 5 x 3 = 15

yellow	blue
x 5 → 2 → 10	3 → 15 x 5



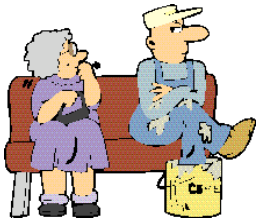
Exercise 3

1. The same shade of green can be made by using yellow : blue = 2 : 3.

   (a) If B & Q used 8 tins of yellow paint, how many tins of blue are needed ?

   Start with this

yellow	blue
x ? → 2 → 8	3 → ... x ?



   (b) If B & Q used 14 tins of yellow, how many tins of blue are needed ?

   (c) If, this time, B & Q used 9 tins of **blue**, how much yellow is needed ?

2.

men	women
4 → 40	3 → ...

In a hall, the ratio of men : women is 4 : 3.

(a) If there are 40 men, how many women must there be ?

(b) If in fact, there are 24 women, how many men are there ?

3. Mrs Jones makes home-made soup for her husband. She mixes lentils with peas in the ratio: **2** cups of **lentils** to **1** cup of **peas**.

How many cups of :-

(a) peas does she mix with 6 cups of lentils ?

(b) lentils does she mix with 5 cups of peas ?

(c) peas with 20 cups of lentils ? (Some soup!)

4. Mr White simply loves flowers - especially daffodils and roses.
In his garden the ratio of **daffodils** to **roses** is **5:3**.

If there are :-

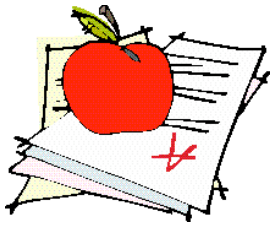
(a) 15 daffodils, how many roses will there be ?

(b) 75 daffodils, how many roses ?

(c) 36 roses, how many daffodils will there be ?

(d) 96 roses, how many daffy`s ?

5. The ratio of "Hard" sums to "Easy" sums in a set of tests was 3 : 7.

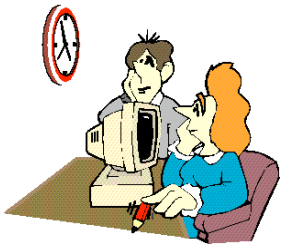


(a) If a test consisted of 15 hard sums, how many easy ones were there ?

(b) If a second test consisted of 70 easy sums :-

(i) how many hard ones were there ?

(ii) how many sums were there altogether ?

6. 

Jim and Lyn compare their weekly pays.
The ratio of their pays is

Jim : Lyn = 6 : 7.

(a) If Jim earned £300, how much must Lyn have earned ?

(b) If Lyn earned £490, how much must Jim have earned ?

7. Darlinda and Lucinda were comparing their weights.
The ratio of Darlinda's weight : Lucinda's weight = 8 : 7.

Darlinda weighed 48 kilograms.
What must Lucinda's weight be ?

8. 

Whilst driving along the motorway, I noticed a train running parallel to my car and going in the same direction.
I guessed that the ratio,

train speed : car speed = 5 : 3.

I was driving at 60 m.p.h. What was the speed of the train ?

9. The ratio of words in "Harry Potter and the Chamber of Secrets" to those in "Lord of the Rings" is 5 : 7.

If the Harry Potter book contains 450 000 words, how many words are there in Lord of the Rings ?

10. Look at this chart for making orange paint.

Which <u>shade</u> of orange paint will I get if I mix :-

(a) 1000 ml of red with 200 ml of yellow ?

(b) 120 ml of red with 200 ml of yellow ?

(c) 6 tins of red with 3 tins of yellow ?

(d) 350 ml of red with 100 ml of yellow ?

(e) 4 litres of red with 18 litres of yellow ?

	Mix in the ratio
Colour	***Red : Yellow***
Very dark orange	5 : 1
Dark orange	7 : 2
Mid orange	2 : 1
Light orange	3 : 5
Very light orange	2 : 9

Sharing (Money) in a given Ratio

Example :- Jack leaves £150 000 in his will to his 2 sons, Ken and Jim, but does **not** split the amount evenly (£75 000 each).

He, instead, divides it between them in the ratio 3 : 2, with Ken receiving the bigger share.

How much of the £150 000 does each son get ?

How to do :-

Step 1 Ken gets **3** parts to Jim's **2** parts
=> this is (3 + 2) = **5** parts altogether.

Step 2 Divide the £150 000 by 5 to see what each part is.
1 part = £150 000 ÷ 5 = £30 000.

Step 3 Ken gets 3 parts (3 x £30 000) = £90 000.
Jim gets 2 parts (2 x £30 000) = £60 000.

Exercise 4

1. Share £180 between Lucy and Jane in the ratio 2 : 1 so that Lucy gets the greater share.

Copy and complete :-

Total number of "shares" = 2 + 1 = 3
Each "share" is worth £180 ÷ 3 = £....

=> Lucy gets 2 shares = £....
=> Jane gets 1 shares = £....

2. Share 350 chocolates between Carol and Mike in the ratio 4 : 3 so that Carol gets the bigger share.

Copy and complete :-

Total number of "shares" = 4 + 3 = ...
Each "share" is worth 350 ÷ .... = ...

=> Carol gets 4 shares = ...
=> Mike gets ....

3. Use the same 4 lines (as shown in Q1 and Q2) to share the following :-

(a) Share £1000 between Ian and Alex in the ratio 2 : 3.

(b) Share £120 between Ann and Jill in the ratio 3 : 1.

(c) Share £15000 between Sue and Dave in the ratio 1 : 4.

(d) Share £21 between Eric and Andy in the ratio 2 : 5.

(e) Share £28000 between Dan and Judy in the ratio 4 : 3.

(f) Share £100000 between Bob and Eva in the ratio 3 : 5.

(g) Share £250000 between Pat and Mick in the ratio 7 : 3.

(h) Share 63p between Jennifer and Mary in the ratio 5 : 4.

(i) Share £1200 between Lucy and Jane in the ratio 5 : 7.

4. A wealthy businessman dies and leaves £270 000 in his will to be shared between his 2 sons, Will and Duncan, in the ratio of **their ages**.

Will is 25 years old and Duncan is only 20.

(a) Write down the ratio Will's age : Duncan's age.

(b) Simplify that ratio as far as possible.

(c) Use the method shown in Q1 – 3 to decide how much money each son will receive.

5. 

Gregor and Peter combine their money to bet on a horse race.

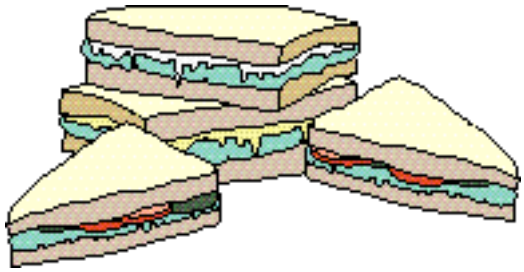
Gregor has £20 and Peter has £30.

(a) Write down and simplify the ratio of their betting stakes.

Their horse wins and the payout is £450.

(b) If they share the £450 in the ratio of their stakes, how much will each receive ?

6. Angela and Carol set up a catering business selling sandwiches and drinks from a van.



Angela uses £600 of her savings and Carol puts £400 into the business.

(a) Write down and simplify the ratio, Angela's share : Carol's share.

(b) Each month they share the profits, not equally, but in the same ratio as their investment [see part (a)]. In July, the profit made was £1500.

How much should each of them receive ?

7. **Harder !!** When Princess Isabella died, she left £2 400 000 in her will to be shared among her 3 nephews, Louis, Hugo and Stephano in the ratio of their ages.

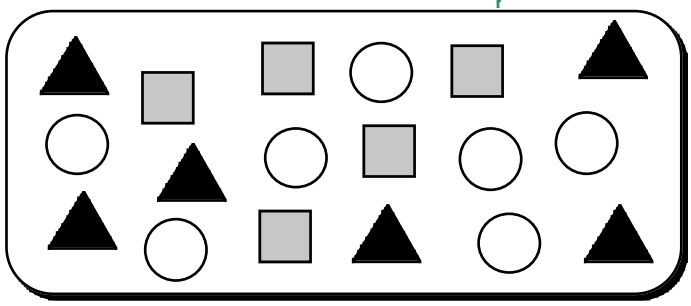
Louis is aged 30, Hugo is 24 and Stephano is 18.

(a) Write down the ratio of their ages, Louis : Hugo : Stephano.

(b) Simplify this ratio as far as possible.

(c) Calculate how much each nephew received.

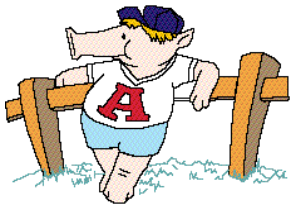
What have I learned ?



1. Write down the ratio
   (a) squares : triangles.
   (b) triangles : circles
   (c) circles : squares.

2. A group of friends meet for a night out. There are 16 girls and 12 boys. (Lucky boys !!!)
   (a) Write down the ratio of girls : boys.
   (b) Simplify this ratio as far as possible.

3. Simplify the following ratios as far as possible :-
   (a) 12 : 14 (b) 20 : 35 (c) 16 : 40 (d) 24 : 18
   (e) 35 : 55 (f) 44 : 33 (g) 360 : 240 (h) $2\frac{1}{2} : 5$ (tricky)



4. A farmer found the ratio of male pigs : female pigs = 2 : 5.
   He had 40 males. How many females did he have ?

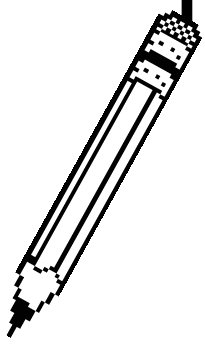
5. A boy bought a mixed bag of "soor plumes" and "cola cubes".
   He discovered the ratio of soor plumes : cola cubes = 5 : 4.
   If there were 20 cola cubes in the bag :-
   (a) How many soor plumes were there ?
   (b) How many sweets were there altogether ?

6. In April 1996, the ratio of wet days to dry days was 3 : 2.
   If there were 18 wet days, how many dry days were there ?

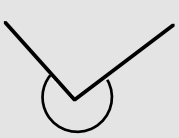
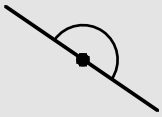
7. Share £80 between Jack and Jill in the ratio 3 : 1.

8. Share £26 000 between Dick and Harry in the ratio 7 : 6.

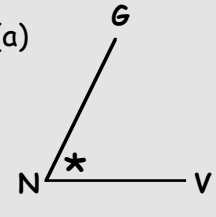
9. An elderly aunt left £33000 in her will to her 2 nephews, Ken and Tom, to be divided in the ratio of their ages.
   Ken is 30 years of age and Tom is 25.
   (a) Write down and simplify the ratio of Ken's age : Tom's age.
   (b) How much should each nephew receive ? (show all working).

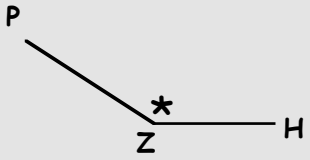


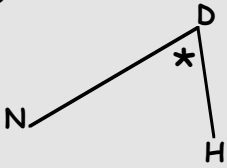
1. What kind of angle is each of these (acute, etc, ...) ?

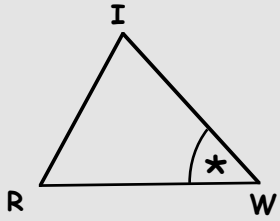
(a)  (b)  (c)  (d)  (e) 

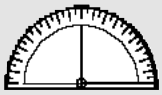
2. Use 3 letters to name each of the angles marked ✱ .

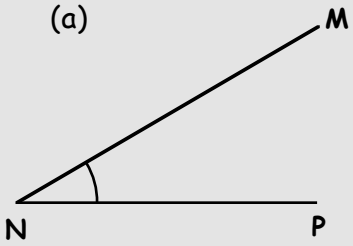
(a) 

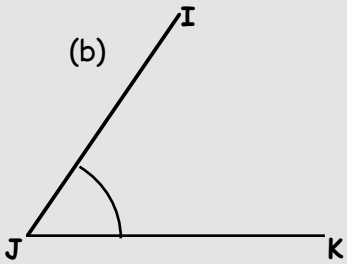
(b) 

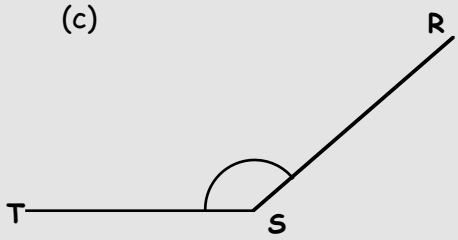
(c) 

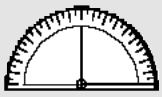
(d) 

3. Measure these 3 angles [Guess their sizes (roughly) first].  **protractor needed**

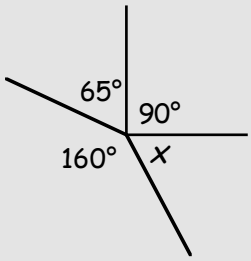
(a) 

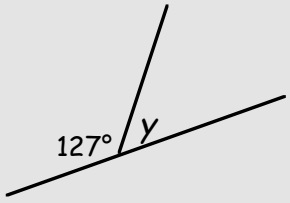
(b) 

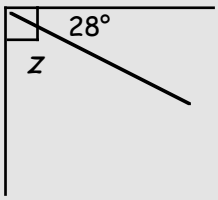
(c) 

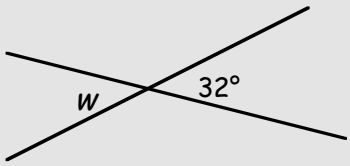
4. (a) Draw a line AB = 5 cm. Use your protractor to show ∠CAB = 75°.
(b) Draw a line PQ = 8 cm. Use your protractor to show ∠MPQ = 130°. 

5. Calculate the sizes of the angles marked *x*, *y*, *z*, ... and *w*. (do <u>not</u> measure them)

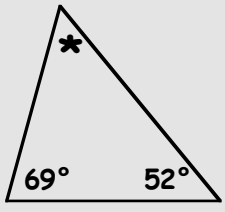


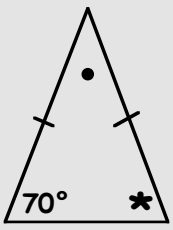


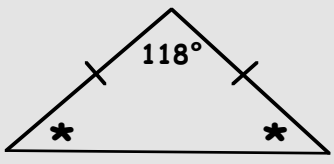




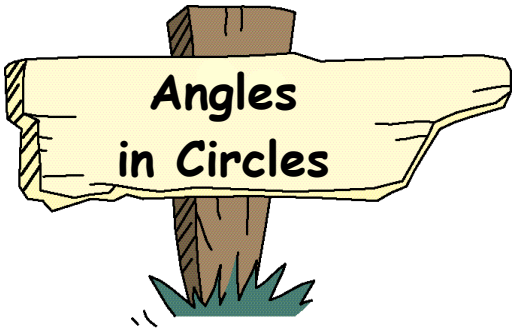
6. Sketch each triangle (neatly). Calculate the sizes of the missing angles and write them on your sketch.

(a) 

(b) 

(c) 

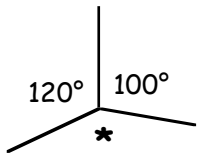
Chapter 12



Reminders

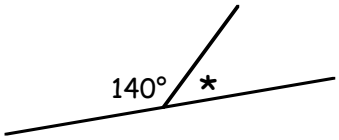
In Book 3G (Chapter 2), you met lots of situations where it was possible to **calculate** the sizes of angles using some basic rules :-

The angles round a point always add to give 360°.



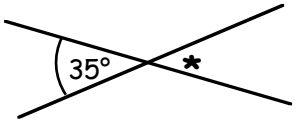
* must be 140° here.

The two angles making a straight line always add to give 180°.



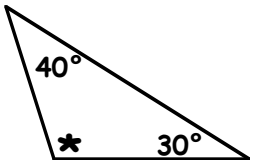
* must be 40° here.

Angles opposite each other at a cross are equal



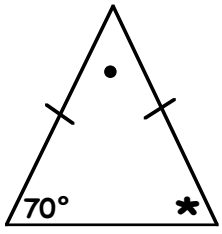
* must be 35° here.

The 3 angles of every triangle always add to give 180°.



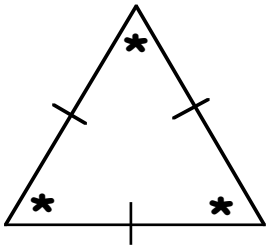
* must be 110° here.

Two of the angles in an **isosceles** triangle are equal.



* must be 70° here.

All three of the angles in an equilateral triangle are equal.



* must be 60° here.

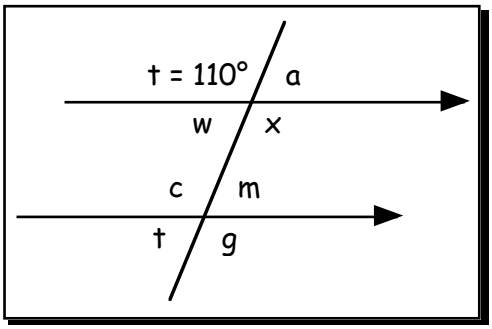
The following should also be known.

c is **corresponding** to t and must be 110°.

x is **(vertically) opposite** t and must be 110°.

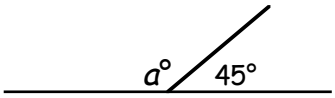
w must be 70°, (**it adds to 110 to give 180**).

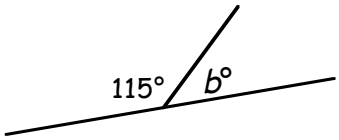
m is **alternate** to w and must be 70° also.

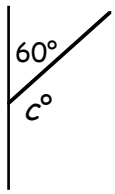


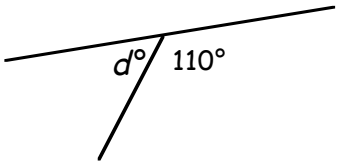
Exercise 1

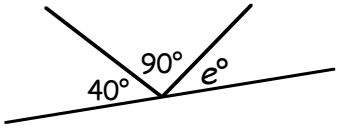
1. Calculate the sizes of the angles marked *a*, *b*, *c*, *d*, ...

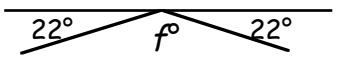


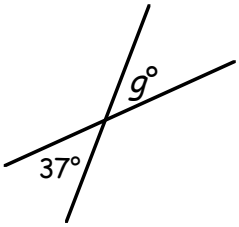


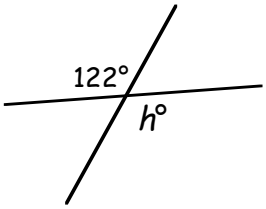


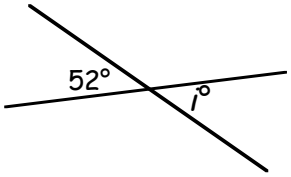


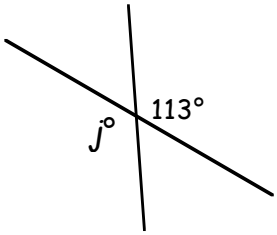


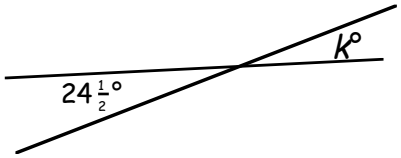


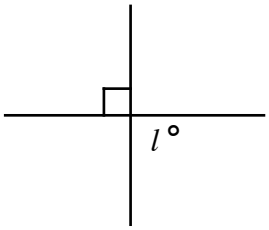


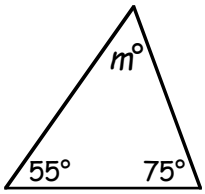


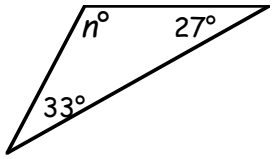


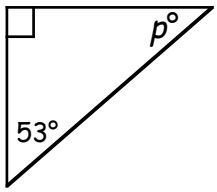


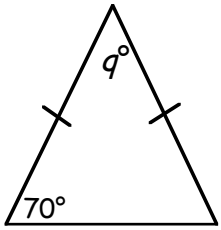


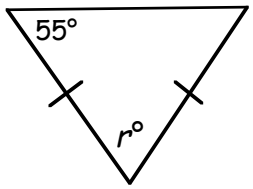


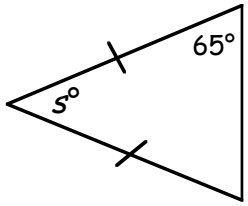


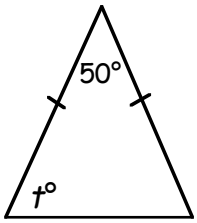


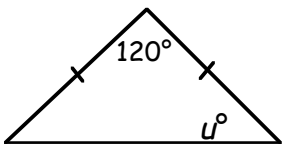


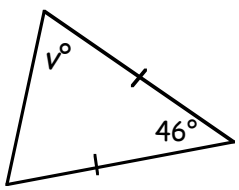






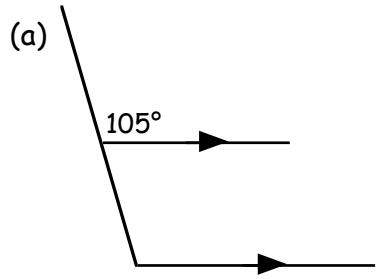






2. Copy each of the following and fill in the sizes of **all** the missing angles

(a)



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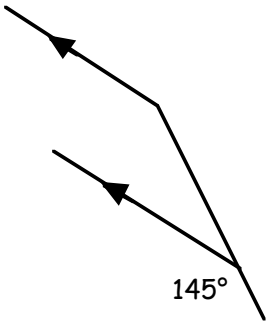
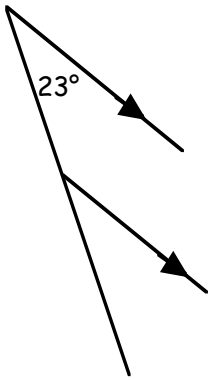
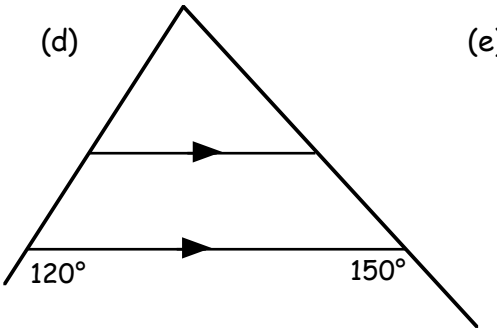


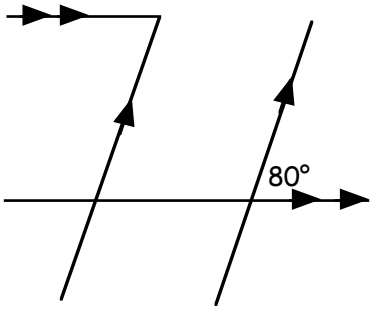
(c)



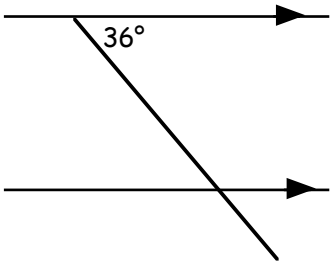
(d)



(e)



(f)



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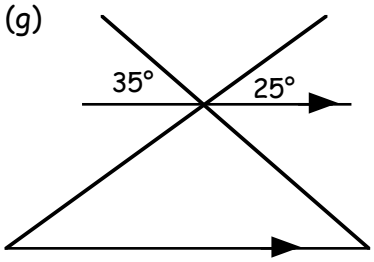

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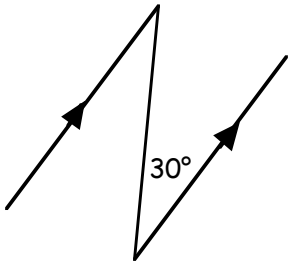
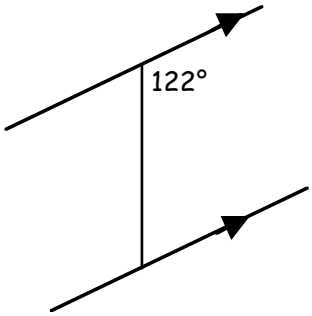
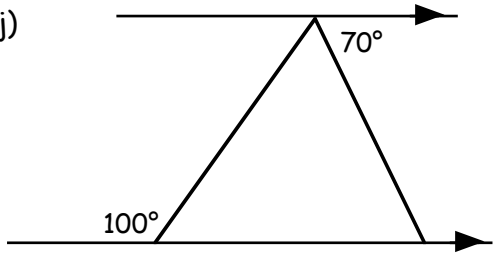


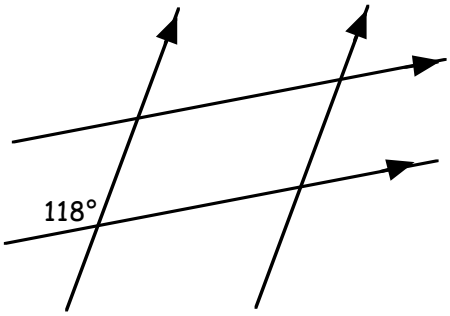
(i)



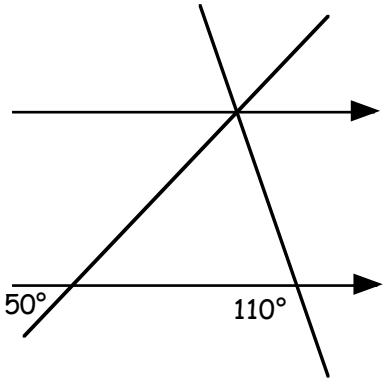
(j)



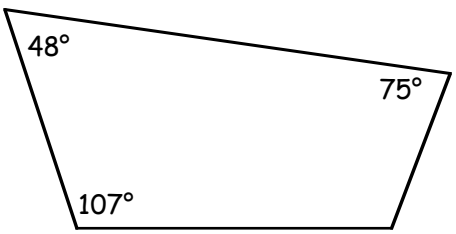
(k)



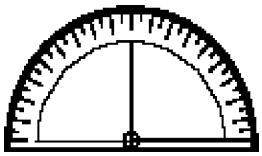
(l)



(m)



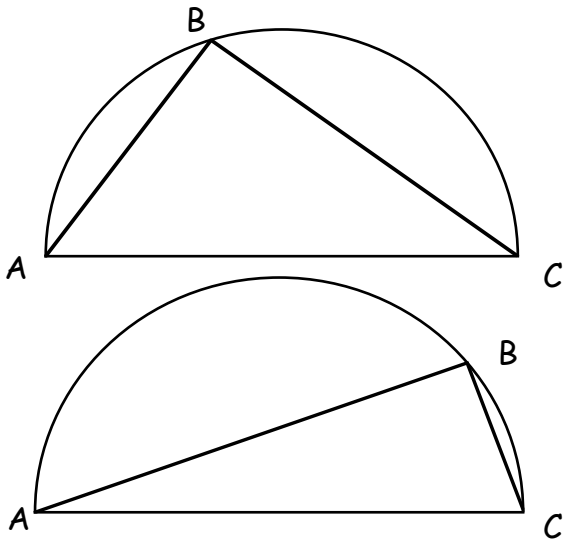
Angles in a Semi-Circle

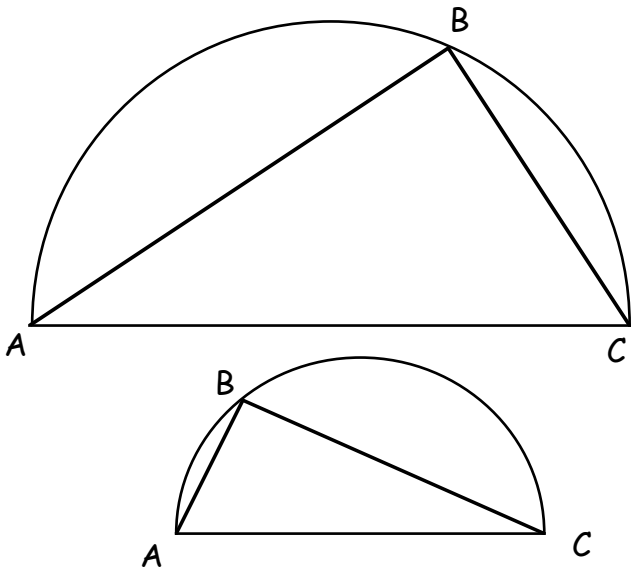


Exploratory Exercise

You will need a protractor for this introductory exercise.

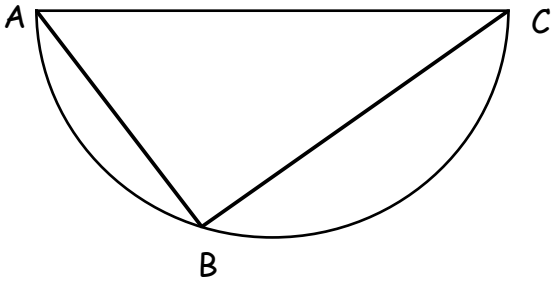
1. Shown below are 4 semi-circles with their diameters and an angle ABC drawn in.

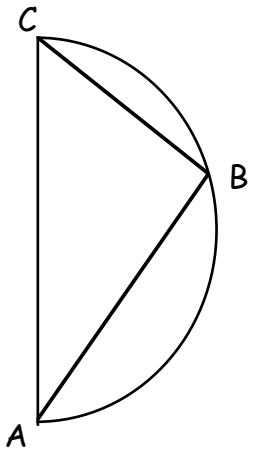


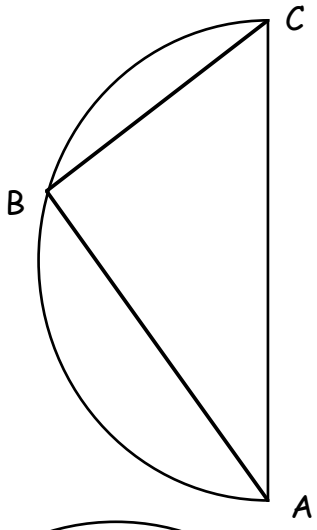


Measure the size of each of the four angles ABC. What did you notice each time ?

2. Do the same for the 4 angles ABC here.







3. Use a pair of compasses to draw this circle.

   Draw a diameter straight across called AC.

   Draw any angle ABC where B lies somewhere on the circumference of the circle.

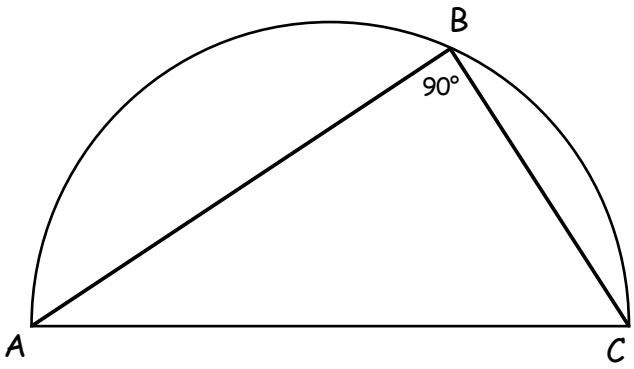
   Measure your ∠ABC.

   Was it also a right angle ?

Do **NOT** mark this CIRCLE

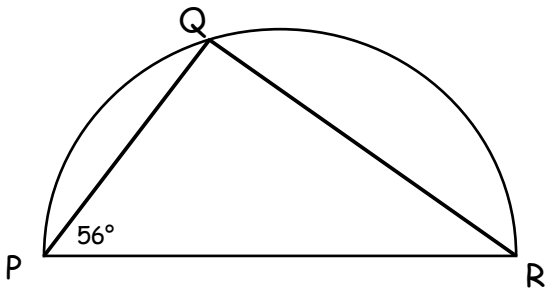
Angles in a Semi-Circle

You should have discovered a very important fact about any angle drawn in a semi-circle with the diameter as its base.



> Every angle in a semi-circle is a **right angle**.

We can use this important fact to help us calculate the sizes of the other angles in the figure.

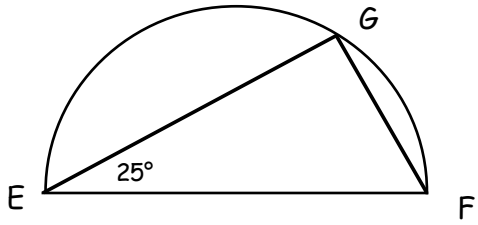


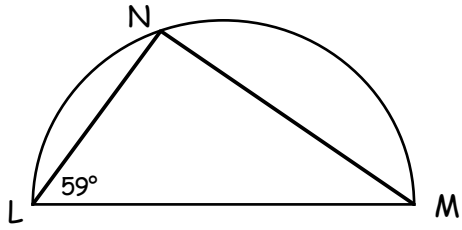
Example :- In this figure ∠RPQ = 56°
Calculate the size of ∠PRQ.

Answer :- Since we know that ∠PQR = 90°,
=> ∠PRQ = 180 – 90 – 56 = 34°

Exercise 2

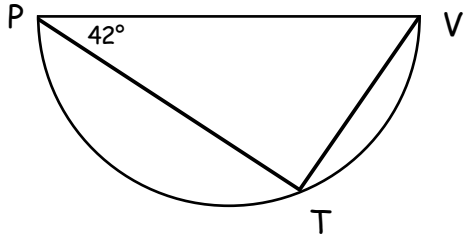
1. (a) Write down the size of ∠EGF in this semi-circle.
   (b) Calculate the size of ∠EFG.



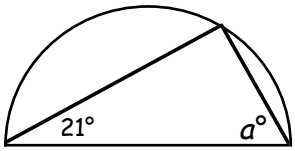
2. 

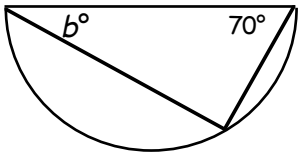
   (a) Write down the size of ∠LNM.
   (b) Calculate the size of ∠LMN.

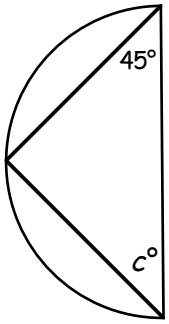
3. (a) Write down the size of ∠PTV.
   (b) Calculate the size of ∠PVT.

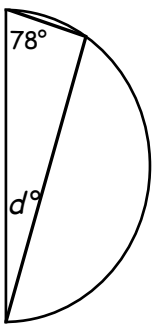


4. Calculate the sizes of the 4 angles marked *a*, *b*, *c* and *d*.

(a) 

(b) 

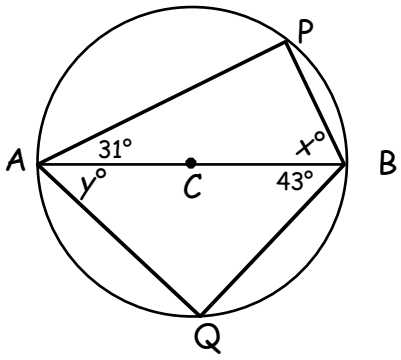
(c) 

(d) 

5. AB is a diameter of this circle, centre C.

(a) Write down the sizes of ∠APB and ∠AQB.

(b) Calculate the sizes of the angles marked *x* and *y*.

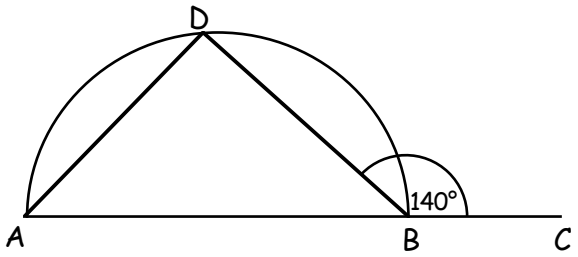


6. AB is the diameter of this semi-circle.
∠DBC = 140°.

(a) Calculate the size of ∠DBA.

(b) Write down the size of ∠ADB.

(c) Calculate the size of ∠DAB.

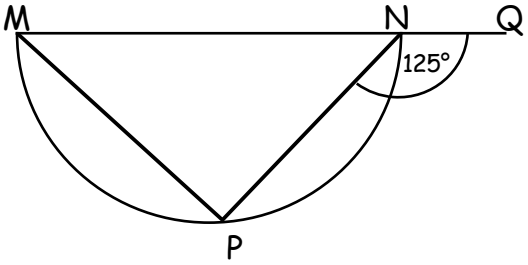


7. MN is the diameter of this semi-circle.
∠PNQ = 125°.

(a) Calculate the size of ∠MNP.

(b) Write down the size of ∠MPN.

(c) Calculate the size of ∠NMP.

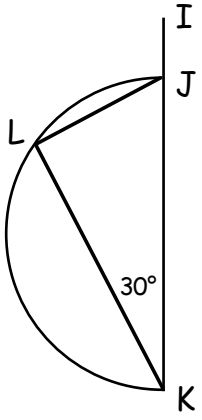


8. JK is the diameter of this semi-circle.
∠LKJ = 30°.

(a) Write down the size of ∠JLK.

(b) Calculate the size of ∠LJK.

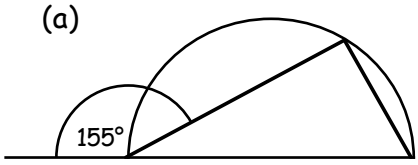
(c) Calculate the size of ∠LJI.



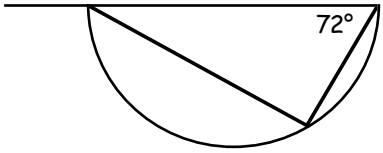
9. Sketch each of the following semi-circles (**a 2p coin is handy**).

In <u>your sketches</u>, fill in the sizes of all the missing angles.

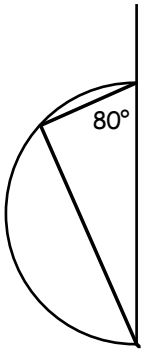
(a)



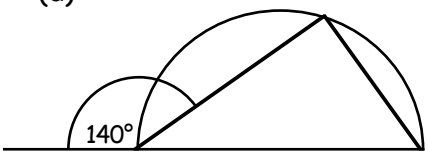
(b)



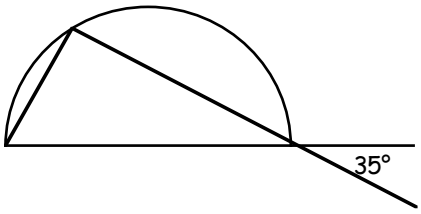
(c)



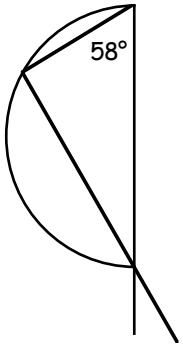
(d)



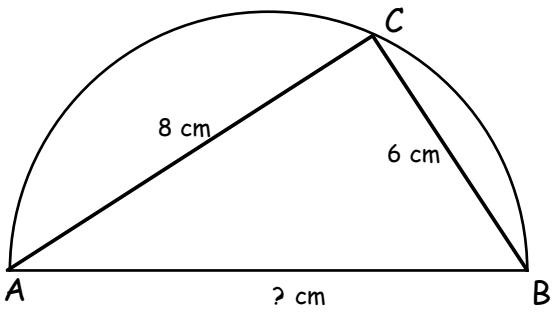
(e)



(f)



Pythagoras Theorem



Since every angle drawn in a semi-circle is 90°,

=> ΔABC is a right angled triangle.

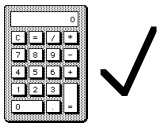
=> We can calculate the length of AB using Pythagoras' Theorem.

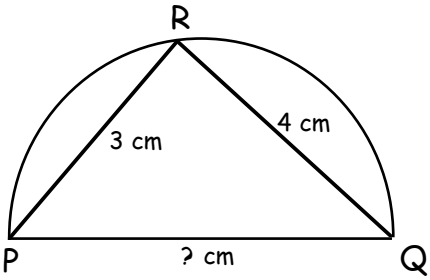
=> $AB^2 = 8^2 + 6^2$ (**Remember ?**)

=> $AB^2 = 64 + 36$

=> $AB^2 = 100$

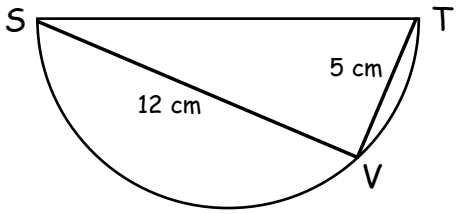
=> $AB = \sqrt{100} = 10$ cm.





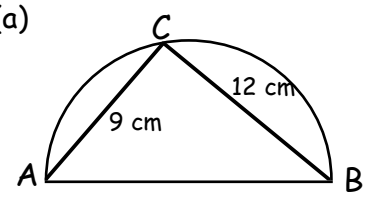
Exercise 3 (Use Pythagoras Theorem)

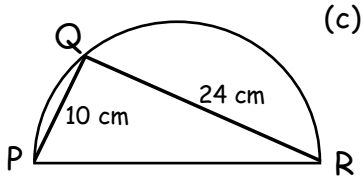
1. PQ is a diameter of this semi-circle.
   (a) What kind of triangle is ΔPQR ?
   (b) Calculate the length of the diameter PQ. ($PQ^2 = ...^2 + ...^2$).

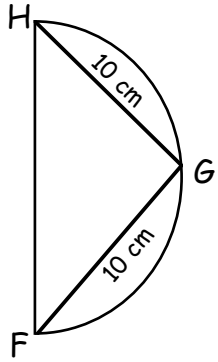
2. 

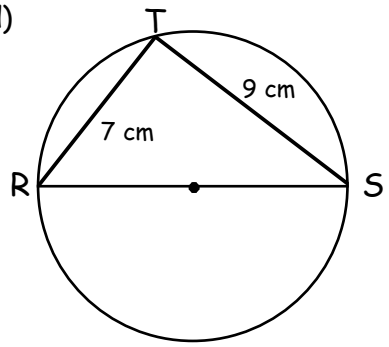
ST is a diameter here.
   (a) What kind of triangle is ΔSTV ?
   (b) Calculate the length of the diameter ST.

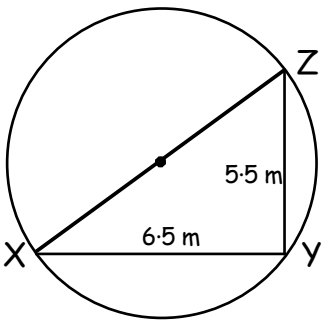
3. Use Pythagoras' Theorem to calculate the diameter of each of the following semi-circles. (*to 1 decimal place*)

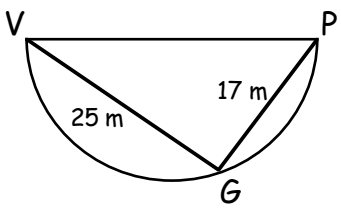
(a) 

(b) 

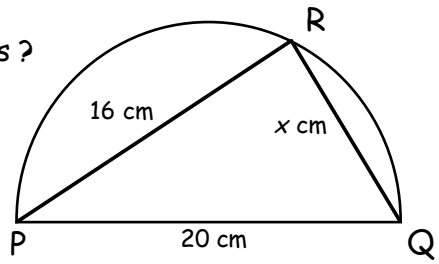
(c) 

(d) 

(e) 

(f) 

4. Can you remember that it is possible to use Pythagoras' Theorem to calculate one of the smaller sides ?



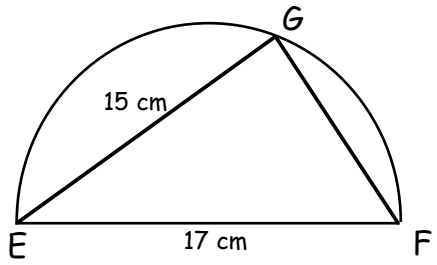
Can you see in this figure ?

=> $RQ^2 = 20^2 - 16^2$ **note**

=> $RQ^2 = 400 - 256$

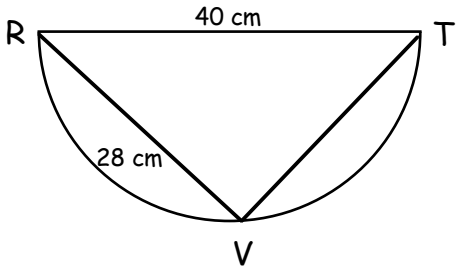
=> $RQ^2 = 144$

=> $RQ = \sqrt{144}$ = ... cm

5. 

(a) What kind of triangle is ΔEGF ?

(b) Calculate the length of the side GF.
($GF^2 = 17^2 - 15^2$) etc.

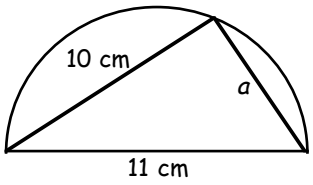
6. 

(a) What kind of triangle is ΔRVT ?

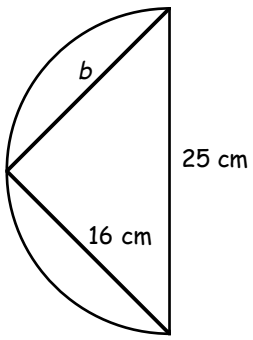
(b) Calculate the length of the side VT.
(**NOT** $VT^2 = 40^2 + 28^2$)

7. Calculate the lengths of the sides marked *a*, *b*, *c*, ... (*they are a mixture of "Addition and Subtraction".*)

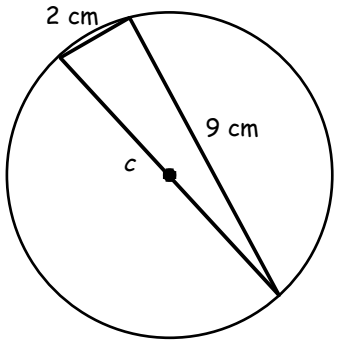
(a)



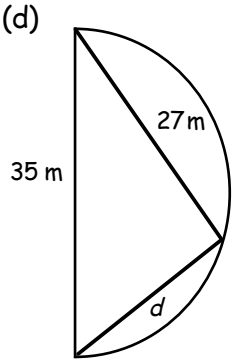
(b)



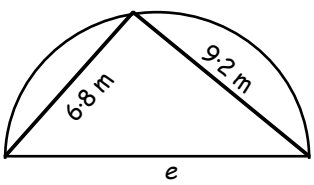
(c)



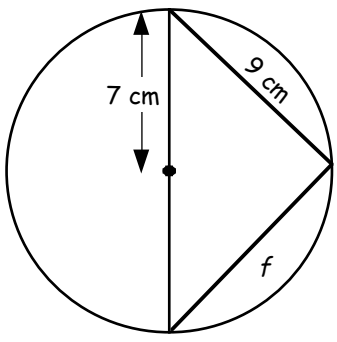
(d)



(e)

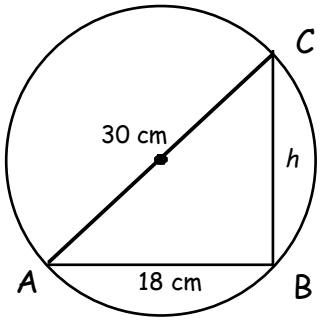


(f)

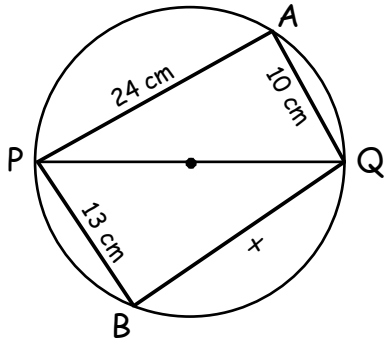


8. (a) Calculate the length of the side CB (h cm).

(b) Now calculate the area of ΔABC.



9.



In this circle, PQ is a diameter.

(a) What kind of triangle is ΔAPQ ?

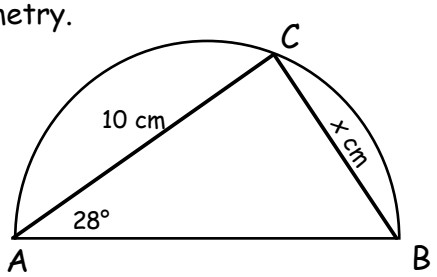
(b) Calculate the length of the diameter PQ.

(c) What kind of triangle is ΔBPQ ?

(d) Calculate the length of the line BQ. (x cm)

Use of Trigonometry

Because ΔABC is right angled (at C) we can use trigonometry.



Tangents

To find x here, use

$$\tan 28° = \frac{\text{opp}}{\text{adj}}$$

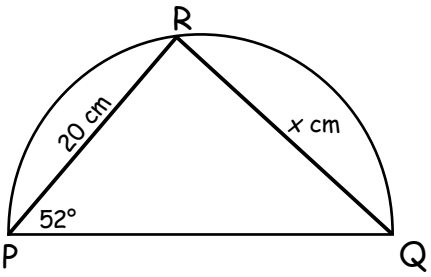
$$\Rightarrow \tan 28° = \frac{x}{10}$$

$$x = 10 \times \tan 28°$$

$$x = 5{\cdot}32 \text{ cm.}$$

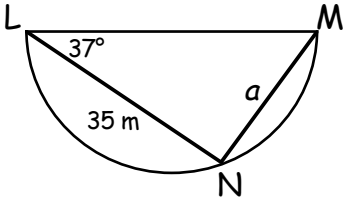
10. Use trigonometry to calculate the length of the side RQ.

(hint : $\tan 52° = \frac{x}{20}$)

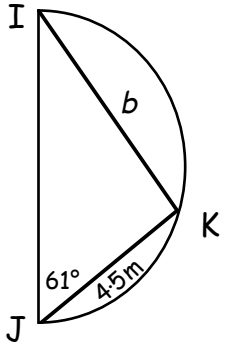


11. Use trigonometry to calculate the value of a, b and c.

(a)



(b)



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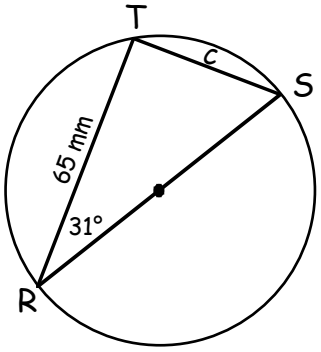
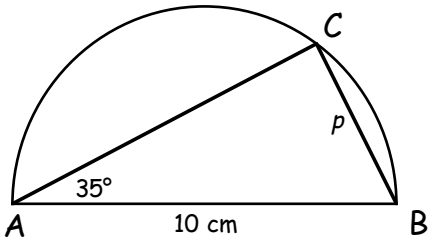


(Only tackle question 13 if you have met sine and cosine in Book 3G)

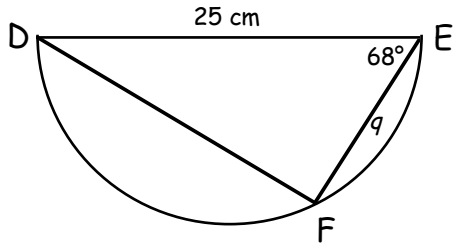
SOH
CAH
TOA

12. Use trigonometry to calculate the value of p, q, r and s.

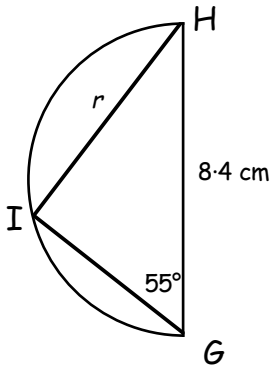
(a)



(b)



(c)



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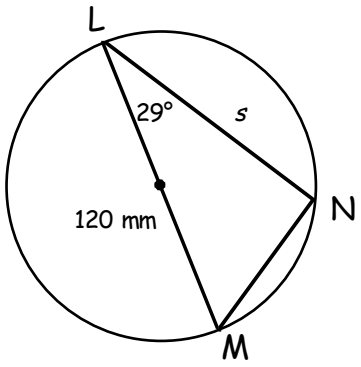
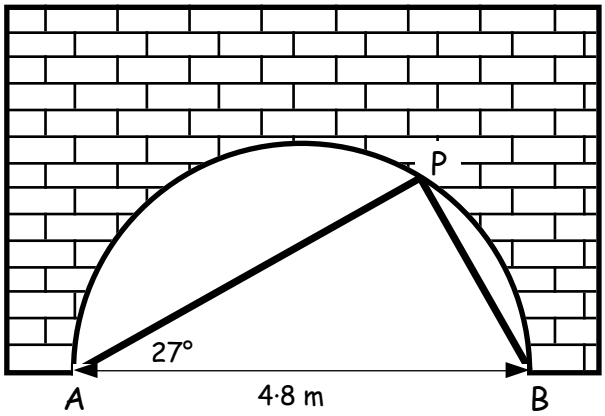


13. The tunnel entrance, under this bridge is in the shape of a semi-circle.

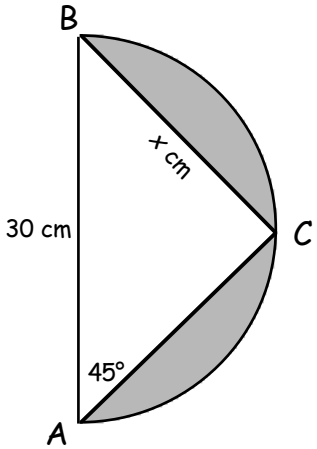
Two wooden planks are used to strengthen the tunnel.

(a) Use trigonometry (sine) to calculate the length of the post PB.

(b) Use trigonometry (cosine) to calculate the length of the post PA.



14.



"DV Travel" have this design as their logo.

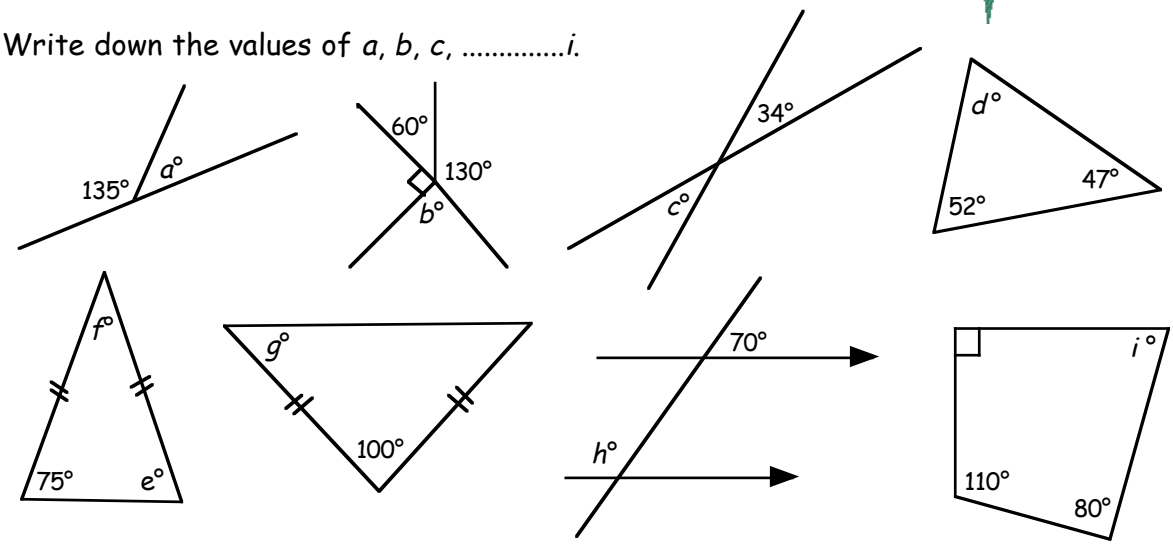
It consists of the letter D (a half-circle) with the letter V inside the D.

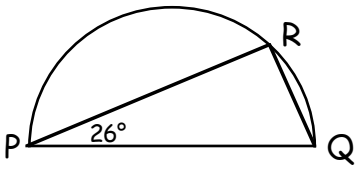
AB is the diameter of the semi-circle.

Calculate the length of the side BC (= x cm).

What have I learned ?

1. Write down the values of *a*, *b*, *c*, ...*i*.



2. 

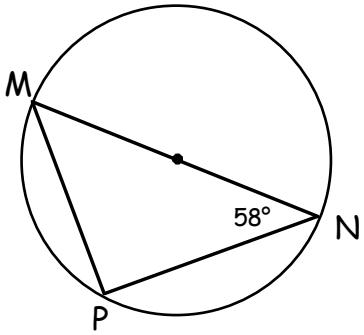
PQ is the diameter of a semi-circle.

(a) Write down the size of ∠PRQ.

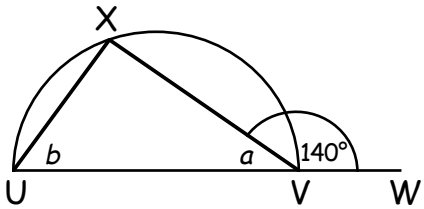
(b) Calculate the size of ∠RQP.

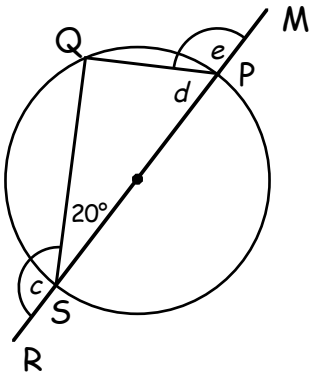
3. MN is the diameter of this circle.

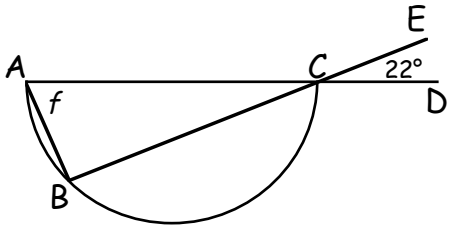
Calculate the size of ∠PMN.



4. Calculate the values of *a*, *b*, *c*, ...*f*.

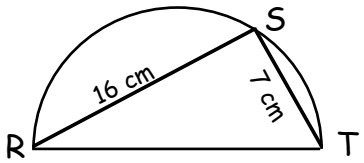






5. RT is a diameter.

Calculate the length of diameter RT to 1 decimal place.

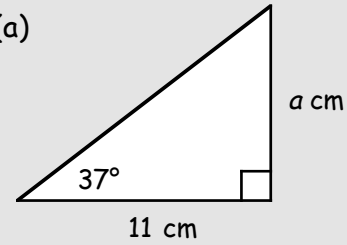


1. Use your calculator (or tables) to find the values of :-

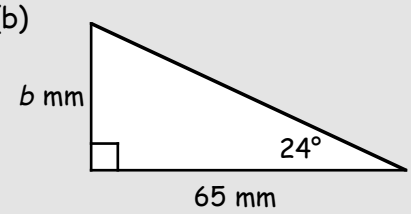
   (a) tan 25° (b) tan 60° (c) tan 52·7°

2. Calculate the value of *a*, *b* and *c* in these right angled triangles :-
   (*Show each step of your working*)

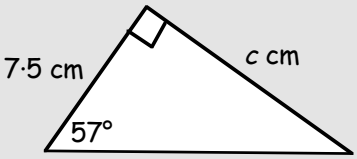
   (a)



   (b)



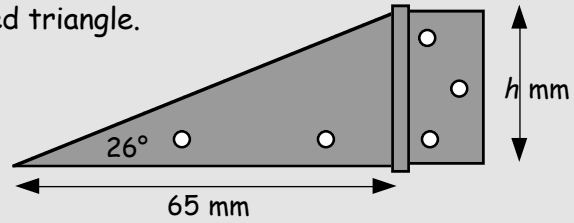
   (c)



3. Part of this hinge is in the shape of a right angled triangle.

   The angle at the tip of the hinge is 26°.

   Calculate the height of the hinge.

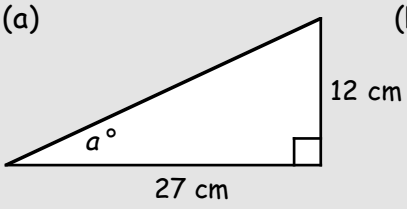


4. Use your calculator (or tables) to calculate the size of the angle ($x°$) given :-

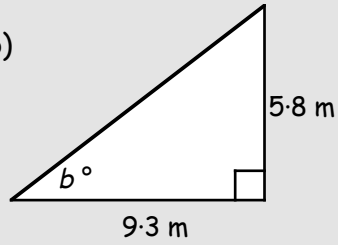
   (a) $\tan x° = 0{\cdot}532$ (b) $\tan x° = 3{\cdot}732$ (c) $\tan x° = 1{\cdot}455$

5. Calculate the sizes of the angles marked *a*, *b* and *c* in these triangles :-
   (*Show each step of your working*)

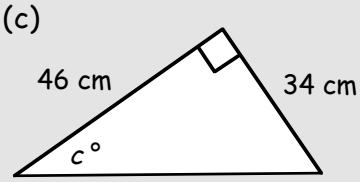
   (a)

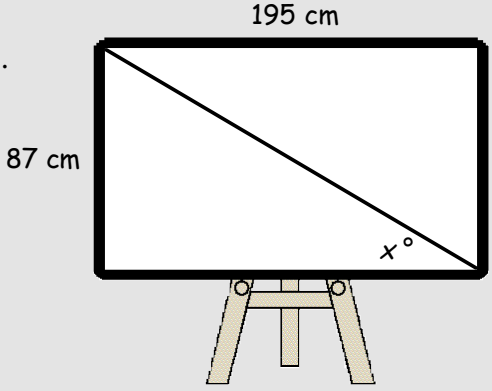


   (b)



   (c)



6. 

   A diagonal line is drawn from corner to corner on a white-board

   Calculate the size of the angle between the line and the foot of the white board.

Non-Calculator

Number Six

Practice Exercise

1. Set down and find :-

   (a) $\begin{array}{r} 53 \\ \times\ 35 \\ \hline \end{array}$ (b) $8\overline{)5624}$ (c) $5 \times 5 \times 4$ (d) $\begin{array}{r} 256 \\ \times\ 7 \\ \hline \end{array}$

   (e) 45×300 (f) $40 \div (16 \div 2)$ (g) $4900 \div 70$ (h) $8000 - 7384$

2. I deposit £325 in the bank each month. How much will I have after 1 year ?

3. Set down and find :-

   (a) $22 \div 8$ (b) $9{\cdot}8 - 7{\cdot}264$ (c) $12 - 10{\cdot}85$ (d) $36 \div 2000$

   (e) $0{\cdot}54 \div 100$ (f) $\begin{array}{r} 15{\cdot}132 \\ \times\ 8 \\ \hline \end{array}$ (g) $17 - 11{\cdot}84 + 16{\cdot}5$ (h) $7\overline{)38{\cdot}36}$

4. Emma is 27, Fran is 24 and Jenny is 18. What is their average age (the mean) ?

5. Find the value of :- (a) $\frac{1}{5}$ of 75 (b) $\frac{7}{10}$ of 130 (c) $\frac{3}{4}$ of 320

6. Find the value of :- (a) $\frac{3}{5} \times \frac{1}{4}$ (b) $3\frac{5}{6} + 1\frac{1}{3}$ (c) $5\frac{1}{4} - \frac{3}{4}$

   (d) $3\frac{1}{5} \times 7$ (e) $\frac{1}{6} + 2\frac{2}{3} - 1\frac{5}{6}$ (f) $9 - 5\frac{5}{8}$

7. I go to Glasgow with £40. I spend $\frac{3}{4}$ of it in W H Smiths.
   Of the money spent in Smiths, $\frac{5}{6}$ of it went on a book. How much did I pay for my book ?

8. Express :- (a) 35 as a percentage of 70 (b) 12 as a percentage of 20.

9. Find the value of :- (a) 25% of 6·4 (b) 60% of £8 (c) 2% of 0·6

   (d) $33\frac{1}{3}$% of 21 (e) $66\frac{2}{3}$% of 219 (f) 5% of £4

10. I deposit £3200 in the bank. I receive 4% interest per annum.
    How much will I have in my bank account after 1 year ?

11. Find :- (a) $(-14) - (-13)$ (b) $6 \times (-6)$ (c) $10 \times (-5)$

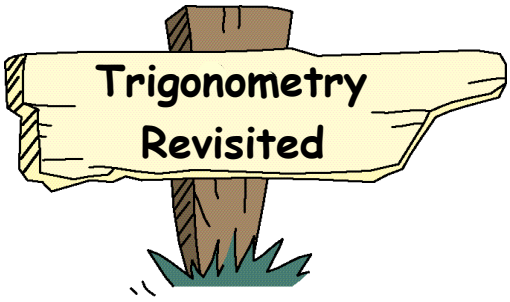
    (d) $(-22) + (-14)$ (e) $(-9) - (-18)$ (f) $0 - (-37)$

12. The temperature fell from 11°C at noon to –7°C at midnight. By how much did it fall ?

13. (a) Today is 18th June. How many days is it until 4th July ?

    (b) Today is 10th May. My birthday was 2 weeks ago. When was my birthday ?

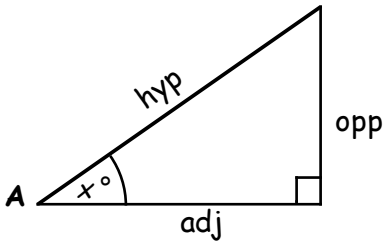
Chapter 13



In Book 3G, you found Trigonometry was extremely useful for calculating the length of one particular side of a right angled triangle assuming you know one other side and an angle.

The Sine of an angle (SIN)

In all of the questions in Book 3G, Chapter 16, you were dealing with the tangent of A which connects the **OPPOSITE** side to the **ADJACENT** side.



$$\tan x^\circ = \frac{\text{opp}}{\text{adj}}$$

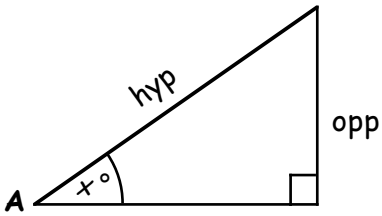
What happens if it is the **OPPOSITE** and the **HYPOTENUSE** you are working with in a particular question ?

The Sine of angle A

For every given angle (A) in a right angled triangle, the sine of x° (or $\sin x^\circ$ for short) is defined as

$$\text{sine of } x^\circ = \frac{\text{opposite}}{\text{hypotenuse}}$$

or $\sin x^\circ = \dfrac{\text{opp}}{\text{hyp}}$ for short



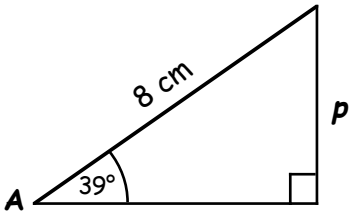
Example :- Calculate the length of the side marked p in this right angled triangle.

$$\sin A = \frac{\text{opp}}{\text{hyp}}$$

$$\sin 39^\circ = \frac{p}{8}$$

$$\Rightarrow p = 8\sin 39^\circ = 5{\cdot}03 \text{ cm}$$

check



Exercise 1

1. Use your "sin" button (or your sine tables) to write down the following (to 3 dec places) :-

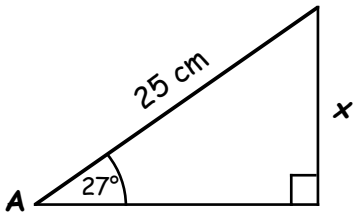
(a)	sin20°	(b)	sin62°	(c)	sin71°	(d)	sin16°
(e)	sin34°	(f)	sin55°	(g)	sin30°	(h)	sin31·5°
(i)	sin73·8°	(j)	sin69·1°	(k)	sin89·8°	(l)	sin75·6°

2. Copy and complete this working to calculate the length of the line *x*.

$\sin 27° = \frac{x}{25}$

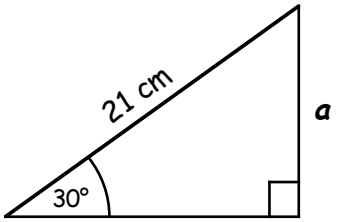
$\Rightarrow x = 25\sin 27°$

$\Rightarrow x = ?$ cm

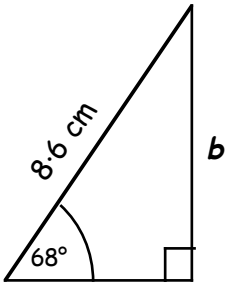


3. For each of the following,
   (i) Sketch the triangle.
   (ii) Show your working.
   (iii) Calculate the size of the sides, *a*, *b*, *c*, ...

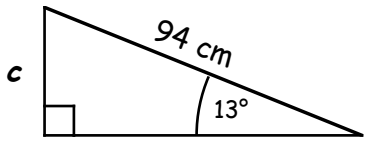
(a)



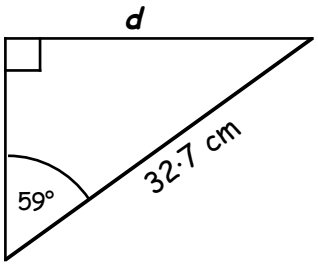
(b)



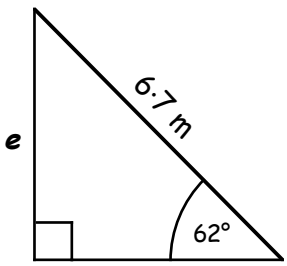
(c)



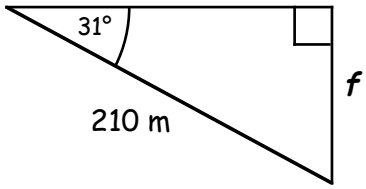
(d)



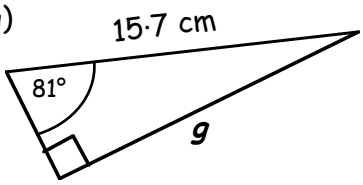
(e)



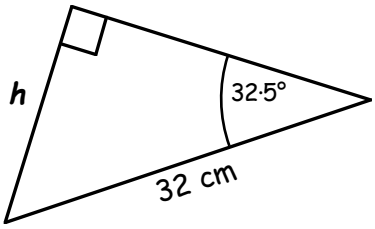
(f)



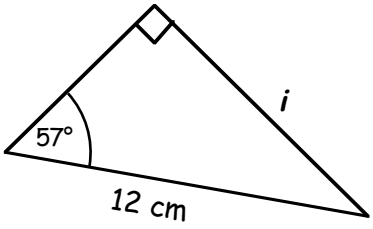
(g)



(h)

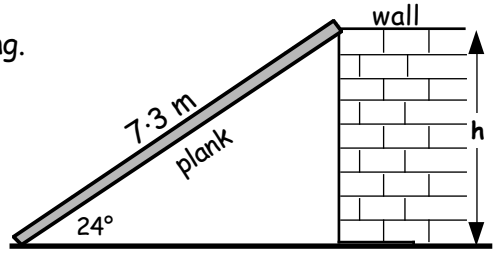


(i)

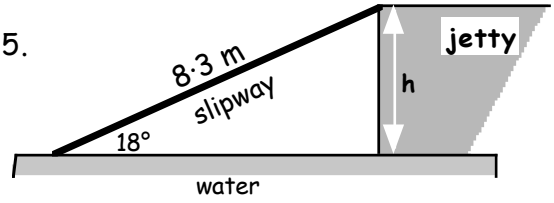


4. A plank, just touching the top of a wall, is 7·3 metres long.

Calculate the height of the wall.



5.

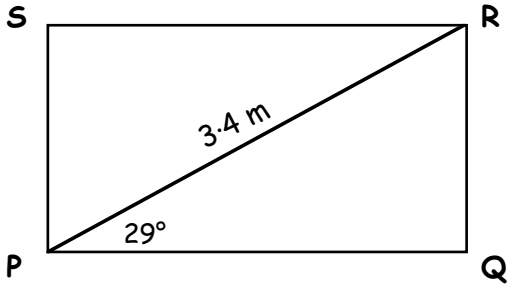


This slipway from the jetty to the water makes an angle of 18° with the water.

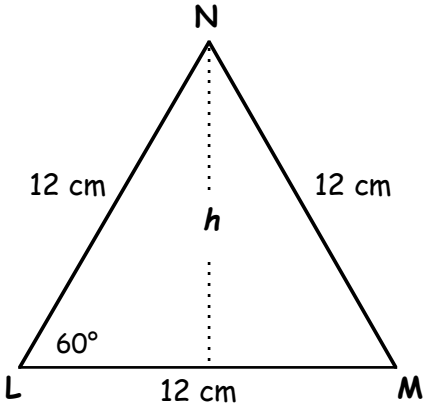
Calculate the height of the jetty above sea level.

6. PQRS is a rectangle.
Diagonal PR = 3·4 m.

Calculate the length of the line QR.



7.



LMN is an **equilateral** triangle (LM = LN = MN = 12 cm).

Calculate the height (h) of the triangle.

Do you remember how we used Shift tan to calculate the size of the angle if we knew its tangent value ?

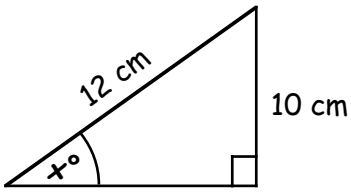
We can use Shift sin to calculate the size of an angle in a triangle when we know the opposite and the hypotenuse.

Example :- In the triangle shown

$$\sin x^\circ = \frac{\text{opp}}{\text{hyp}} = \frac{10}{12} = (10 \div 12)$$

$$\Rightarrow \sin x^\circ = 0{\cdot}8333....$$

$$\therefore x = 56{\cdot}4^\circ \quad [\text{shift sin } 0{\cdot}83333]$$



(On some calculators it is 2nd sin and some Inv sin).

You can also use tables of sines instead of a calculator.

Exercise 2

1. Look up your tables or use the **two** buttons on your calculator to find the sizes of the angles L, M, N, ...

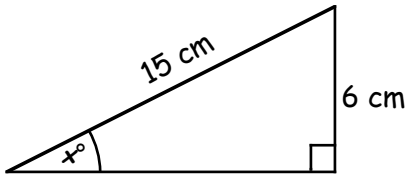
(a)	sinL = 0·375 (22°)	(b)	sinM = 0·559	(c)	sinN = 0·777
(d)	sinO = 0·988	(e)	sinP = 0·208	(f)	sinQ = 0·695
(g)	sinR = 0·595	(h)	sinS = 0·814	(i)	sinT = 0·466
(j)	sinU = 0·953	(k)	sinV = 0·999	(l)	sinW = 0·061

2. Copy this working and complete it.

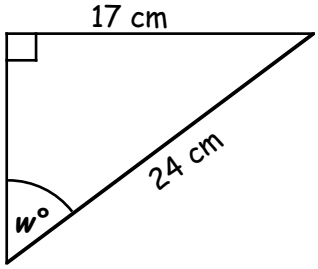
$\sin x^\circ = \frac{6}{15} = (6 \div 15)$

$\Rightarrow \sin x^\circ = 0{\cdot}4$

$\Rightarrow x = ?$



(remember to use **TWO** buttons)

3. 

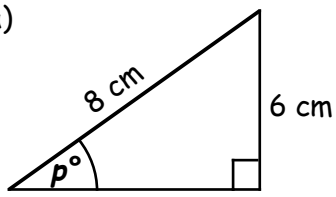
Copy and complete the working to find *w*.

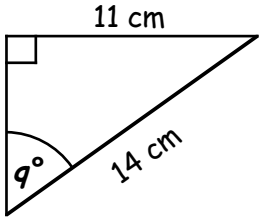
$\sin w^\circ = \frac{17}{24} = (17 \div 24)$

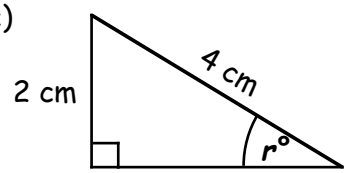
$\Rightarrow \sin w^\circ = ?$

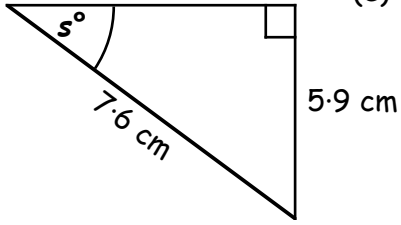
$\Rightarrow w = ?$ (2 buttons)

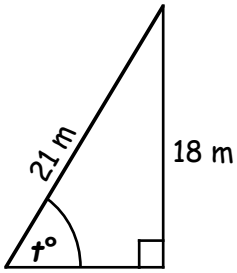
4. Sketch each of the following triangles and show the THREE lines of working needed to calculate the sizes of the angles *p*, *q*, *r*, ...

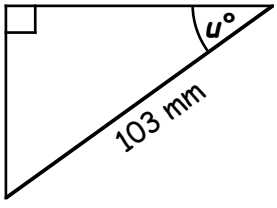
(a) 

(b) 

(c) 

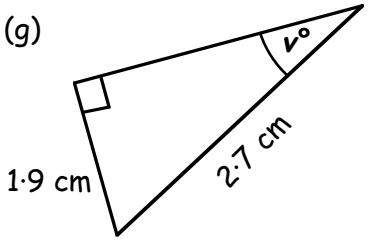
(d) 

(e) 

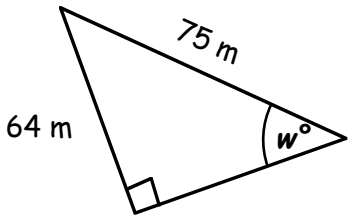
(f) 

cont'd...

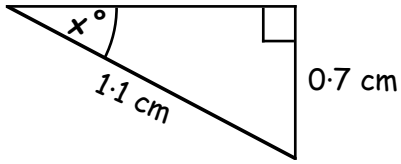
(g)



(h)



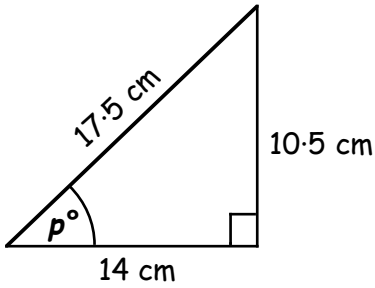
(i)



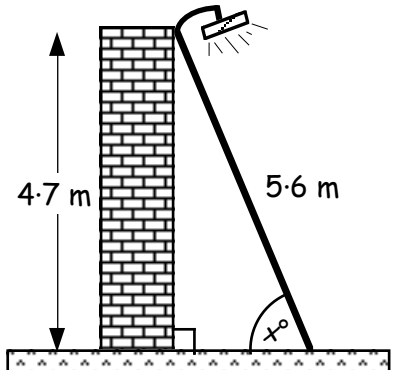
5. In this triangle, all 3 sides are given. You only need 2 of them to calculate the value of the angle marked $p°$.

   (a) Which two could you use ?

   (b) Now find the value of p.



6.



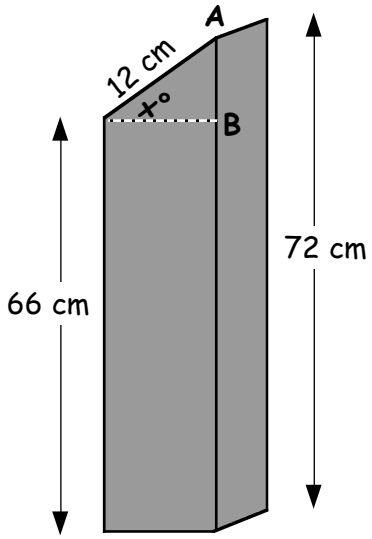
This picture shows a lamppost 5·6 metres long, which has toppled over and come to rest against the top of a wall, 4·7 metres high.

Calculate the size of the angle ($x°$) between the lamppost and the ground.

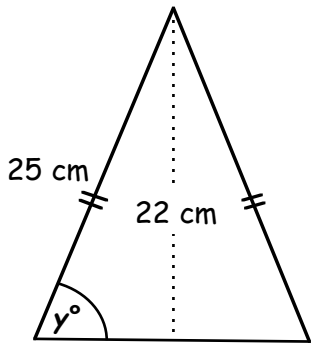
7. The top of this fence has a sloping edge 12 centimetres long.

   (a) Write down the length of the line marked AB.

   (b) Now calculate the angle of the slope ($x°$).



8.

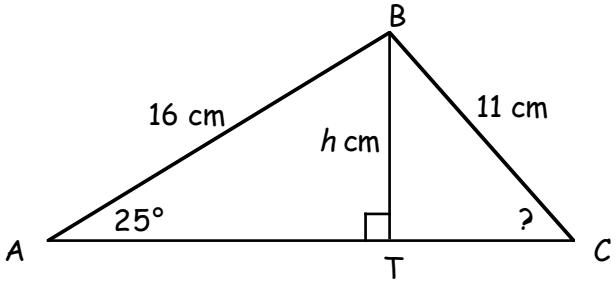


This isosceles triangle is 22 cm in height. The 2 sloping sides are each 25 cm long.

Calculate the size of the angle ($y°$) between a sloping side and the base.

9. (a) In triangle ABT, use sine to calculate the length of the line BT (h).

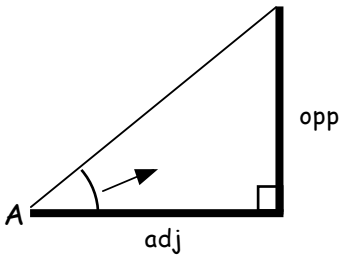
   (b) Now use triangle CBT to calculate the size of $\angle BCT$.



The Cosine of an angle (COS)

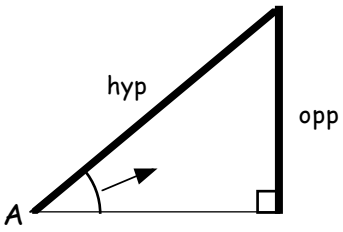
So far we have used :-

Tangent when dealing with
the **opposite** and the **adjacent**



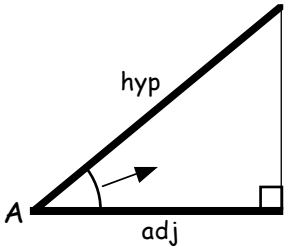
$$\tan A = \frac{\text{opp}}{\text{adj}}$$

Sine when dealing with
the **opposite** and the **hypotenuse**



$$\text{Sin}A = \frac{\text{opp}}{\text{hyp}}$$

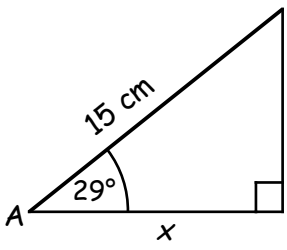
We now have a final Trigonometric Ratio called the **COSINE** (cos) which we use when dealing with the **ADJACENT** and the **HYPOTENUSE**.



$$\cos A = \frac{\text{adjacent}}{\text{hypotenuse}}$$

or $\cos A = \frac{\text{adj}}{\text{hyp}}$ for short

Example :- To calculate the size of the adjacent side in this triangle, when we know the hypotenuse :-



$$\cos A = \frac{\text{adj}}{\text{hyp}}$$

$$\Rightarrow \cos 29° = \frac{x}{15}$$

$$\Rightarrow x = 15\cos 29°$$

$$\Rightarrow x = 13{\cdot}1 \text{ cm}$$

Exercise 3

1. Use your calculator (or set of cosine tables) to find :-

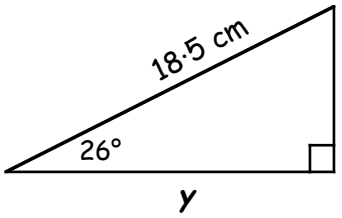
(a)	cos30°	(b)	cos60°	(c)	cos72°	(d)	cos84°
(e)	cos25°	(f)	cos48°	(g)	cos49°	(h)	cos59·3°
(i)	cos55·4°	(j)	cos37·8°	(k)	cos76·5°	(l)	cos14·8°

2. Copy and complete the working to find the value of *y*.

$\cos 26° = \frac{y}{18{\cdot}5}$

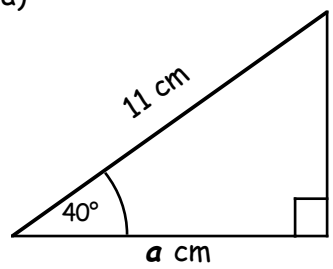
$y = 18{\cdot}5\cos 26°$

$y = ?$

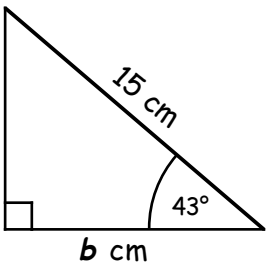


3. Sketch each of the following triangles and set down the 3 lines of working (as shown above) to calculate the values of *a*, *b*, *c*, ...

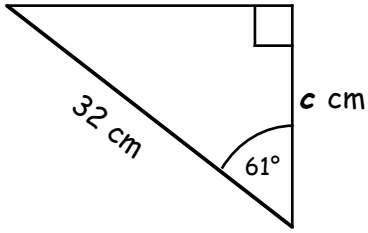
(a)



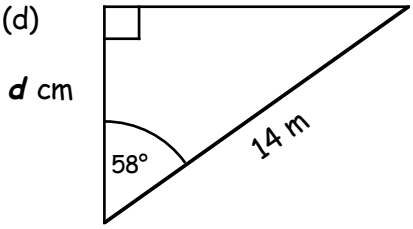
(b)



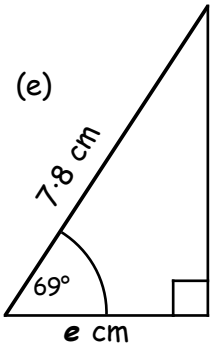
(c)



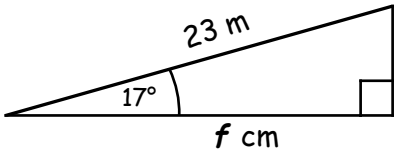
(d)



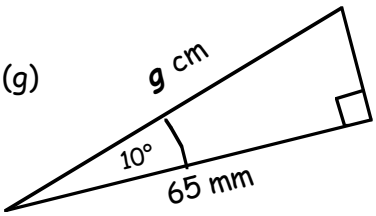
(e)



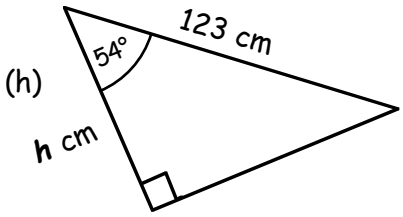
(f)



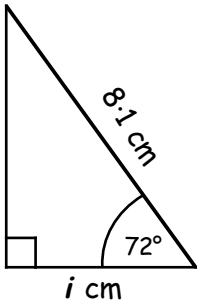
(g)



(h)

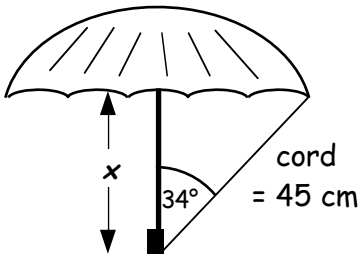


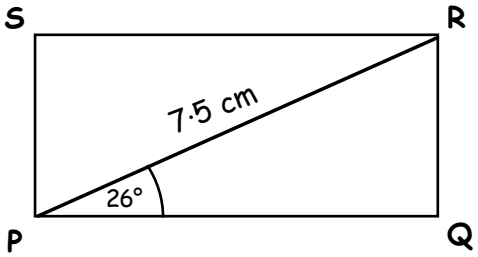
(i)



4. This umbrella has a cord joining the end of the handle to one of the "prongs" of the cover.

Calculate the length of the handle shown.



5. 

The diagonal of this rectangle PQRS is 7·5 centimetres long.

Calculate the length of the side PQ.

As with sine and tangent, we can calculate the <u>size</u> of an angle in a right angled triangle by using the

2nd cos buttons

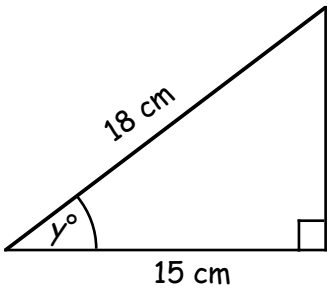
<u>Example</u> :-

$\cos y^\circ = \frac{\text{adj}}{\text{hyp}}$

$\cos y^\circ = \frac{15}{18}$ $= (15 \div 18)$

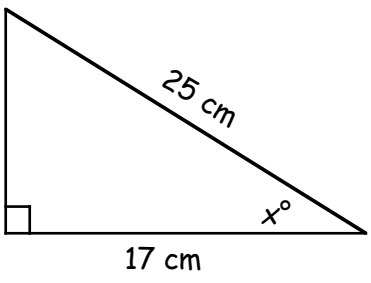
$\cos y^\circ = 0{\cdot}8333\ldots$

$\Rightarrow y = 33{\cdot}6^\circ$ (2 buttons)



6. Look up your tables (or use two buttons on your calculator) to find the sizes of the following angles :-

(a)	cosZ = 0·259	(b)	cosY = 0·755	(c)	cosX = 0·839
(d)	cosW = 0·866	(e)	cosV = 0·966	(f)	cosU = 0·454
(g)	cosT = 0·334	(h)	cosS = 0·462	(i)	cosR = 0·105
(j)	cosQ = 0·304	(k)	cosP = 0·949	(l)	cosO = 0·787

7. 

Copy and complete to find the size of (x°).

$\cos x^\circ = \frac{\text{adj}}{\text{hyp}}$

$\cos x^\circ = \frac{17}{25}$ $= 17 \div 25 = 0{\cdot}\ldots$

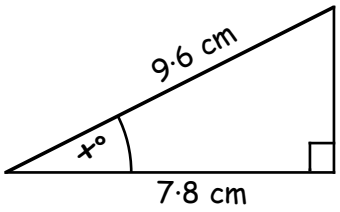
$x^\circ =$ ..... (2 buttons)

8. Copy and complete the working to find the value of x.

$\cos x° = \frac{7{\cdot}8}{9{\cdot}6}$ $(7{\cdot}8 \div 9{\cdot}6)$

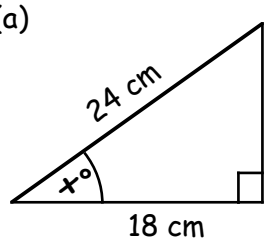
$\cos x° = ?$

$x = ?$ (2 buttons)

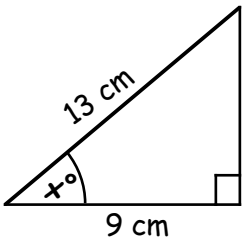


9. Sketch each of the following triangles and set down the 3 lines of working (as shown above) to calculate the value of x each time :-

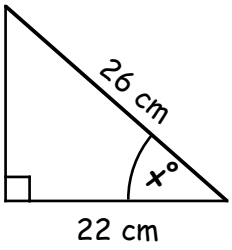
(a)



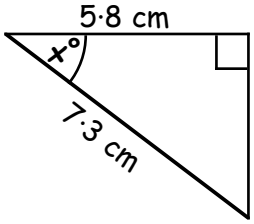
(b)



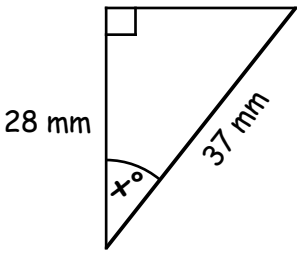
(c)



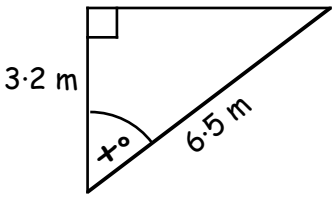
(d)



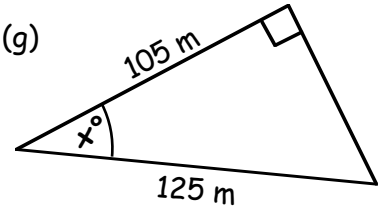
(e)



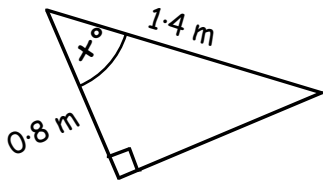
(f)



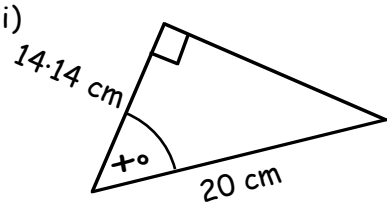
(g)



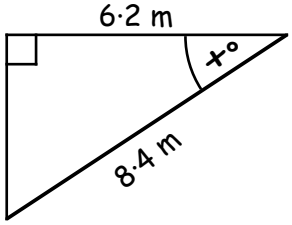
(h)



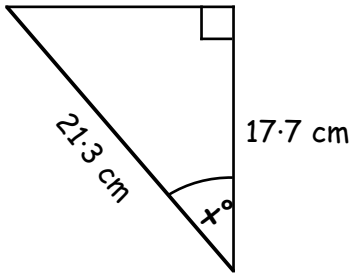
(i)



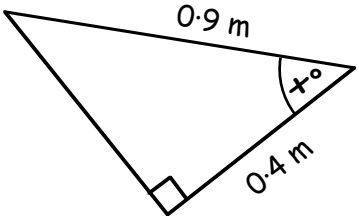
(j)



(k)



(l)

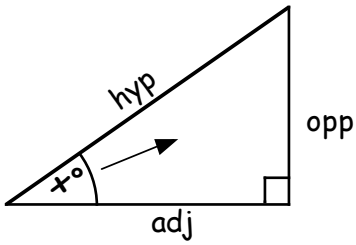


A MIXTURE.

In all the exercises so far you have been told which ratio to use

tan — sin — cos

Now you are going to have to decide for yourself which one to use.



S O H C A H T O A

SOH
CAH
TOA
} is a small rule for helping to decide which ratio to use.

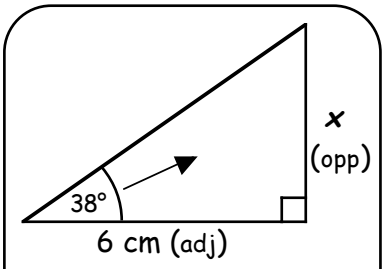
$\text{Sin} = \frac{\text{Opp}}{\text{Hyp}}$ SOH

$\text{Cos} = \frac{\text{Adj}}{\text{Hyp}}$ CAH

$\text{Tan} = \frac{\text{Opp}}{\text{Adj}}$ TOA

How to use them. - decide which **TWO** sides you are dealing with in a question (*e.g.* **opp** and **hyp**) and use SOH CAH TOA.
(*e.g. if it is opp and hyp, use sine*)

3 Examples :-

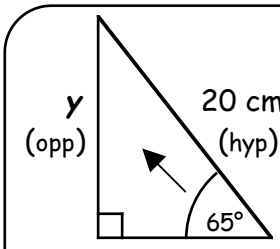


We are dealing with
Opp and **A**dj
=> **TOA**

$\tan 38° = \frac{x}{6}$

$x = 6\tan 38°$

$x = 4{\cdot}69$ cm

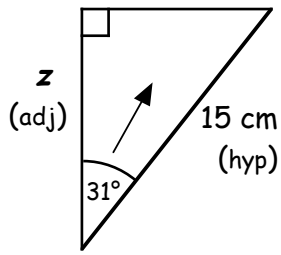


We are dealing with
Opp and **H**yp
=> **SOH**

$\sin 65° = \frac{y}{20}$

$y = 20\sin 65°$

$y = 18{\cdot}13$ cm



We are dealing with
Adj and **H**yp
=> **CAH**

$\cos 31° = \frac{z}{15}$

$z = 15\cos 31°$

$z = 12{\cdot}86$ cm

Note :- The arrow from the angle points to the opposite side.
(This is often a help in deciding which 2 sides you are dealing with)

Exercise 4

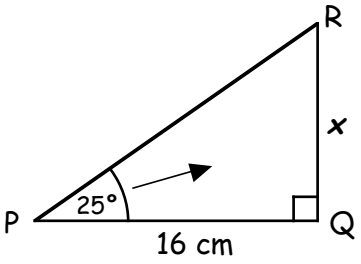
1. Look at ΔPQR.

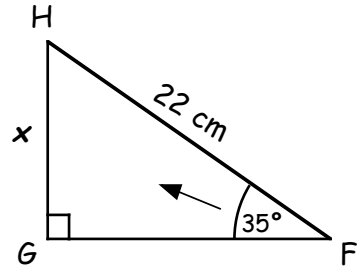
   (a) Which side is already known (opp, adj, hyp) ?

   (b) Which side are you trying to find (opp, adj, hyp) ?

   (c) Which ratio should be used (sin, cos, tan) ?

   (d) Use the appropriate ratio to find *x*.



2. 

   Look at ΔFGH.

   (a) Which side is already known (opp, adj, hyp) ?

   (b) Which side are you trying to find (opp, adj, hyp) ?

   (c) Which ratio should be used (sin, cos, tan) ?

   (d) Use the appropriate ratio to find *x*.

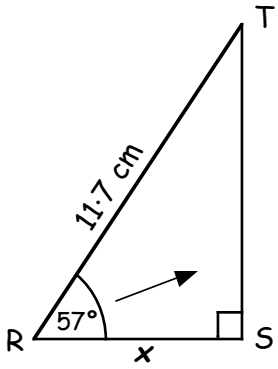
3. Look at ΔRST.

   (a) Which side is already known (opp, adj, hyp) ?

   (b) Which side are you trying to find (opp, adj, hyp) ?

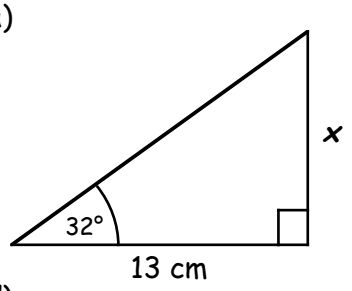
   (c) Which ratio should be used (sin, cos, tan) ?

   (d) Use the appropriate ratio to find *x*.

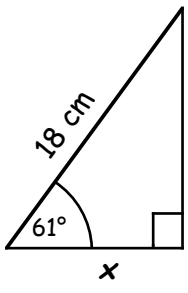


4. Sketch each of the following triangles, state which TWO sides you are dealing with, decide which ratio (sin, cos, tan) you need to use to find x and find the value of x :-

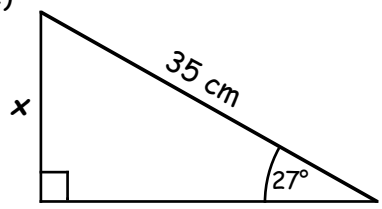
(a)



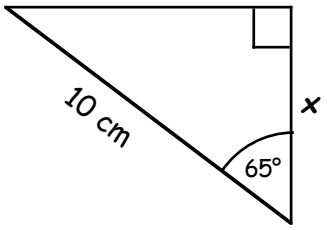
(b)



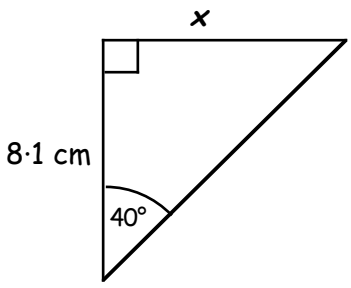
(c)



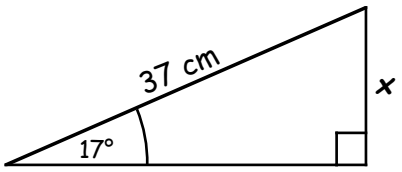
(d)



(e)



(f)



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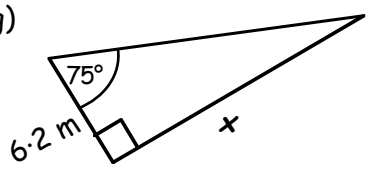
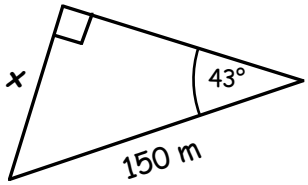
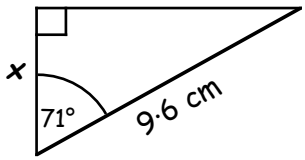
(g)



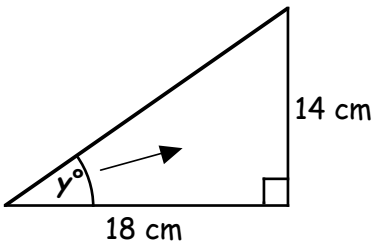
(h)



(i)



5. This time, you have to find a missing angle.
(remember to use Shift ? – 2 buttons)

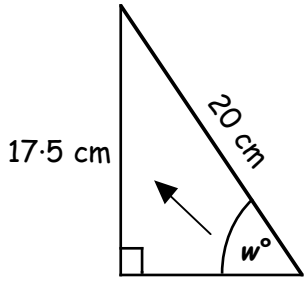


(a) Which **TWO** sides do you know (opp, adj, hyp) ?

(b) Which trig ratio do you use (sin, tan, cos) ?

(c) Start with $\tan y^\circ = \frac{14}{18}$ and calculate the value of y.

6.



(a) Which **TWO** sides do you know (opp, adj, hyp) ?

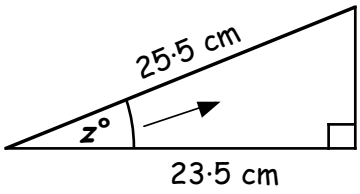
(b) Which trig ratio do you use (sin, tan, cos) ?

(c) Calculate the size of the angle marked w.

7. (a) Which **TWO** sides do you know (opp, adj, hyp) ?

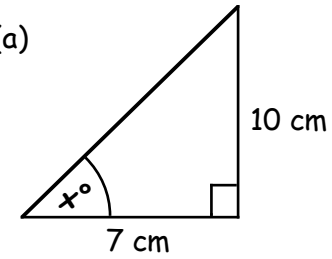
(b) Which trig ratio do you use (sin, tan, cos) ?

(c) Calculate the size of the angle marked z.

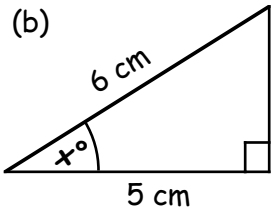


8. Sketch each of these triangles, state which TWO sides you know already (opp, adj, hyp), decide which ratio (sin, tan, cos) to use and calculate the value of x each time :-

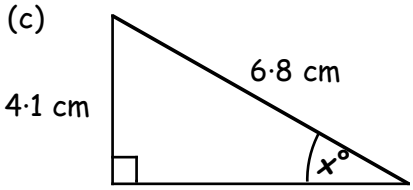
(a)



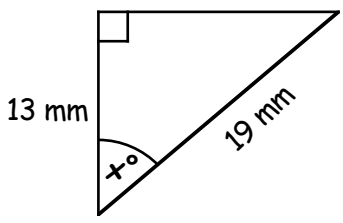
(b)



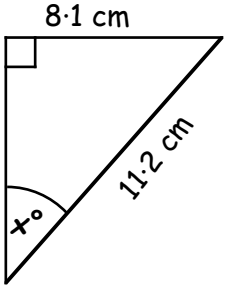
(c)



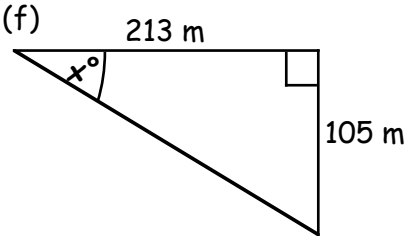
(d)



(e)



(f)



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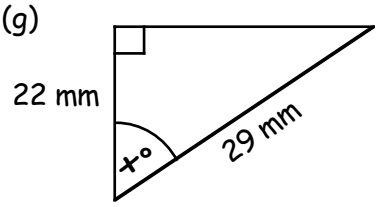
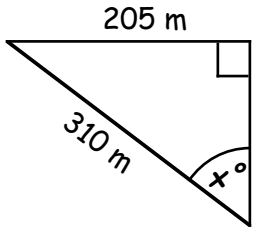
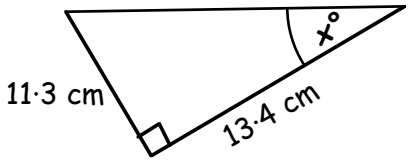
(g)



(h)

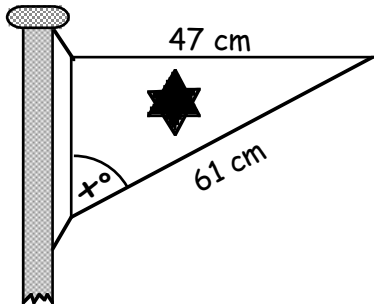


(i)

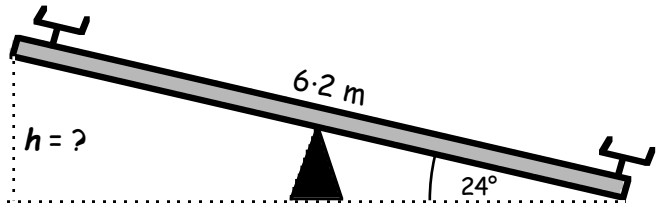


9. This flag is in the shape of a right angled triangle.

   Calculate the size of the angled marked x in the flag.



10.



This see-saw is 6·2 metres long.
When one end is on the ground,
it makes an angle of 24° to the ground.

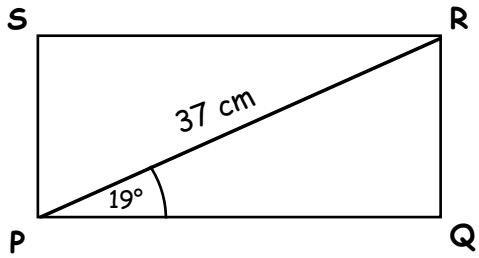
How high is the other end of the see-saw above the ground ?

11. The diagonal of this rectangle is 37 cm long.

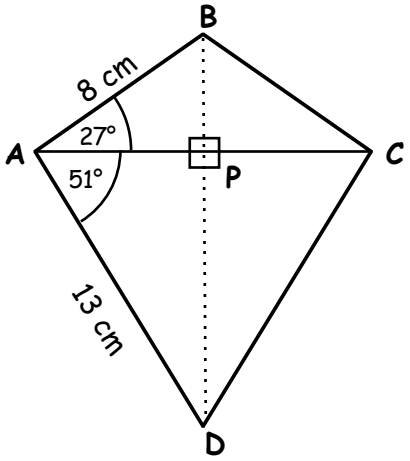
   (a) Calculate the length of the small side QR.

   (b) Calculate the length of the larger side PQ.

   (c) Now calculate the AREA of the rectangle.



12.



The diagonals of this kite meet at right angles at P.

(a) In ΔABP, calculate the length of BP.

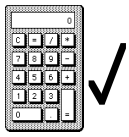
(b) In ΔABP, calculate the length of AP.

(c) In ΔAPD, calculate the length of PD.

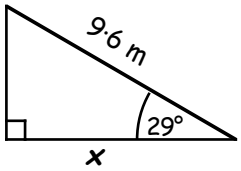
(d) Write down the length of the two diagonals AC and BD.

What have I learned ?

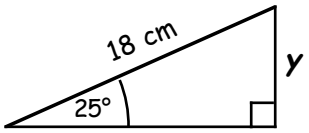
1. Use "**cosine**" to calculate the value of x and "**sine**" to calculate the value of y.



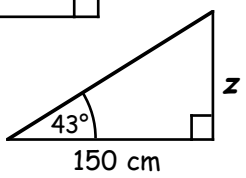
(a)



(b)

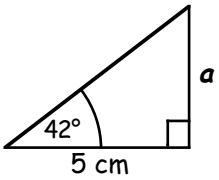


2. Use "**tangent**" to calculate the value of z.

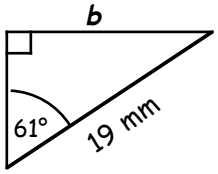


3. In each of the following, decide which of the 3 ratios (sin, tan, cos) to use and then find the values of a, b, c, ...

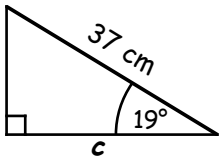
(a)



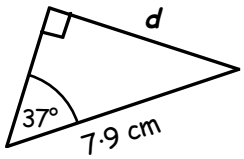
(b)



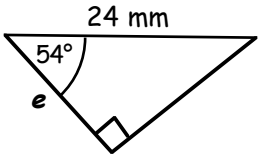
(c)



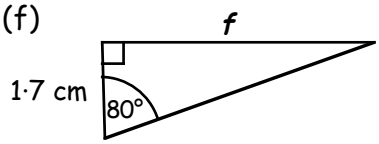
(d)



(e)

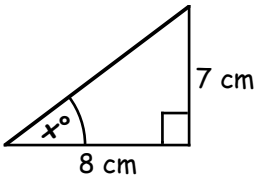


(f)

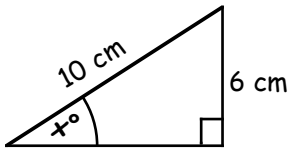


4. Calculate the size of each of the following angles (*remember to use "**2nd**" buttons*) :-

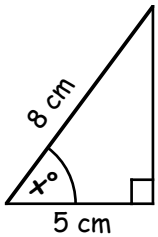
(a)



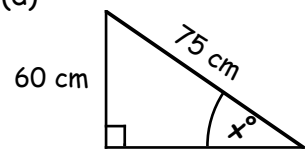
(b)



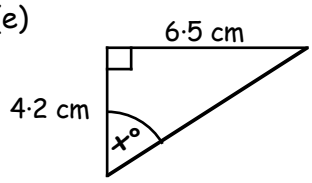
(c)



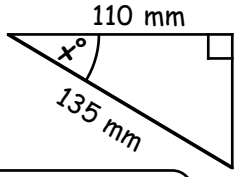
(d)



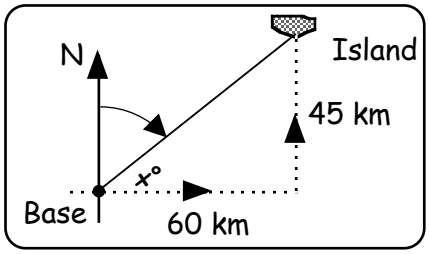
(e)



(f)



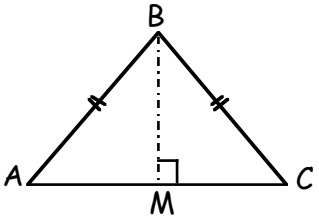
5. To get to an island from an airbase, a pilot flies 60 km East, then 45 km North.



(a) Calculate the size of the angle x.

(b) Write down the 3 figure bearing of the island from the base.

6.

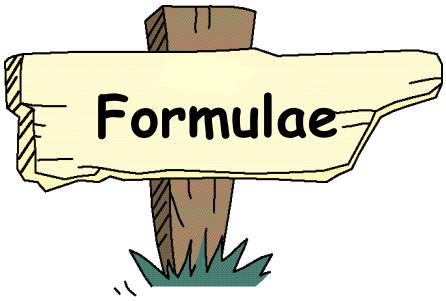


ΔABC is isosceles with $AB = BC = 17$ cm and $AC = 22$ cm.

(a) Write down the length of the line MC.

(b) Calculate the size of $\angle BCM$.

Chapter 14



Working with Expressions

Example 1:- If $a = 3$ and $b = 5$, find the value of :-

(i) $a + b$
$= 3 + 5$
$= 8$

(ii) $9a$
$= 9 \times 3$
$= 27$

Example 2:- For $p = 8$ and $q = 2$ find the value of :-

$3p - 10q$
$= 3 \times 8 - 10 \times 2$
$= 24 - 20$
$= 4$

Exercise 1

1. If $a = 5$ and $b = 4$, work out the value of :-

(a)	$a + b$	(b)	$a - b$	(c)	ab	(d)	$8a$
(e)	$6b$	(f)	$2ab$	(g)	$3ba$	(h)	$b \div 4$
(i)	$a \div 2$	(j)	$ab \div 2$	(k)	$ba \div 10$	(l)	$\frac{a + b}{3}$

2. For $k = 6$ and $m = 9$, find the value of :-

(a)	$k + m$	(b)	$m - k$	(c)	km	(d)	mk
(e)	$10k$	(f)	$4m$	(g)	k^2	(h)	m^2
(i)	k^2m^2	(j)	$\frac{k^2}{3}$	(k)	$\frac{m^2}{3}$	(l)	$\frac{54}{km}$

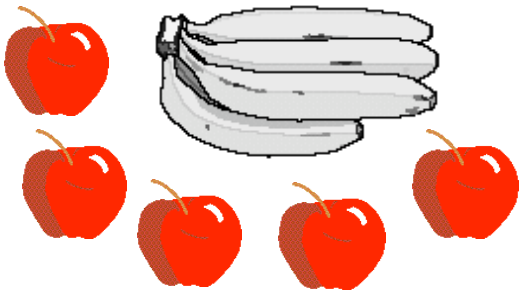
3. For $x = 5$, $y = 1$ and $z = 10$, calculate :-

(a)	$x + y + z$	(b)	$z - x$	(c)	$z - y$	(d)	$x - y + z$
(e)	$z - y + x$	(f)	$z + x - y$	(g)	xy	(h)	xz
(i)	yz	(j)	xyz	(k)	$2x$	(l)	$7y$
(m)	$9z$	(n)	$\frac{1}{2}z$	(o)	$\frac{1}{5}x$	(p)	$\frac{1}{2}y$
(q)	$2x + y$	(r)	$3z - y$	(s)	$2y + x$	(t)	$2z - 2x$
(u)	$12y - z$	(v)	$2xz$	(w)	x^2	(x)	y^2

4. If $p = 3$, $q = 2$, $r = 1$ and $s = 0$, work out :-

(a)	$\frac{1}{2}p$	(b)	$\frac{1}{2}q$	(c)	$\frac{1}{2}r$	(d)	$\frac{1}{5}s$
(e)	p^2	(f)	$2p^2$	(g)	$(2p)^2$	(h)	q^2
(i)	pqr	(j)	$(pqr)^2$	(k)	$p + q + r$	(l)	$(p + q + r)^2$
(m)	qrs	(n)	$(qrs)^2$	(o)	$(p - r)^2$	(p)	$\frac{(p + r)^2}{8}$

5. We could represent the cost of 5 apples and 4 bananas by **$5a + 4b$**.
where ***a*** is the cost (in pence) of one apple and ***b*** is the cost (in pence) of one banana.



What is the cost when :-

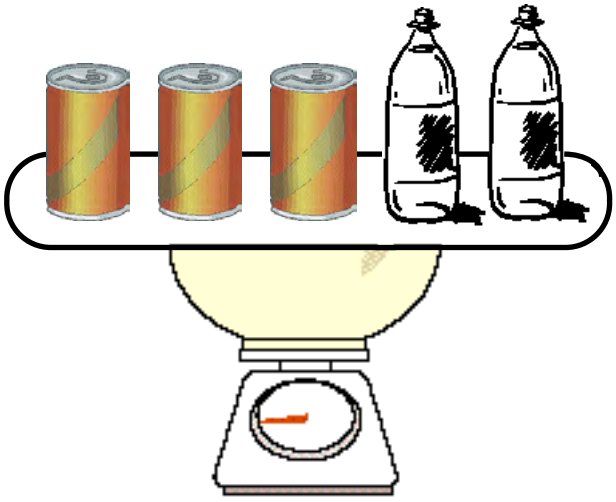
(a) $a = 10$ and $b = 9$? $(5 \times 10 + 4 \times 9)$

(b) $a = 12$ and $b = 7$?

(c) $a = 15$ and $b = 10$?

(d) $a = 20$ and $b = 25$?

6. We could represent the total weight(in grams) of 3 cans and 2 bottles by **$3c + 2b$**,
where ***c*** is the weight of a can and ***b*** is the weight of a bottle.



What is the total weight when :-

(a) $c = 450$ and $b = 375$?

(b) $c = 525$ and $b = 475$?

Formulae Expressed in Words

Example 1:-

There are 10 C.D.'s in a pack. How many C.D.'s will there be in 7 packs ?

1 pack has 10 C.D.'s

=> 7 packs must have 10 x 7 C.D.'s = 70 C.D.'s

Example 2:-

To find the area of a rectangle :- "Multiply the LENGTH by the BREADTH".

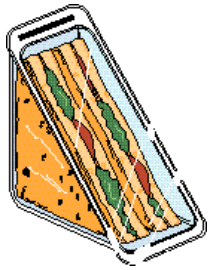
Find the area of a rectangle with length 5 cm and breadth 9 cm.

=> Area = LENGTH x BREADTH

= 5 x 9

= 45 cm^2

Exercise 2



1. The number of sandwiches is "twenty times the number of cartons".

   How many sandwiches will there be in 4 cartons ?

2. 

   A waiter's tray can hold six glasses.

   (a) How many glasses can five trays hold ?

   (b) How many **trays** will be required for :-

   (i) eighteen glasses ? (ii) twenty glasses ?

3. Sandy plays nine holes of golf.
   He scores four at each of the first eight holes, but scores an eight at the final hole.

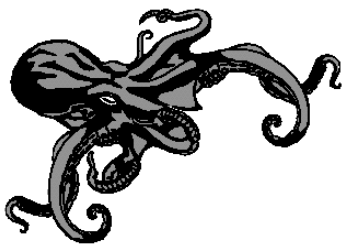
   What is his score for the nine holes ?

4. To find your PROFIT :- "Subtract how much you paid for the goods in the first place from the amount you actually sold them for".

   How much profit did Geraldine make when she sold a computer game for £52·50, having previously bought it for £40 ?

5. Dave bought the same game as Geraldine in a shop for £40, but sold it for only £30.

   Did he make a profit ? Explain !

6. 

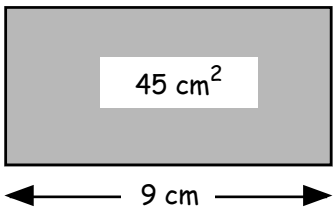
   "To find how many tentacles a group of octopuses have, you simply multiply the number of octopuses by eight".

   How many tentacles do fifty octopuses have ?

7. The distance, in miles, which a train can travel can be found as follows :-

"Multiply the speed you are travelling at by the time you take for the journey".

How many miles did a train travel, doing 60 miles per hour for a period of 4 hours ?

8. 

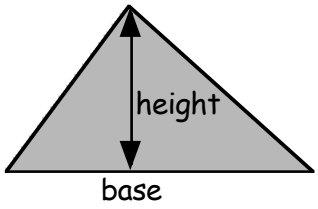
The length of a rectangle can be found by dividing the area of the rectangle by its breadth.

Find the length of a rectangle which has an area of 45 cm^2 and a breadth measuring 9 cm.

9 To find the area of a triangle :-

"Multiply the base by the height and then halve your answer".

What is the area of a triangle with base 10 cm and height 8 cm ?



10. The cost of hiring a carpet cleaner from the local D.I.Y. store is

"£20 PLUS £2·50 per day".

How much will it cost to hire a carpet cleaner for :-

(a) 2 days ? (b) 6 days ? (c) a fortnight ?

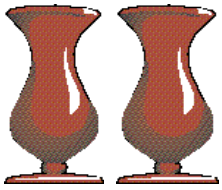
11. To find the cost of ordering a set of vases from The Shopping Channel the following formula is to be used :-

"Multiply the number of vases you want to buy by 15 and then add 4".

The answer is then given in pounds (£'s).

(a) How much will it cost to order 3 vases ?

(b) What do you think the 4 in the formula represents ?



12. 

To cook a turkey :-

"Give it 20 minutes per pound and then add an extra 15 minutes".

For how long should you cook a ten pound turkey ?

13. To change from degrees Celsius (°C) to degrees Fahrenheit (°F) use the following formula :-

"Multiply the temperature in °C by 1·8, then add 32 to the answer".

Use the formula to change 20°C to °F.

14. If you are given the area of a square piece of ground (in square metres) and are asked to find the length of one side, you should :-

"find the Square Root of the area."

What is the length of a side of a square whose area is 144 square metres ?

Formulae with Symbols

Example 1:-

If $P = Q \times R$, find P when $Q = 5$ and $R = 7$.

$P = Q \times R$

$= 5 \times 7$

$= 35$

Example 2 :-

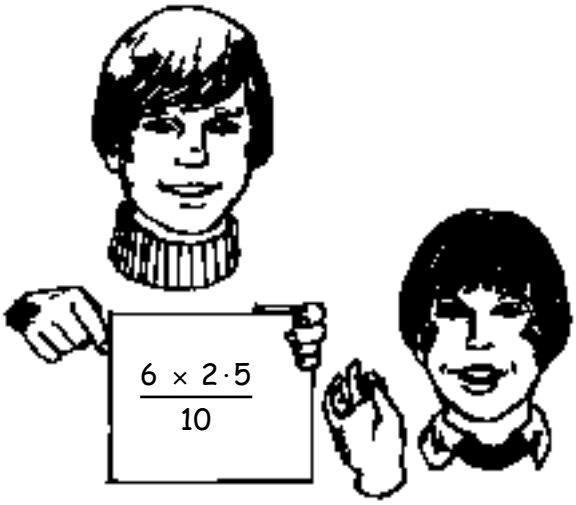
If $A = \frac{bc}{10}$, find A when $b = 6$ and $c = 2{\cdot}5$.

$A = \frac{bc}{10}$

$= \frac{6 \times 2{\cdot}5}{10}$

$= \frac{15}{10}$

$= 1{\cdot}5$



Example 3:-

If $x = 3w^2 + 2v$, find x when $w = 5$ and $v = 10$.

$= 3w^2 + 2v$

$= 3 \times 5^2 + 2 \times 10$

$= 3 \times 25 + 2 \times 10$

$= 75 + 20$

$= 95$

Exercise 3

1. The following formulae are often used in Mathematics and Science.

   For the formulae :-

(a)	$P = s - b$	find P,	when $s = 9{\cdot}5$ and $b = 6{\cdot}5$.
(b)	$D = S \times T$	find D,	when $S = 50$ and $T = 4{\cdot}5$.
(c)	$V = I \times R$	find V,	when $I = 18$ and $R = 5$.
(d)	$V = Ah$	find V,	when $A = 20{\cdot}5$ and $h = 20$.
(e)	$F = ma$	find F,	when $m = 10{\cdot}2$ and $a = 5$.
(f)	$Q = m \times s \times t$	find Q,	when $m = 150$, $s = 1$ and $t = 13$.
(g)	$A = 2\pi rh$	find A,	when $\pi = 3{\cdot}14$, $r = 100$ and $h = 5$.
(h)	$P = 2L + 2B$	find P,	when $L = 4{\cdot}5$ and $B = 3{\cdot}5$.

cont'd ..

(i) $T = 20 + 7W$ find T, when $W = 4$.

(j) $V = u - 10t$ find V, when $u = 80$ and $t = 3{\cdot}5$.

(k) $D = \frac{m}{v}$ find D, when $m = 250$ and $v = 25$.

(l) $R = \frac{F}{A}$ find R, when $F = 2250$ and $A = 50$.

(m) $W = \frac{mv}{10}$ find W, when $m = 50$ and $v = 7$.

(n) $K = 8M \div 5$ find K, when $M = 40$.

(o) $F = \frac{9C}{5} + 32$ find F, when $C = 25$.

(p) $x = \sqrt{A}$ find x, when $A = 100$.

(q) $T = 2\sqrt{L}$ find T, when $L = 169$.

(r) $A = L^2$ find A, when $L = 15$.

(s) $D = 5t^2$ find D, when $t = 30$.

(t) $P = k^2 r$ find P, when $k = 4$ and $r = 5$.

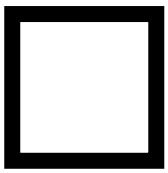
(u) $d = (a - b)^2$ find d, when $a = 25$ and $b = 15$.

(v) $V = \pi r^2 h$ find V, when $\pi = 3{\cdot}14$, $r = 10$ and $h = 20$.

(w) $q = u^2 + 2as$ find q, when $u = 4$, $a = 5$ and $s = 3$.

2. The formula $P = 4L$ is used to find the perimeter P (cm) of a square with side of length L (cm).

Find P when $L = 9{\cdot}5$.



L cm

3. When a kettle is switched on, the temperature rises.
The formula for calculating the temperature is

$$T = 0{\cdot}9t + 16$$

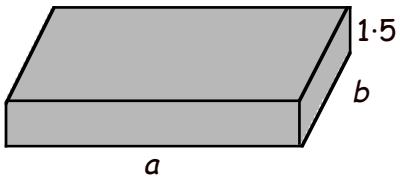
where t is the time (in seconds),
and T is the temperature (in °C).

Calculate the temperature (the value of T) when :-

(a) $t = 0$ (b) $t = 10$

(c) $t = 30$ (d) $t = 60$.

4. Given $D = 120$ and $T = 8$, find S from the formula $S = \frac{D}{T}$.

5. 

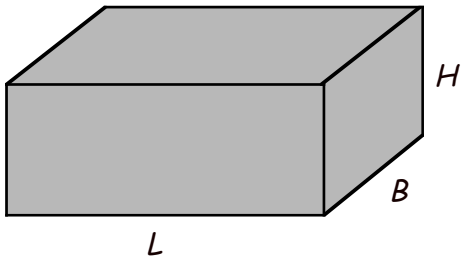
The volume of a metal plate is given by $V = 1{\cdot}5 \times a \times b$.

Find V when $a = 8$ and $b = 7$.

6. The volume of a cuboid is found by using the formula :-

$V = L \times B \times H$.

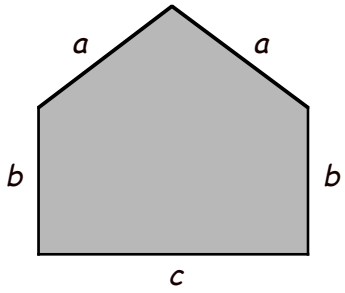
Find V when $L = 10$, $B = 6$ and $H = 2{\cdot}5$.



7. The Perimeter of this shape is found by using the formula :-

$P = 2a + 2b + c$.

Find P when $a = 6$, $b = 4$ and $c = 8$.

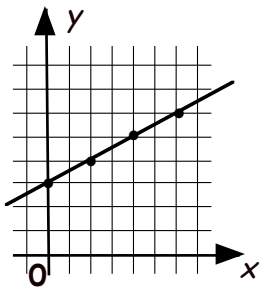


8. The equation of a particular straight line is $y = 3x + 1$.

Find the value of y when $x = 5$.

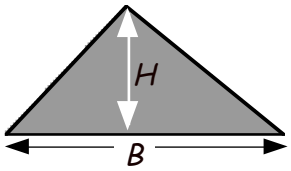
9. The equation of a another straight line is $y = \frac{1}{2}x + 3$.

Find y when $x = 10$.



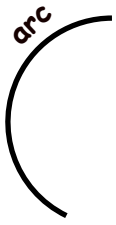
10. The area of a triangle is found by using $A = \frac{1}{2}(B \times H)$.

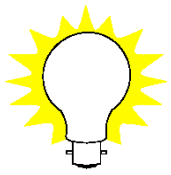
Find A when $B = 14$ and $H = 6$.



11. The length of an arc is found by using the formula $L = \frac{1}{3}(8h - c)$.

Find L when $h = 3$ and $c = 9$.



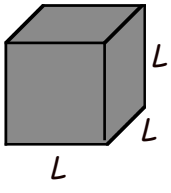
12. 

The illumination from a light bulb is $I = C \div d^2$.

Find I, if $C = 1000$ and $d = 5$.

13. The volume of a cube is found by using the formula $V = L^3$, where L is the length of a side of the cube.

Calculate V when $L = 10$.



What have I learned ?

1. For $a = 3$ and $b = 8$, find the value of :-

   (a) $a + b$ (b) $b - a$ (c) ab (d) $25a$

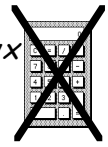
   (e) $90b$ (f) $20ab$ (g) $b \div 4$ (h) $a \div \frac{1}{2}$

2. If $v = 5$, $w = 10$, $x = 1$ and $y = 0$, work out :-

   (a) $\frac{1}{2}v$ (b) $\frac{1}{5}w$ (c) $\frac{1}{2}x$ (d) v^2

   (e) w^2 (f) $2x^2$ (g) $9200y$ (h) vwx

   (i) $w - 2v$ (j) $w - 10x$ (k) $(v + w + x)^2$ (l) $\dfrac{5v + w}{7}$



3. There is a simple rule for making a good cup of tea using tea-bags :-

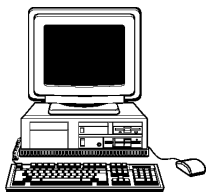
   "**One bag for each person and one for the pot.**"

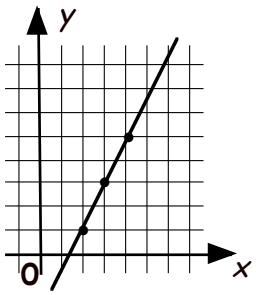
   How many tea-bags are needed for a party of 12 senior citizens ?

4. The net profit made by a computer shop is given by the formula :-

   "**Profit (£) = (selling price of computer – cost price) × 0·5**"

   Calculate the shop owner's profit on an iCam Computer, bought for £400 and sold for £750·50.



5. 

   The equation of a straight line is $y = 2x - 3$.

   Find the value of y when $x = 3$

6. A library charges a fine (£F) for any book returned late.

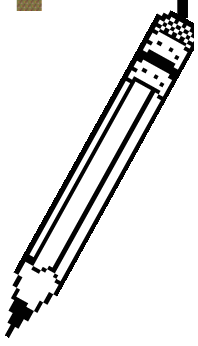
   To calculate F, use the formula :- $\boxed{F = 0 \cdot 8 + 0 \cdot 05d}$,
   where d is the number of days late.

   Calculate F, for :- (a) $d = 4$ (b) $d = 10$.

7. If $M = \dfrac{k}{n}$, find M when $k = 250$ and $n = 25$.

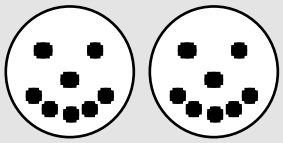
8. $R = g^2 - 5h$.

   Calculate R when $g = 10$ and $h = 16$.



1. Look at these Halloween Cakes with Smarties on top of the icing :-

1 cake
8 Smarties



2 cakes
? Smarties

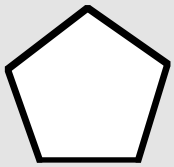
3 cakes
? Smarties

(a) How many extra Smarties (S) are needed for each extra cake (*c*) ?

(b) Write a formula connecting them of the form :- $S = ? \times c$.

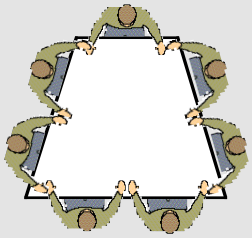
2. This table tells how many sides there are in several pentagons :-

No. of pentagons (*P*)	1	2	3	4	5	6
No. of sides (*S*)	5	10	?	?	?	?

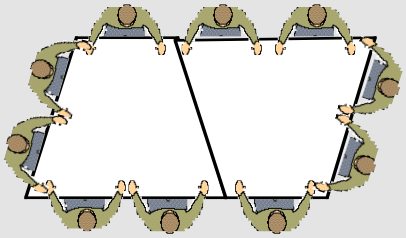


From the table, construct a formula connecting the number of sides to the number of pentagons :- $S = ? \times P$.

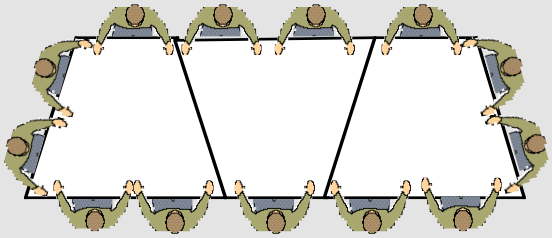
3. Shown is a seating arrangement of customers around trapezium shaped tables :-



1 table
7 customers



2 tables
10 customers



3 tables
? customers

(a) How many **extra** customers can be seated for every new table added ?

(b) Make up a formula for calculating the number of customers (*C*) that can be seated around (*T*) tables.

4. Make up a formula showing the connection between *T* and *w* here :-

weight (*w*)	2	3	4	5
time (*T*)	13	19	25	31

$T = ? \times w + ?$

Non-Calculator Practice Exercise

Number Seven

1. Set down and find :-

   (a) $\begin{array}{r} 5286 \\ +\ 1776 \\ \hline \end{array}$ (b) $\begin{array}{r} 4000 \\ -\ 1724 \\ \hline \end{array}$ (c) $\begin{array}{r} 335 \\ \times\ 8 \\ \hline \end{array}$ (d) $\begin{array}{r} 41 \\ \times\ 17 \\ \hline \end{array}$

   (e) 14^2 (f) 225×30 (g) $30 + 8 \times 3$ (h) $18 \div (7 - 4)$

2. Set down and find :-

   (a) $\begin{array}{r} 6{\cdot}82 \\ +\ 2{\cdot}95 \\ \hline \end{array}$ (b) $7 - 3{\cdot}58$ (c) $\begin{array}{r} 4{\cdot}13 \\ \times\ 6 \\ \hline \end{array}$ (d) $4\overline{)35{\cdot}16}$

   (e) $0{\cdot}726 \times 100$ (f) $918 \div 10$ (g) $\frac{3 \times 14{\cdot}7}{100}$ (h) $13 \div 1000$

3. Change the following :-

   (a) 2·75 km to m (b) 0·04 km to m (c) 705 cm to m (d) 2·06 kg to g

   (e) 4 km 15 m to km (f) 6750 ml to litres (g) 4370 mm to cm (h) 800 mm to cm

4. Find the value of :- (a) $\frac{4}{5}$ of 60 (b) $\frac{2}{7}$ of 350 (c) $\frac{9}{10}$ of 2300

5. Simplify :- (a) $\frac{12}{18}$ (b) $\frac{9}{36}$ (c) $\frac{14}{42}$

6. Find the value of :- (a) $\frac{5}{6} + \frac{1}{6}$ (b) $\frac{7}{8} - \frac{1}{4}$ (c) $4\frac{3}{4} + 5\frac{1}{2}$

   (d) $\frac{3}{4} \times \frac{5}{6}$ (e) $\frac{4}{7} \times \frac{2}{3}$ (f) $5 \times 3\frac{2}{5}$

7. Write as mixed numbers (a) $\frac{19}{5}$ (b) $\frac{32}{7}$ (c) $\frac{40}{6}$

8. Express as a fraction :- (a) 35% (b) 90% (c) 4%

9. Find the value of :- (a) 50% of £9 (b) 10% of 180 (c) 40% of 40

   (d) $33\frac{1}{3}$% of 6000 (e) 90% of 30 (f) 4% of £6

10. Express as a decimal :- (a) 72% (b) 3% (c) $17\frac{1}{2}$%

11. Find :- (a) 11 + 23 (b) 8 + (–12) (c) (–6) + 15

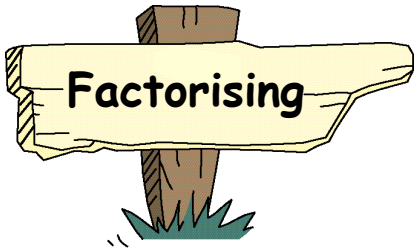
    (d) (–6) + (–8) (e) 7 – 16 (f) (–4) – 31 (g) 5 – (–5)

    (h) (–1) – (–2) (i) 0 – (–11) (j) 8 × (–3) (k) (–8) × 7

12. Change to am or pm form (a) 0145 (b) 2215 (c) 1359

13. How long from :- (a) 10·55 am till noon (b) 25 to midnight to 3·35 am ?

Chapter 15



Reminder - Multiplying out Brackets

Can you remember how you "multiplied out brackets" in Chapter 7 in Book 3G ?

Look at the examples shown opposite.

Remember to multiply **both parts** inside the brackets by the number outside

$3(2x + 5) = 3 \times 2x + 3 \times 5$

$= 6x + 15$

$3(x + 4)$ $= 3x + 12$	$4(x - 5)$ $= 4x - 20$
$7(3a + 2)$ $= 21a + 14$	

Exercise 1

1. Multiply out the brackets :-

(a)	$3(x + 1)$	(b)	$4(x - 3)$	(c)	$2(x + 9)$
(d)	$6(x - 5)$	(e)	$5(t - 2)$	(f)	$7(p - 3)$
(g)	$10(b + 8)$	(h)	$15(m + 2)$	(i)	$11(h + 1)$
(j)	$4(x + y)$	(k)	$6(a - b)$	(l)	$3(f - g)$
(m)	$9(e + f)$	(n)	$3(a + b + 4)$	(o)	$5(x + y - 3)$
(p)	$10(x - y - 1)$	(q)	$4(3x + 5)$	(r)	$3(4a - 3)$
(s)	$5(4p - 7)$	(t)	$7(5t + 2)$	(u)	$6(5m - 2)$

Look at the following examples :-

$5(x + 3) - 12$ $= 5x + 15 - 12$ $= 5x + 3$	$2(3x + 4) - 7$ $= 6x + 8 - 7$ $= 6x + 1$	$10 + 3(x - 2)$ $= 10 + 3x - 6$ $= 3x + 4$

2. Multiply out the brackets and then simplify. (Show all working) :-

(a)	$3(x + 2) + 1$	(b)	$2(x + 5) + 3$	(c)	$5(p + 3) - 11$
(d)	$4(h + 4) + h$	(e)	$6(m - 2) - m$	(f)	$7(x - 1) - 5x$
(g)	$4(y - 3) + 3y$	(h)	$5(2x + 2) + 3x$	(i)	$3(2d - 3) + 2d$
(j)	$3 + 2(x + 1)$	(k)	$7 + 3(x + 1)$	(l)	$13 + 4(2x - 3)$
(m)	$9 + 5(3t - 1)$	(n)	$3(x + 1) + 2(x + 3)$	(o)	$6(g + 3) + 3(g + 1)$
(p)	$4(w + 1) + 2(w - 2)$	(q)	$5(3b + 2) + 3(2b + 1)$	(r)	$7(2n + 3) + 3(n - 4)$

Factors

The **FACTORS** of a number are simply all the (smallish) numbers that "divide into" it **exactly**.

Example :-

the factors of 15 are :- 1, 3, 5 and 15.
the factors of 21 are :- 1, 3, 7 and 21.
the factors of 32 are :- 1, 2, 4, 8, 16 and 32.

Exercise 2

1. Decide if the following statements are true of false :-

   (a) 5 is a factor of 20 (b) 3 is a factor of 14 (c) 4 is a factor of 22

   (d) 2 is a factor of 18 (e) 7 is a factor of 42 (f) 6 is a factor of 32

   (g) 8 is a factor of 40 (h) 10 is a factor of 135 (i) 9 is a factor of 81

2. (a) Write down all **four** factors of 10.

   (b) Write down all **four** factors of 26.

   (c) Write down all **six** factors of 12.

   (d) Write down all **six** factors of 20.

   (e) Write down all **eight** factors of 24.

3. Write down all the factors of each of the following :-

   (a) 8 (b) 14 (c) 17 (d) 30 (e) 36

   (f) 50 (g) 23 (h) 100 (i) 60 (j) 27

4. (a) Write down **all** 6 factors of 18.

   (b) Write down **all** 4 factors of 27.

   (c) Look at your 2 lists in (a) and (b) of this question. What factors appear in **both** ?

   (d) What is the highest factor they have in common ?
   (*this is called the HIGHEST COMMON FACTOR* (***HCF***)).

5. Find the HIGHEST COMMON FACTOR for each pair of numbers :-

   (a) 12 and 9 — [Factors of 12 are 1, 2, 3, 4, 6, 12]
   — [Factors of 9 are 1, 3, 9]
   — Highest Common Factor = ?

   (b) 10 and 5 (c) 15 and 12 (d) 20 and 30

   (e) 18 and 24 (f) 14 and 21 (g) 5 and 40

   (h) 25 and 35 (i) 12 and 20 (j) 40 and 25

   (k) 80 and 50 (l) 18 and 45 (m) 36 and 24

Factorising

In Exercise 1, you learned how to multiply out brackets

$4(x + 3) = 4x + 12$

Now we will find out how to do this in reverse

=> $4x + 12$ can be written as $4(x + 3)$

This is called "**FACTORISING**" the expression.

Example :- To factorise $5x + 20$

-> step 1	Find a number (5) which will divide into both $5x$ and 20
-> step 2	Write this down with brackets => 5(.....)
-> step 3	Decide what has to go into the brackets which, when multiplied by 5, takes you back to $5x + 20$
	=> $5x + 20 = 5(x + 4)$

Exercise 3

1. Copy down each of the following and complete the factorisation :-

(a) $4x + 20 = 4(x + ...)$ (b) $3x + 21 = 3(x + ...)$ (c) $5x - 15 = 5(x - ...)$

(d) $2x + 18 = 2(\quad)$ (e) $7p + 35 = 7(\quad)$ (f) $10m + 70 = 10(\quad)$

(g) $6a - 36 = 6(\quad)$ (h) $9t + 18 = 9(\quad)$ (i) $15m + 30 = 15(\quad)$

(j) $8d + 40 = 8(\quad)$ (k) $3f + 36 = 3(\quad)$ (l) $11z - 55 = 11(\quad)$

2. Factorise each of the following by taking out a common factor :-

(a) $5x - 15 = 5(\quad)$ (b) $7x + 7$ (c) $3x - 24$

(d) $2x + 40$ (e) $10t - 20$ (f) $4a + 8b$

(g) $6m - 18n$ (h) $5g + 25h$ (i) $6p - 42q$

(j) $7d + 7e$ (k) $8x - 80y$ (l) $15b + 30c$

Be careful, when factorising, to take out the **HIGHEST** common factor.
(*the biggest number that divides into both bits*)

Example :-

	$6x + 9$
<u>can</u> be factorised to	$3(2x + 3)$ ✓
and **<u>not</u>**	$6(.....)$ ✗

3. Factorise each of the following :-

(a) $8x - 12$
$= 4(2x - \ldots)$

(b) $9x + 15$
$= 3(3x \quad \ldots)$

(c) $4x - 18$
$= 2(\quad)$

(d) $6x + 3$
$= 3(\quad)$

(e) $12x - 8$
$= 4(\quad)$

(f) $10x + 25$
$= 5(\quad)$

(g) $20x - 30$
$= 10(\quad)$

(h) $16x + 40$
$= 8(\quad)$

(i) $12x - 15$
$= 3(\quad)$

(j) $21x + 14y$
$= 7(\quad)$

(k) $18x - 27y$
$= 9(\quad)$

(l) $15x + 55y$
$= 5(\quad)$

4. Factorise each of the following :-

(a) $4x + 18$
(b) $12x - 6$
(c) $8x + 20$
(d) $9x + 21$
(e) $6a + 9$
(f) $10p + 35$
(g) $12c + 16$
(h) $8n + 10$
(i) $15h - 12$
(j) $20t + 24$
(k) $25w + 45$
(l) $16f - 20$
(m) $18m + 15$
(n) $14d - 35$
(o) $8x + 36$
(p) $50s + 40t$
(q) $9m - 21n$
(r) $15u - 35$
(s) $12g + 18h$
(t) $25c + 95d$
(u) $6r - 20s$
(v) $15m - 40n$
(w) $24d - 32e$
(x) $44m + 77n$

5. Extension of Factors (**A bit harder !!**).
Factorise :-

(a) $ab + ac$
(b) $pm - pn$
(c) $xt + xs$
(d) $mn + m$
(e) $uv - u$
(f) $de + df$
(g) $ab + ac + ad$
(h) $pi + pj + pk$
(i) $wa + wb + w$
(j) $ab + 2a$
(k) $pq + 3p$
(l) $5m + mn$
(m) $6a + ab$
(n) $ef - 7e$
(o) $a^2 + ab$

6. Factorise (each has 3 terms this time) :-

(a) $2x + 2y + 2z$
(b) $3a - 3b + 3c$
(c) $2p + 4q + 6r$
(d) $5m - 10n + 20$
(e) $6s + 18t + 24$
(f) $10a - 40b + 80c$
(g) $6x + 8y + 10$
(h) $12a - 9b + 6c$
(i) $15p - 10q + 25r$
(j) $ab + ac + ad$
(k) $pr - ps + p$
(l) $2ab + 4ac + 6ad$

What have I learned ?

1. Multiply out the brackets :-

(a) $2(x + 5)$ (b) $7(x - 3)$ (c) $4(a + b)$

(d) $5(p - 7)$ (e) $2(3x + 5)$ (f) $10(2x - 3)$

(g) $3(7t + 5s)$ (h) $5(6m - 2n)$ (i) $a(b + c)$

2. Multiply out the brackets and simplify :-

(a) $4(x + 3) + 2$ (b) $5(x + 1) - 4$ (c) $2(3x + 5) - 7$

(d) $3 + 2(x + 4)$ (e) $5 + 3(x - 1)$ (f) $10 + 2(3x + 4)$

3. Write down **ALL** the factors of :-

(a) 18 (b) 22 (c) 32

4. What is the highest common factor of :-

(a) 8 and 12 (b) 16 and 18 (c) 27 and 36 ?

5. Factorise the following :-

(a) $2x + 12$ (b) $4x - 8$ (c) $5x + 30$

(d) $3a + 6b$ (e) $7t - 14s$ (f) $8p + 32q$

6. Factorise the following :-

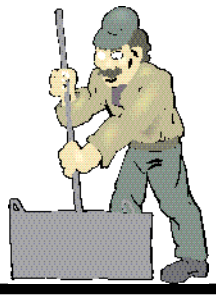
(a) $6x + 14$ (b) $9a - 21$ (c) $10p + 15q$

(d) $8d - 12f$ (e) $21x + 28y$ (f) $18d - 45w$

7. Factorise the following :-

(a) $7x - 7y + 7z$ (b) $2t + 4w + 12z$ (c) $5a - 20b + 30c$

(d) $4a + 10b + 14c$ (e) $6r - 12q + 15$ (f) $gt - gh + gc$

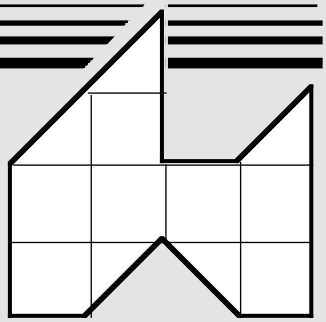


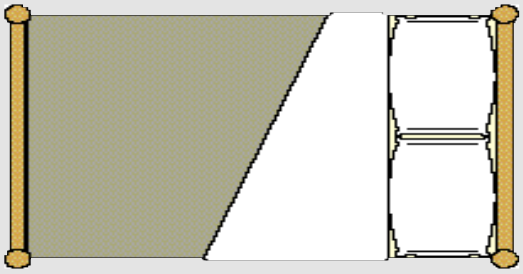
REVIEW

Scales/Enlargements

"RULER & PROTRACTOR REQUIRED HERE"

1. Make a two times enlargement of this figure.

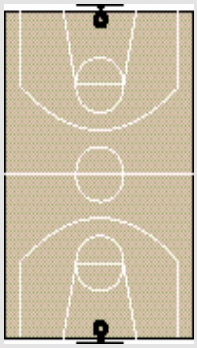


2. 

This bed has been drawn using a scale :-

1cm represents 25cm

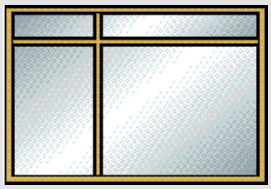
Calculate the **real** length of the bed.

3. 

(a) Measure the length and breadth of this scale drawing of a junior basketball court.

The scale is ***1cm = 20 feet***

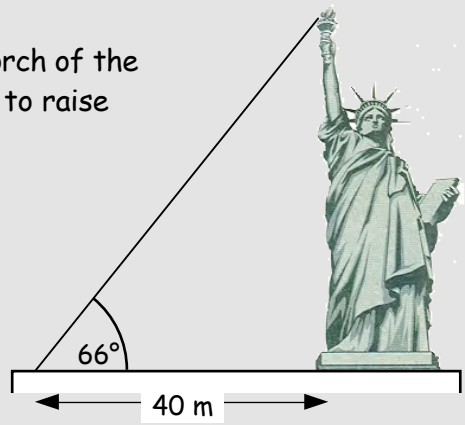
(b) Calculate the **real** length and breadth of the basketball court.

4. 

Make a scale drawing of this window frame using a scale :-

1cm represents 30cm.

5. A stuntman connected a wire from the ground to the torch of the Statue of Liberty in New York, and slid down the wire to raise money for charity.



(a) Make a scale drawing of the Statue and wire.

scale :- ***1cm = 5 metres***

(b) Measure the height of the Statue on your scale drawing, in centimetres.

(c) Now calculate the **real** height of the Statue of Liberty in metres.

6. (a) I am facing West. In which direction will I be facing if I turn through an angle of 45° anti-clockwise ?

(b) A yachtsman changes from sailing North East to a new direction of South. Through how many degrees must he have turned ?
(*clockwise or anti-clockwise*)

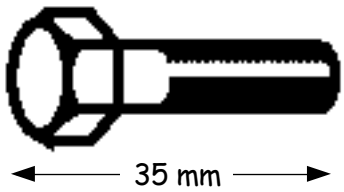
(c) An orienteerer sets off North West from Milngavie to Dumbarton Muir. In what direction must he walk to return to Milngavie from Dumbarton Muir ?

Chapter 16

Tolerance

When a car manufacturer orders steel bolts to help build his car engines, he would like them to be 35 millimetres long **exactly**.

This is not always possible so the manufacturer allows a "little error" either side of this.



He might be willing to accept any bolt as long as it lies between 33 mm and 37 mm.

This means he will accept a bolt which is **within 2 mm** of the 35 mm he asked for.

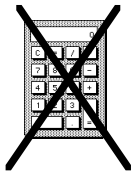
This is referred to as the **tolerance** for the measurement.

He will then specify the *acceptable limits* as => (35 ± 2) mm

and this means minimum length is (35 – 2) mm = 33 mm

maximum length is (35 + 2) mm = 37 mm

Exercise 1



1. A tomato grower ideally wants his tomatoes to have a diameter of 60 mm. He states the tolerance as (60 ± 3) mm.
   (a) What is the minimum acceptable diameter (60 – 3 = ? mm) ?
   (b) What is the maximum acceptable diameter ?

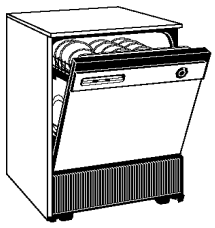
2. For each of the following tolerances, write down the minimum (min) and maximum (max) allowable sizes :–

(a)	(20 ± 1) mm	(b)	(35 ± 5) kg	(c)	(16 ± 2) m
(d)	(15 ± 3) kg	(e)	(150 ± 4) cm	(f)	(75 ± 2) mm
(g)	(350 ± 10) km	(h)	(120 ± 15) mg	(i)	(100 ± 20) ft
(j)	(9·6 ± 0·1) cm	(k)	(7·5 ± 0·2) m	(l)	(19·7 ± 0·3) kg
(m)	(23·2 ± 0·1) cm	(n)	(10 ± 0·3) cm	(o)	(30 ± 0·5) ml
(p)	(85 ± 0·5)°C	(q)	(4·2 ± 0·3) litres	(r)	(50 ± 1·5) cm

3. Write down the maximum and minimum values given by these tolerances :–

(a)	(9·23 ± 0·01) cm	(b)	(6·45 ± 0·03) m	(c)	(18·25 ± 0·05) km
(d)	(0·84 ± 0·04) km	(e)	(10·23 ± 0·05) kg	(f)	(24·57 ± 0·03)°C
(g)	(4·98 ± 0·02) g	(h)	(3·147 ± 0·002) km	(i)	(8·063 ± 0·003) ml

4. In the manufacture of dishwashers, the bolts required to secure the back plate are required to be (45 ± 3) mm long.



(a) Write down the minimum and maximum acceptable lengths.

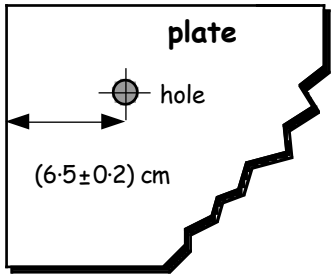
(b) State which of the following bolts should be <u>rejected</u> :-

(i) 47 mm (ii) 42 mm (iii) 49 mm (iv) 50 mm

(v) 40 mm (vi) 43 mm (vii) 44·2 mm (viii) 47·9 mm

5. A hole has to be drilled in a metal plate so that it lines up with a bolt projecting from a wall.

The hole is to be at a distance of $(6{\cdot}5 \pm 0{\cdot}2)$ cm from the left side of the plate.



(a) What is the minimum and maximum acceptable distance ?

(b) It is discovered that the hole has been drilled 6·29 cm in from the left hand side of the plate. Is this O.K. ?

6. To bake a cake in a oven, a particular recipe recommends a temperature of $(190 \pm 5)°C$.

State which of the following temperatures are acceptable :-

(a) 190°C (b) 189°C (c) 185°C (d) 195·5°C (e) 184·8°C

7. 

Most stop-watches are only accurate to a certain degree.

When Andy Holtz ran the 100 metres final, his time was given as $(10{\cdot}23 \pm 0{\cdot}02)$ seconds.

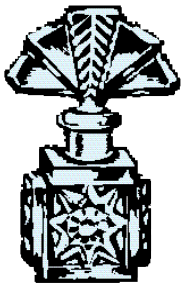
(a) What was Andy's fastest possible time, (from the tolerance) ?

(b) What was his slowest time ?

8. To make a batch of meringues, the amount of castor sugar used is important.
The recommended weight is $(0{\cdot}125 \pm 0{\cdot}005)$ kg.

(a) What is the minimum weight of castor sugar required ?

(b) What is the maximum weight of castor sugar required ?

9. 

When "Eau de Glesca" fill their bottles of perfume, they expect the bottles to hold (150 ± 5) ml.

(a) What is the minimum and maximum acceptable volume ?

(b) A bottle is found to contain 146 ml of perfume.
Is this O.K. ?

Using Tolerance Notation

When blowing up balloons for an office party, the manager decides that, for effect, the diameters should be between 25 and 35 centimetres.

Example 1 This can be put into "**tolerance form**" as follows :-

Step 1 Find the "middle" of 25 and 35 => $\frac{(25 + 35)}{2}$ = 30.

Step 2 Write it as $\boxed{(30 \pm 5)\text{ cm}}$.

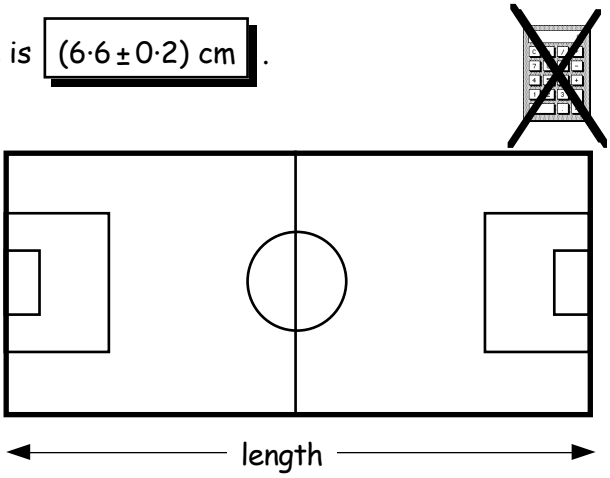
Example 2 The diameter of a drilled hole is to be between 6·4 and 6·8 centimetres.

=> Mid-point is $\frac{(6 \cdot 4 + 6 \cdot 8)}{2}$ = 6·6 => Tolerance is $\boxed{(6 \cdot 6 \pm 0 \cdot 2)\text{ cm}}$.

Exercise 2

1. The length of a football pitch should be between 80 and 100 yards.

   Put this into tolerance notation (.... ± ....) yards.



2. 

   The working temperature in an office should be between 20°C and 26°C.

   Write this in tolerance form.

3. Write each of the following in tolerance form :-

(a)	min = 18 cm max = 20 cm	(b)	min = 50 cm max = 60 cm	(c)	min = 10 cm max = 11 cm	(d)	min = 120 m max = 140 m
(e)	min = 4 kg max = 5 kg	(f)	min = 37 mm max = 43 mm	(g)	min = 6·2 m max = 6·6 m	(h)	min = 10·1 cm max = 10·5 cm
(i)	min = 0·9 cm max = 1·1 cm	(j)	min = 20·2 cm max = 20·8 cm	(k)	min = 9·8 cm max = 10·2 cm	(l)	min = 700 km max = 900 km

4. Harder !! Put the following into tolerance form :-

(a)	min = 6·32 cm max = 6·34 cm	(b)	min = 8·05 cm max = 8·09 cm	(c)	min = 0·24 cm max = 0·28 cm	(d)	min = 10·71 cm max = 10·77 cm
(e)	min = 9·38 cm max = 9·42 cm	(f)	min = 0·05 cm max = 0·09 cm	(g)	min = 0·95 m max = 1·05 m	(h)	min = 0·062 cm max = 0·068 cm

5. In a recording studio, the sound engineer tries to keep the volume between 6·2 and 6·8 decibels.

(a) Write this in tolerance notation.

(b) Say whether the following are "too quiet", "too loud" or "just right" :-

(i) 6·1 db (ii) 6·67 db (iii) 6·31 db (iv) 6·81 db.

6. 

A plane, flying across the Atlantic Ocean, tries to maintain a steady height of between 30 000 ft and 34 000 ft.

Write this in tolerance notation.

7. A typist claims she can type between 100 and 112 words per minute.

Write this in tolerance notation.

8. 

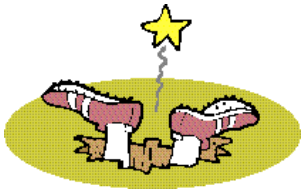
Whilst following a recipe for tablet, Mrs Jones uses between 65 grams and 75 grams of sugar.

Express this in tolerance notation.

9. John knows he has between £7·80 and £8·20 in his pocket.

(a) Write this in tolerance form.

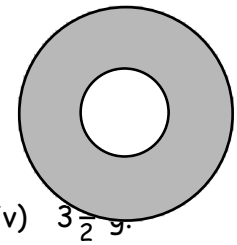
(b) Is it possible he has a £5 note, two £1 coins and three 50p coins in his pocket ?

10. 

All 8 runners in the 400 metre race took between 52 and 60 seconds to complete the race.

Write this in tolerance notation.

11. The weight of a metal washer, stamped out in a factory press, should weigh between 3·24 grams and 3·30 grams.



(a) Write this in tolerance form.

(b) State which of these are acceptable weights for washers :-

(i) 3·29 g (ii) 3·23 g (iii) 3·30 g (iv) $3\frac{1}{2}$ g.

12. In a chemist shop, when medicine is poured into a bottle, each bottle should contain between 340 ml and 360 ml.

(a) Write this in tolerance form.

(b) Is 361 ml acceptable ?

What have I learned ?

1. When a pianist plays a melody, the time taken is given by (125 ± 10) seconds.

   (a) What is his quickest time ?

   (b) What is his slowest time ?

2. For each of the following, write down the minimum and maximum values :-

   (a) (30 ± 2) mm (b) (75 ± 5) m (c) (240 ± 20) kg

   (d) (1600 ± 150) m (e) (8·6 ± 0·1) litres (f) (19·2 ± 0·3) mg

   (g) (28·3 ± 0·5) tonnes (h) (370 ± 30) m.p.h. (i) (0·8 ± 0·2) m.

3. The weight of a particular ingredient in making tablet should be quite accurate. It is given as

   (0·332 ± 0·005) mg.

   (a) What is the maximum permitted weight ?

   (b) What is the minimum permitted weight ?

4. The diameter of any tomato grown on a plant should have a certain value in order for a supermarket to purchase it

   diameter = (4·8 ± 0·3) cm.

   Which of the following are acceptable diameters :-

   (a) 5·75 cm (b) 5·01 cm (c) 4·95 cm (d) 5·11 cm ?

5. 

   Davie is a boxer. In any week, his weight varies between 52 kg and 56 kg.

   Write this in tolerance form as (.... ± ....) kg.

6. Put the following into tolerance form :-

   (a) min = 60 g
   max = 70 g

   (b) min = 128 cm
   max = 132 cm

   (c) min = 1500 m
   max = 1700 m

   (d) min = 8·4 cm
   max = 8·6 cm

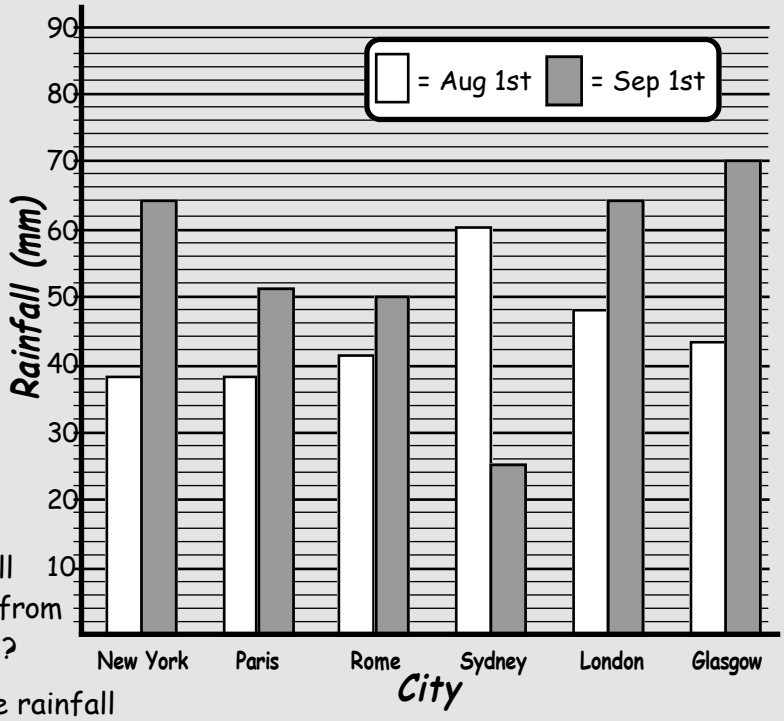
   (e) min = 19·7 cm
   max = 20·3 cm

   (f) min = 0·6 g
   max = 0·8 g

7. A tolerance is given as (.... ± 0·3) m.
   The maximum value allowed is 7·1 m.

   What must the minimum value be ?

1. The bar graph shows the rainfall in six places on 2 different days.



(a) What was the wettest place on August 1st ?

(b) What was the rainfall in London on August 1st ?

(c) What was the rainfall in New York on August 1st ?

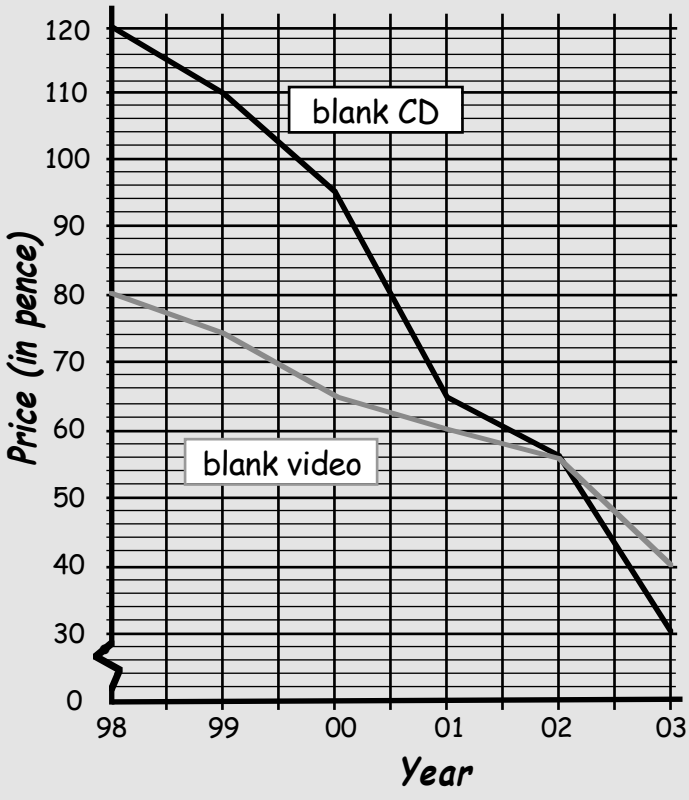
(d) What was the rainfall in Paris on September 1st ?

(e) In which city did the rainfall rise by the greatest amount from August 1st to September 1st ?

(f) Which 2 cities had the same rainfall on September 1st, and how much rain fell ?

(g) Which place had a rise in rainfall of 16 mm between August and September ?

2.



The graph shows the changes in the cost of a blank CD and a blank video over a 6 year period.

(a) What was the price of :-

(i) a video in 2000 ?

(ii) a CD in 1999 ?

(b) In what year did they cost both the same ?

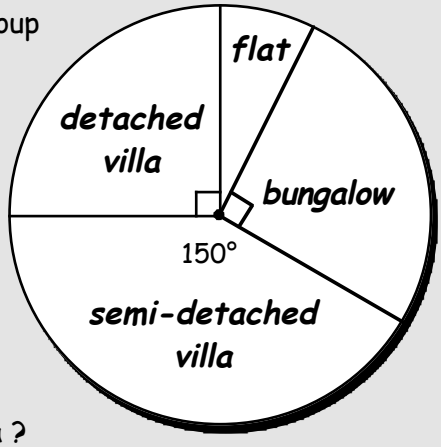
(c) Describe the "trend" in CD prices over the 6 year period.

(d) Which of the two fell by more and by how much more ?

(e) How much less expensive was a CD in 2003 than in 1998 ?

(f) How much more expensive was a CD than a video in 2001 ?

3. The pie chart shows the different type of houses a group of 36 families stay in.



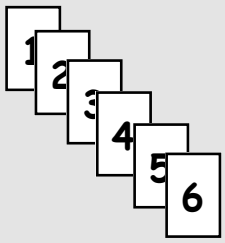
(a) Calculate the size of the missing angle representing those living in a flat.

(b) What fraction of the 36 families stay in a detached villa ?

(c) Of the 36 families, how many of them stay in a :-

(i) bungalow (ii) flat (iii) semi-detached villa ?

4. A man can choose at random three cards from six, numbered 1 to 6. He picks 3 cards twelve times and notes the total each time. These totals are :-



12 13 5 7 13 15 9 14 12 7 7 10

(a) Write his scores in order, starting with the lowest.

(b) What is his **median** score ? (c) What is the **mode** ?

5. A class of pupils sit the 5-14 National Test level D.

The test is out of a total of 60 marks.

41	51	28	52	42	57	53	38	48	45	39
42	54	51	26	52	49	43	42	56	31	51
60	35	50	48	37	59	24	46	30	55	46

(a) Copy the diagram opposite and set up an **ORDERED** stem-and-leaf diagram. (*you may have to draw the stem-and-leaf diagram <u>unordered</u> then re-draw it as an ordered diagram*)

(b) What was the **median** (the middle mark) ?

(c) The pass mark was 48 out of 60. How many of the class passed their level D test ?

Test Scores

2	.....
3	.....
4	.....
5	.....
6	.....

4 | 1 = 41

6. Neatly draw this "**Probability Line**".

For each of the following, put the capital letter below the line in the correct place to represent the probability.

A – When I toss a coin, it will land showing a **head**.

B – If it is mid-June, the sun will shine at least **once** today.

C – If today is Tuesday, tomorrow will be **Thursday**.

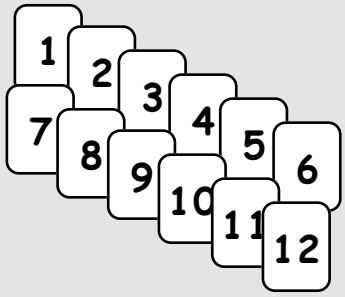
D – When I roll a normal die, it will show a number from **1 to 6**.

E – In a bag containing 6 red beads and 4 white beads, if I choose one at random, it will be **red**.

F – If I choose a page from my calendar at random, it will show **August**.

G – The next person I meet will be over 4 metres tall.

7. 12 cards have the numbers 1 to 12 printed on them.



The cards are turned face down and shuffled, If one is chosen at random, what is the probability it will :-

(a) be a **7** ? (b) be an **odd number** ?

(c) **not** be a 3 ? (d) be a number **bigger** than 8 ?

(e) be a **15** ? (f) be **any** number less than 13 ?

8. In a box of mixed crisps, there are :-

8 packets of **Plain**. 3 packets of **Bacon**.

4 packets of **Prawn**. 9 packets of **Vinegar**.

If I put my hand in the box and pick a packet without looking, what is the probability that it will be :-

(a) Bacon ? (b) be Prawn or Plain ? (c) **not** be Vinegar ?

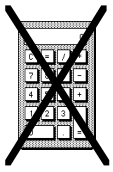
9. There are 30 adults in a room. The probability that a woman will leave the room first is $\frac{3}{5}$. (*assume each person is equally likely to leave the room*)

(a) What is the probability a man will leave the room first ?

(b) How many women and how many men must there be in the room ?

10. The probability of winning a game is $\frac{7}{20}$ and the probability it will be a draw is $\frac{9}{20}$.
What is the probability of losing the game ?

Non-Calculator Practice Exercise



Number Eight

1. Set down and find :-

   (a) $\begin{array}{r} 34 \\ \times\ 18 \\ \hline \end{array}$ (b) $665 \div 7$ (c) 403×300 (d) $7000 - 679$

   (e) $5079 + 876$ (f) $12 - 3 \times 3$ (g) $5 \times 5 \times 5 \times 5$ (h) $30 + 20 \div 5$

2. Set down and find :-

   (a) $\begin{array}{r} 17{\cdot}6 \\ \times\ 7 \\ \hline \end{array}$ (b) $\begin{array}{r} 54{\cdot}65 \\ +\ 38{\cdot}77 \\ \hline \end{array}$ (c) $\overline{)\ 150{\cdot}4}$ (d) $41{\cdot}32 \times 200$

   (e) $884 \div 40$ (f) $20 - 9{\cdot}457$ (g) $32 + 8{\cdot}905$ (h) $624 \div 600$

3. Find the value of :- (a) $\frac{6}{7}$ of 2100 (b) $\frac{4}{5}$ of 250 (c) $\frac{1}{6}$ of 1938

4. Simplify :- (a) $\frac{12}{16}$ (b) $\frac{36}{45}$ (c) $\frac{18}{24}$

5. Do the following and simplify where possible :-

   (a) $\frac{5}{8} - \frac{1}{8}$ (b) $\frac{1}{2} + \frac{3}{4}$ (c) $\frac{2}{5} \times \frac{7}{8}$ (d) $5\frac{7}{8} - 2\frac{3}{8}$

   (e) $6 \times 3\frac{3}{4}$ (f) $\frac{4}{5} \times \frac{10}{11}$ (g) $4\frac{7}{10} - 1\frac{3}{5}$ (h) $8\frac{1}{3} + 2\frac{5}{6}$

6. Write as mixed number (a) $\frac{13}{6}$ (b) $\frac{25}{8}$ (c) $\frac{50}{7}$

7. Express as a fraction :- (a) 20% (b) 60% (c) $66\frac{2}{3}\%$

8. Find :- (a) 20% of £150 (b) 25% of £6 (c) 75% of 800

   (d) 70% of 110 (e) 6% of 300 (f) $33\frac{1}{3}\%$ of 750

9. Express :- (a) 8 as a percentage of 16 (b) 3 as a percentage of 12

   (c) 10 as a percentage of 50 (d) 40 as a percentage of 50

10. Express as a percentage :- (a) 0·47 (b) 0·06 (c) 0·625

11. Find :- (a) $10 + 3$ (b) $8 + (-2)$ (c) $17 + (-9)$

    (d) $(-6) + 20$ (e) $(-8) + (-9)$ (f) $5 - 20$ (g) $(-4) - 17$

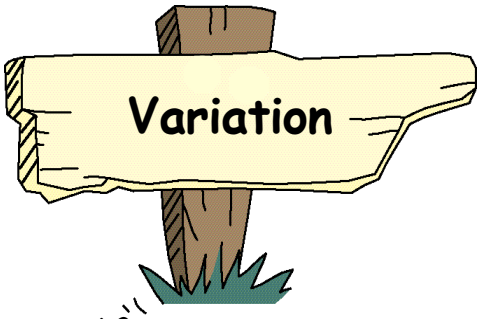
    (h) $3 - (-8)$ (i) $(-4) - (-21)$ (j) $0 - (-9)$ (k) $(-7) \times 7$

12. (a) Today is April 24th. How many days till my birthday on May 12th ?

    (b) Today is November 13th. My mum's birthday was 3 weeks ago. What was that date ?

13. How many hours and minutes in :- (a) 2·5 hours (b) 1·25 hours (c) 3·2 hours ?

Chapter 17

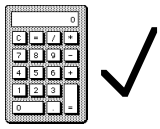


Reminder

In Chapter 2 of this book, you met the idea of proportion.

Example :- 4 loaves cost me £1·40. What would 5 loaves cost ?

Answer :- Find the cost of 1 first :-



	loaves		cost
	4	—>	140 p
=>	1	—>	140 p ÷ 4 = 35 p
=>	5	—>	35 p x 5 = £1·75

Exercise 1 (In each of these, 3 lines of working as well as two headings are expected)

1. 5 copies of a novel cost £30.

   (a) Find the cost of 1 copy. (*divide*) (b) Find the cost of 7 copies. (*multiply*)

2. When I exchanged £10 for euros, I received €15·60.

   (a) How many euros would I get for £1 ? (b) How many would I get for £7 ?

3. In 6 minutes, I ran 2400 metres around a track.

   How far could I run in 8 minutes at the same pace ?
   (Hint:- *Find how far I would travel in 1 minute first*).

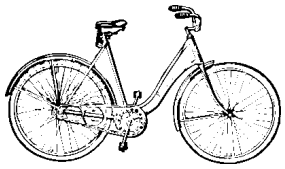
4. I bought 15 square metres of turf for my lawn for a cost of £120.

   What would I pay for 25 square metres of turf ?
   (*Find the cost of 1 square metre first*)

5. In 30 seconds, a bicycle wheel spun 45 times.

   How many times will it spin in :-

   (a) 1 second ? (b) 10 seconds ?
   (c) 20 seconds ? (d) 1 minute ?



6. 50 copies of a dictionary, packed end to end, take up 2 metres (200 cm) of a shelf.

   What length of the shelf would be covered by 36 copies ?

7. 3 metres of heavy duty metal chain for snow tyres costs £7·20.

   How much would I pay for 5 metres ?

8. 5 tins of beans weigh 2·25 kilograms. (2250 g).

   What would the weight of 12 tins be ? Answer in kilograms.

Variation

Variation is the **ALGEBRA** form of Proportion

It is **obvious** that if you **increase** the number of stamps you buy from a shop,
=> then you **increase** the total cost for the stamps.

In fact, if you **"double"** (or "treble" of "half") the number of stamps,
=> you will end up with **"double"** (or "treble" of "half") the cost.

We say that the the ***cost*** of the stamps **VARIES** with the ***number*** of stamps bought.

(*this is the same as saying the cost is in **proportion** to the number of stamps bought*).

A short way of writing this is to use the symbol "α " to stand for "varies as".

=> Cost α number of stamps

=> or $\boxed{C \alpha n}$

Though this is neat to write, it is not handy to use. We need to write this as an equation.

$C \alpha n$ becomes $\boxed{C = kn}$ where k is a fixed constant.

Example The distance (D) metres travelled by a man varies with the number (m) of minutes he walked.

(a) Write this in variation form.

(b) Make this into an equation using the constant k.

(c) Given that the man walked 240 metres in 3 minutes, find k.

(d) Now find how far he can walk in 5 minutes.

Solution

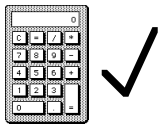
(a) Variation statement is => $D \alpha m$.

(b) In equation form, this is => $D = km$.

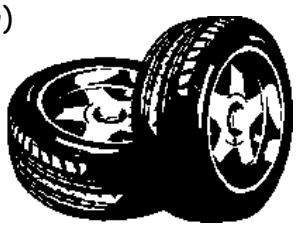
(c) Given $D = 240$ when $m = 3$ => => $240 = k \times 3$
This solves, by dividing 240 ÷ 3 => $k = 80$.

(d) The equation now becomes :- $D = 80m$.

This means that if we replace $m = 5$, we get :- $D = 80 \times 5 = 400$ metres.



Exercise 2 (In each of these, show clearly each step of your working)

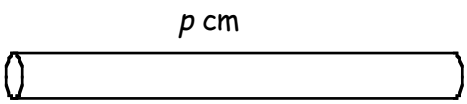


1. The cost (£C) of buying new tyres varies with the number of tyres (t) bought.

   (a) Find a formula connecting C and t.
   (Start with $C \alpha t$, and introduce the letter k).

   (b) Given that the cost of 2 tyres is £70, find the cost of 5 tyres.
   (Find the value of k first, then use the formula you have to find C when $t = 5$).

2. The weight (W grams), of a metal pipe varies with the length (p cm) of the pipe.



(a) Find a formula connecting W and p.
(Start with $W \propto p$, and introduce the letter k).

(b) Given that the weight W is 300 grams when the length p = 5 cm, find the weight of a piece of pipe 9 cm long.

(Find the value of k first, then use the formula you have to find W when p = 9).

3. The volume (V litres), of water in a bath varies with the time (t minutes) the tap is open.

(a) Find a formula connecting V and t.
(Start with $V \propto t$).

(b) Given that the volume (V) is 60 litres when the tap has been open for (t =) 15 minutes, find the volume of water after the tap has been open for 25 minutes.

(Find the value of k first, then use the formula you have to find V when t = 25).

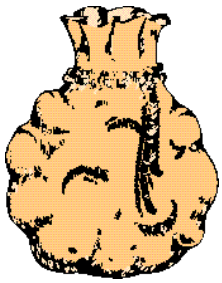
4. 

When the burner in a hot air balloon is lit, the balloon begins to rise.
The height (H metres) of the balloon varies with the time (t minutes) after it has been lit.

(a) Find a formula connecting H and t.

(b) After (t =) 10 minutes, the balloon has risen to a height of (H =) 1200 metres.
Find the height of the balloon after 15 minutes.
(Find k first).

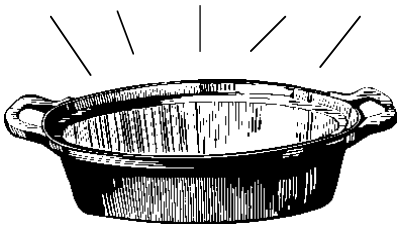
5. When marbles are weighed, it is found that the weight (g grams) varies with the number (n) of marbles placed on the scales.



(a) Find a formula connecting g and n.

(b) 30 marbles weigh 75 grams. Determine the value of k.

(c) Use your formula to calculate the weight of 45 marbles.

6. 

When a pan of ice-cold water is slowly heated, the temperature (T°C) varies with the time (t minutes) that the pan has been heated.

(a) Make up a formula connecting T and t.

(b) After 6 minutes, the temperature rose to 54°C.
Determine the value of the constant k.

(c) What will the temperature be 5 minutes later ?
(i.e. after 11 minutes).

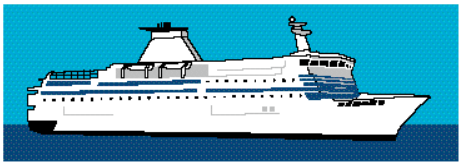
7. The cost (£C) of buying tickets to take a group of children to a Pantomime varies with the actual number (N) in the party.

(a) Write a formula connecting the cost (£C) to the number (N) of children.

(b) For a party of 8 children, the cost was £28. Determine the value of k.

(c) Use your formula to calculate the cost for a group of 18 children.

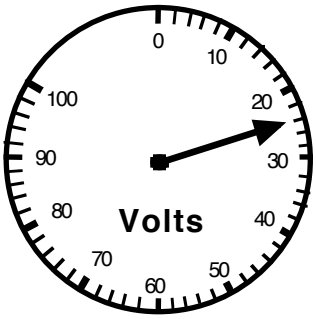
8. The distance (D km) travelled by a Transatlantic liner varies with the number of hours (h) for which it sails.



(a) Write a formula connecting D and h.

(b) After 8 hours, the liner had sailed a distance of of 256 kilometres. How far will it have travelled after sailing for a whole day (24 hours) ? (hint : find k first).

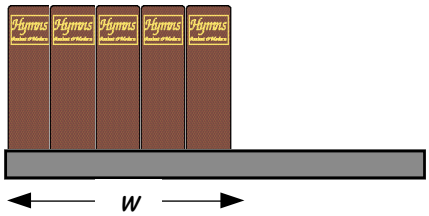
9. The voltage (V volts) in an electrical circuit varies with the current (i amps).



(a) Write a formula connecting V and i.

(b) When the current i = 6 amps, the voltage is V = 24 volts. What will the voltage be when the current rises to 8 amps ? (find k first)

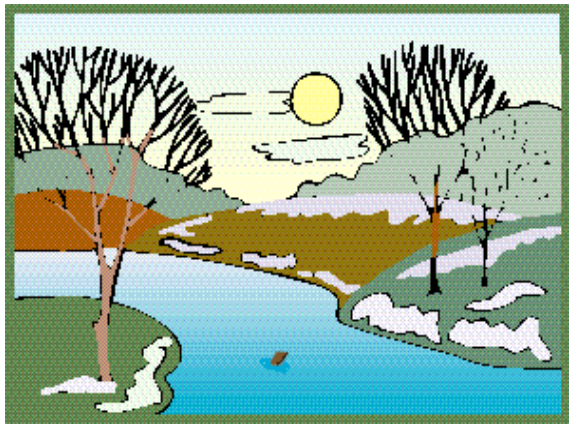
10. Copies of hymn books are stacked along a shelf. The width (w cm) of the stack varies with the number (n) of books.



(a) When 7 books are stacked, the width is 29·4 cm. Write down a formula connecting w and n and determine the value of k.

(b) What would the width be of a stack of 12 hymn books ?

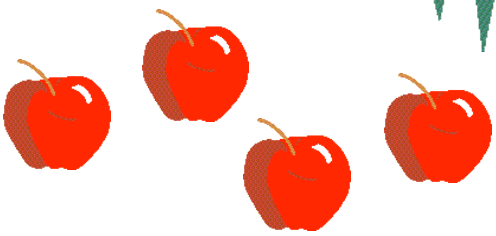
11. A boy drops a piece of wood from a bridge into a stream.
The distance (d metres) travelled down the stream by the piece of wood varies with the time (t seconds) after it enters the water.



(a) After 20 seconds, the wood had travelled 64 metres.
Find a formula connecting d and t.

(b) How far had the wood travelled after 1 minute ?

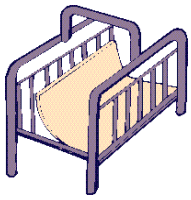
What have I learned ?



1. A pack of 6 apples costs £1·50.

   (a) Find the cost of 1 apple.

   (b) What should a pack of 4 cost ?



2. 40 copies of a magazine weigh 1·2 kg (1200 grams).

   (a) What is the weight of 1 copy ?

   (b) What would 70 copies weigh ?

3. The vanes of a windmill turn 5 times in 120 seconds.

   How long will it take for the vanes to turn 6 times ?

4. 

   A girl likes a piece of music so much that she sets the song to "repeat" on her C.D. player.
   The time (t seconds) that the music lasts varies with number (n) of times the music is repeated.

   (a) Find a formula connecting t and n.

   (b) When it is repeated (n =) 4 times, the music lasts for 600 seconds.
   Determine the value of the constant (k).

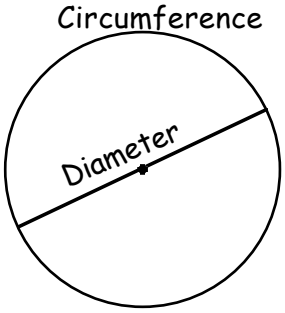
   (c) How long will it take to play the song 6 times ?

5. The circumference of a circle (C cm) varies with the diameter (d cm).

   (a) Write a formula connecting C and d.

   (b) When the diameter = 20 cm, the circumference is 62·8 cm.
   Determine the value of the constant (k).

   (c) What will the circumference be when d = 15 cm ?

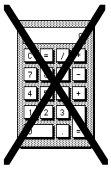


6. The cost (£C) of staying at a hotel varies with the number of days (d) I stay there.

   (a) Write a formula connecting C and d.

   (b) When I stayed for 3 days, the bill came to £64·50.
   What will it cost to stay for a whole week ?

Non-Calculator Practice Exercise



Number Nine

1. Set down and find :-

   (a) $\begin{array}{r} 7165 \\ +\ 3427 \\ \hline \end{array}$ (b) $\begin{array}{r} 3406 \\ -\ 765 \\ \hline \end{array}$ (c) $\begin{array}{r} 4103 \\ \times\ 400 \\ \hline \end{array}$ (d) 38×23

   (e) $4200 \div 700$ (f) 4^3 (g) $9 + 8 \div 2 - 3$ (h) $\frac{608}{8}$

2. Set down and find :-

   (a) $35{\cdot}4 + 8{\cdot}917$ (b) $16 - 4{\cdot}57 + 0{\cdot}385$ (c) $\frac{15{\cdot}6}{6}$ (d) $7\overline{)1{\cdot}75}$

   (e) $4 \times 11{\cdot}36$ (f) $14{\cdot}23 \times 600$ (g) $46{\cdot}14 \div 200$ (h) $0{\cdot}00032 \times 1000$

3. Change :- (a) 2 kg 95 g to grams (b) 4·7 m to centimetres

   (c) 5040 m to km (d) 1 litres 15 ml to millilitres

4. How many :- (a) quarters in 5 (b) sixths in 2 ?

5. Find :- (a) $5\frac{1}{4} - 2\frac{3}{4}$ (b) $3 \times \frac{5}{7}$ (c) $9 - 4\frac{2}{5}$

   (d) $5 \times 2\frac{3}{10}$ (e) $\frac{3}{5}$ of 45 (f) $1\frac{1}{2} + 3\frac{3}{8} - 2\frac{1}{4}$ (g) $\frac{5}{6} \times \frac{3}{10}$

6. Simplify :- (a) $\frac{25}{30}$ (b) $\frac{18}{21}$ (c) $\frac{15}{24}$

7. Write as decimals :- (a) 95% (b) 8% (c) 14·7%

8. Find :- (a) 10% of £7 (b) 50% of £23 (c) 25% of £3·20

   (d) 3% of £16 (e) 40% of £1500 (f) $66\frac{2}{3}$% of £18

9. 40% of the 210 people at a meeting are male.

   (a) What percentage of them are female ? (b) How many females are there ?

10. Rewrite in order, smallest first :- 2, -6, 13, -15, -12, 5, 7, -7

11. Find :- (a) (−5) + 11 (b) (−3) + (−7) (c) 9 + (−13)

    (d) (−8) × 7 (e) 4 × (−14) (f) (−12) − 32 (g) 9 − 21

    (h) 6 − (−1) (i) (−4) − (−3) (j) (−15) × 0 (k) (−17) + (−13)

12. Write in 12 hour form (a) 1445 (b) 1012 (c) 2358

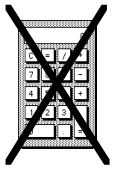
13. Write these in hours as a decimal :- (a) 3 hours 15 mins (b) $2\frac{3}{4}$ hours

14. A pantomime began on November 29th. The last show was on January 15th.

    For how many days did it run ?

Non-Calculator Practice Exercise

Number Ten



1. Set down and find :-

   (a) $\begin{array}{r} 63 \\ \times\ 24 \\ \hline \end{array}$ (b) $7\overline{)2233}$ (c) $18 - 10 \div 2$ (d) $4 \times 8 - 6 \div 2$

   (e) 405×200 (f) $4800 \div 60$ (g) 2^5 (h) $\frac{7 \times 6}{3 \times 5}$

2. Set down and find :-

   (a) $\begin{array}{r} 14{\cdot}96 \\ +\ 54{\cdot}27 \\ \hline \end{array}$ (b) $\begin{array}{r} 29{\cdot}31 \\ \times\ 6 \\ \hline \end{array}$ (c) $42 \div 5$ (d) $\frac{2 \times 4{\cdot}83}{10}$

3. 152·04 metres of rope is cut equally into 7 pieces. What length will each piece be ?

4. Change :- (a) 85 m to km (b) 2 tonnes 75 kg to kg

   (c) $\frac{1}{4}$ litre to millilitres (d) 200 seconds to minutes and seconds

5. Simplify :- (a) $\frac{35}{40}$ (b) $\frac{36}{45}$ (c) $\frac{39}{45}$

6. Find the value of :- (a) $\frac{4}{5}$ of 200 (b) $7\frac{1}{2} - 2\frac{3}{4}$ (c) $\frac{7}{8} - \frac{3}{4}$

   (d) $\frac{5}{6} \times \frac{3}{5}$ (e) $7 \times 2\frac{1}{4}$ (f) $5\frac{7}{10} - 1\frac{2}{5}$ (g) $6 - 5\frac{8}{9}$

7. Of the 8 eggs in a box, 6 are brown. What fraction are brown (in its simplest form) ?

8. Find the value of :- (a) 5% of 180 (b) 10% of £3·40 (c) 30% of 500

   (d) 7% of £5 (e) 1% of 8600 (f) $33\frac{1}{3}$% of 450

9. A suit costs £120. In a sale a 30% reduction was offered.
   Calculate the reduction and say what the suit would now cost.

10. Find the value of :- (a) $18 - 20$ (b) $(-41) + (-9)$ (c) $(-4) + 4$

    (d) $(-11) - (-23)$ (e) $13 - (-9)$ (f) $0 - (-51)$ (g) $4 \times (-8)$

    (h) $(-20) \times 6$ (i) $(-3) + (-4) + (-5)$ (j) $(-40) + 60$ (k) $10 \times (-17)$

11. Write in 24 hour format :-

    (a) 5 minutes to noon (b) 5·55 am (c) quarter to 3 in the afternoon

12. How long is it from :-

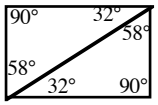
    (a) 0845 to 1240 (b) 10·50 am to 2·05 pm ?

13. Which of these were leap years :- (a) 1982 (b) 1992 (c) 2001 ?

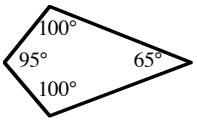
answers to GENERAL 4G

Answers to Chapter 0

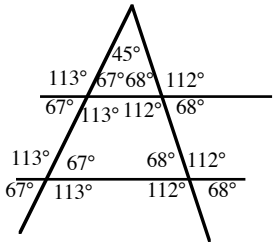
1. a. 8 b. 14 c. 40
2. a. 100 b. 370 c. 1110
3. a. 400 b. 1300 c. 15800
4. a. 270 b. 4500 c. 36000 d. 402000
   e. 38 f. 46 g. 590 h. 250
5. a. 1530 b. 8440 c. 15500 d. 32
   e. 14 f. 20
6. a. obtuse b. acute c. reflex
7. a. i)∠MGV ii) 40–50° iii) 50°
   b. i)∠RET ii) 100–120° iii) 114°
8. a. 130° b. 33° c. 56° d. 37°
   e. 28°
9. a. 69° b. 100°
10. a. 84°
    b



    c.



    d.



11. a. 19·7 b. 8·73
12. a. 5·3 b. 19·1 c. 0·1
13. a. 3·53 b. 6·90 c. 0·80
14. a. 10·25 b. 5·47 c. 129·88 d. 6·58
15. a. 29 b. 82·7 c. 61·5 d. 1·94
    e. 0·5624 f. 0·67
16. a. 480 b. 3250 c. 7·6 d. 5·8
    e. 640 f. 7·825 g. 9600 h. 5·7
    i. 860
17. a. $^3/_5$ b. $^7/_{20}$ c. $^3/_{20}$ d. $^6/_{25}$
18. a. 0·8 b. 0·95 c. 0·325 d. 0·625
19. 80%
20. a. £40·80 b. £33·60 c. £27
21. £19136
22. $33·60
23. a. £2 b. 25%
24. Art - 85% Comp - 72% Geog - 70%
25. a. 20 b. 25%
26. See drawing
27. a. 20 m by 12 m b. Area = 240 m^2
28. See drawing
29. a. See drawing b. 7·4 cm c. 74 m
30. a. SW b. 135° clockwise
31. a. 6 b. 48 cm
32. £293·40
33. £8·50
34. £15840
35. £750
36. £14008
37. a. £480 b. £1440
38. £72
39. a. £230·40 b. £76·80
    c. £307·20
40. a. £418·07 b. £142·93
41. a. 10x b. 5b c. 9a + 1 d. 3p + q
    e. 4m f. 12pq g. t^2 h. 24n^2
42. a. 4x + 20 b. 14p – 21
    c. 20a + 35b d. 4x + 2
    e. 5x + 23 f. 27h + 2
43. a. 7 b. 12 c. 5 d. 6·5
    e. 5 f. 5 g. 3 h. 3
44. a. 5·5 b. 10 c. 3
45. a. x > 5 b. x < 13 c. x ≥ 6 d. x ≤ 5
    e. x > 6 f. x < 11
46. a. £320 b. £8320
47. a. £600 b. £50 c. £350
48. £33 — £92·70 — £16·22 — £108·92
49. 327 — £47·42 — £3·79 — £51·21
50. 132 cm
51. 47·1 m
52. a. 128·5 m b. 25·7 cm
53. 50 cm
54. 907 cm^2
55. a. 4·3 cm b. 58·1 cm^2
56. a. 112 cm^2 b. 100·48 cm^2
    c. 212·48 cm^2
57. a. 0855 b. 1640 c. 1210
58. a. 7·45 pm b. 2·05 pm
    c. 3·50 am
59. 1 hr 40 min
60. a. 140 m b. 20 km c. 24 m
61. a. 30 mph b. 40 km/hr
    c. 40 km/hr
62. a. 4 hr 30 min b. 1 hr 30 min
    c. 45 min
63. a. 0·8 hr b. 2·2 hr c. 3·1 hr
64. a. 2 hr 24 min b. 15 mins
    c. 2 hr 40 min
65. a. $^4/_9$ b. $^5/_9$
66. a. $^2/_8$ b. $^4/_{10}$ c. $^6/_{20}$
67. a. $^4/_5$ b. $^1/_3$ c. $^4/_5$
68. a 40 b. 60 c. 30
69. a 30 b. 12 c. 1620
70. a. $^1/_2$ b. $^1/_4$ c. $^1/_5$
    d. $^3/_4$ e. $^1/_3$ f. $^7/_{10}$
71. a. 40 b. 8 c. 19 d. 20
    e. £15 f. £20
72. a. $^3/_5$ b. $^1/_2$ c. $5^2/_5$ d. $3^3/_5$
    e. $^3/_4$ f. $^1/_4$ g. $2^1/_4$ h. $^7/_{12}$
    i. $^1/_2$ j. $6^5/_6$ k. $2^1/_6$ l. $2^1/_5$
73. a. $2^2/_5$ b. 2 c. $6^3/_4$ d. $2^2/_5$
    e. $8^2/_3$ f. $16^1/_5$ g. $5^5/_6$ h. $^3/_{10}$
    i. $^2/_5$
74. a. 137 cm b. 161 cm
    c. 143 cm d. 15
75. See diagram
76. £70
77. 16
78. a. 10 b. 24
79. a. £101 b. 2·0
80. 28
81. See frequency tables with frequences –
    2, 4, 5, 7, 4, 0, 2, 0, 1
82. a. (f x x column) = 69, 168, 225, 156, 54, 84
    b. 25 c. 25 d. 5 e. 25·2
    f. see bar graph - labelled
83. a. 27·7 cm b. 10·1 cm
84. 21·9 cm
85. a. 43·3 cm b. 8·1 cm
86. a/b. See diagram c. 5·83 units
87. a. 9·16 cm b. 2·28 cm
88. 135 cm^2
89. 6 cm
90. a. See diagram b. 20 cm^2
    c. 10 cm^2
91. a. 60 cm^2 b. 49 cm^2
92. a. 135 cm^2 b. 35 cm^2
    c. 90 cm^2 d. 56 cm^2
93. a. 800 b. 30 c. 20 d. 370
    e. £7 f. £30
94. 306 ml
95. £3·41
96. a. i) £45 ii) 25%
    b. i) £40 ii) 10%
97. a. £817·60 b. £97·60
98. a. £34 b. £49·50
99. a. £390
    b. i) £308·75 ii) £214·50 iii) £523·25
100. a. $385 b. £281·25
101. a. 8·29 cm b. 23·1 cm
     c. 36 mm
102. a. 43·5° b. 60·6° c. 31·8°
103. a. 2·83 cm b. 5·66 cm by 14 cm
104. 25°
105. a. 10·9 cm b. 56·9 cm
     c. 6·61 cm d. 49·8 m
     e. 4·06 cm f. 0·6 m
106. a. 53·1° b. 33·1° c. 49·8° d. 59·3°
107. a. 19 b. 7, 11, 15, 19, 23, 27
     c. M = 4T + 3
108. a. 450 b. W = 450N + 100 c. 5500 g
109. a. $^1/_6$ b. $^1/_2$ c. 0
110. a. $^3/_5$ b. $^2/_5$
111. $^1/_6$
112. $^5/_{15}$ ($^1/_3$)

Answers to Chapter 1

Ex 1

1. a. 2°C b. -2°C c. -6°C d. -9°C
   e. 8°C f. -8°C g. -15°C h. -15°C
2. a. -20
   b. i) £63·50 in bank ii) overdrawn £18
   iii) overdrawn £123·50 iv) balance = zero
   c. -£5 d. -£25·00 e. -£80 f. -£60
   g. £85 h. -£10·60
3. a. i) + 30 ii) + 15 iii) – 15
   iv) + 55 v) – 35 vi) – 40
   vii) + 45 viii) – 25
   b. 30 metres
4. a. i) + 1066 ii) + 1812 iii) – 25
   iv) – 1200
   b. 41 or 42 c. 59 or 60
   d. 49 or 50 e. 25 or 26BC

Ex 2

1. See drawing
2. a. 13°C b. 9°C c. 18°C d. 5°C
   e. 11°C f. 2°C g. -10°C h. 14°C
   i. -1°C j. -10°C k. -9°C l. -14°C
   m. -8°C n. -5°C
3. a. 8°C up b. 5°C down
   c. 15°C down d. 7°C up
   e. 7°C down f. 12°C up
   g. 5°C down h. 8°C down
   i. 40°C up j. 10°C down
4. -40°C
5. 50°C
6. 9°C
7. a. 2°C b. -3°C c. -8°C d. -38°C

Ex 3

1. a. 12 b. 11 c. 9 d. 6
   e. 5 f. 0 g. – 1 h. – 8
   i. – 9 j. 3 k. 0 l. 16
   m. – 4 n. – 4 o. – 5 p. – 9
   q. – 8 r. – 15 s. – 10 t. – 14
2. a. 6 b. 0 c. 3 d. – 2
   e. – 5 f. – 10 g. – 15 h. – 5
   i. – 10 j. – 16 k. – 22 l. – 35
   m. – 20 n. – 40 o. – 200 p. – 100
3. a. 9 b. – 3 c. – 3 d. 7
   e. – 5 f. – 4 g. – 7 h. – 35
   i. 5 j. – 13 k. – 13 l. – 22
   m. 8 n. – 8 o. 0 p. – 34

Ex 4

1. a. – 20 b. – 42 c. – 18 d. – 25
   e. – 24 f. – 36 g. – 22 h. – 70
   i. – 48 j. – 24 k. – 48 l. – 49
   m. – 9 n. – 27 o. – 20 p. – 45
2. a. – 5 b. – 4 c. – 8 d. – 7
   e. – 20 f. – 9 g. – 11 h. – 8
   i. – 1 j. – 5 k. – 9 l. – 20
3. a. 6 b. – 4 c. – 24 d. – 30
   e. – 4 f. – 9 g. – 12 h. – 20
4. a. 21 b. – 18 c. – 16 d. – 6
   e. – 20 f. – 25 g. – 35 h. – 2
   i. – 4 j. – 20 k. 0 l. – 9

Ex 5

1. B(4,1) C(2,-2) D(-4,-2) E(0,4) F(-2,-3) G(-2,0) H(6,-3) I(0,-1)
2. a. kite b. parallelogram c. line d. rhombus e. pentagon f. hexagon
3. a. See diagram b. S(-3,-3)
4. a. See diagram b. trapezium c. See diagram d. (2,-1) (3,-5) (5,-5) (6,-1)
5. TEEJAY OK

Review 1 — Rounding

1. a. 22 b. 18 c. 203
2. a. 290 b. 2140 c. 1990
3. a. 1500 b. 3200 c. 2000
4. a. 18000 b. 50000 c. 2000
5. a. 4000 b. 200 c. 900
6. a. 370 b. 31060 c. 6200 d. 50900 e. 7000 f. 94000
7. a. 1240 b. 12660 c. 1020 d. 12400 e. 8400 f. 163200
8. a. 52 b. 206 c. 510 d. 6 e. 114 f. 62
9. 1080
10. £4900
11. 18000 mm^2
12. 30 grams

Answers to Chapter 2

Ex 1

1. 40 miles/gallon
2. 9 m/s
3. 42 matches/box
4. 5·2 kg/cow
5. 15p per banana
6. 2·15 tonnes per lorry
7. £0·55 per hour
8. £6·40 per copy
9. £3·20 per hour
10. $1·50 per £1
11. 120 words per minute
12. 103 beats per minute
13. a. £4·50 p/h b. £5·00 p/h c. Shona
14. 1·5 turns per minute

Ex 2

1. £46
2. $12·16
3. 6000 m
4. £240
5. a. 6 b. 42 c. 270 d. 720
6. 7·50 m
7. £7·90
8. 15·6 m
9. 525 words
10. 320 ml
11. 300 times
12. 840 pages
13. 10 metres
14. 55 pancakes

Review 2 — Decimals

1. 2·8
2. Diagram showing 3·4
3. a. 5·3 b. 23·9 c. 7·5 d. 0·9 e. 14·0
4. a. 8·26 b. 20·30 c. 0·88 d. 5·24 e. 0·04
5. a. 10·40 b. 12·06 c. 39·99 d. 12·38 e. 13·66 f. 9·68 g. 6·6 h. 0·95
6. a. 16·2 b. 65·1 c. 77·0 d. 4·92 e. 6·4 f. 7·4 g. 4·53 h. 0·82
7. a. 52·3 b. 7·93 c. 647 d. 10 e. 80·7 f. 4863 g. 73·9 h. 0·03
8. a. 1·84 b. 0·92 c. 0·876 d. 0·97 e. 0·605 f. 0·65 g. 5·67 h. 0·021 i. 3·817 j. 0·296 k. 0·0117 l. 0·0008

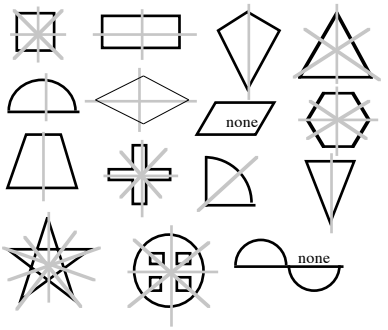
Non Calculator Exercise No. 1

1. a. 6035 b. 5571 c. 3332 d. 703 e. 947 f. 49 g. 9360 h. 2 i. 27 j. 26
2. a. 1·46 b. 2·783 c. 25·92 d. 1·82 e. 24·6 f. 57·2 g. 0·0528 h. 0·003
3. a. 8·5 km b. 300 m c. 0·57 m d. 3·02 kg
4. a. 8 b. 180 c. 1400
5. a. $^2/_3$ b. $^3/_5$ c. $^2/_3$
6. a. $1^1/_3$ b. $3^5/_8$ c. $4^1/_8$ d. $^1/_9$ e. 10 f. $10^2/_3$
7. a. $2^2/_5$ b. $3^3/_4$ c. $7^1/_7$
8. a. $^1/_4$ b. $^2/_5$ c. $^3/_{25}$
9. a. £350 b. £170 c. £7·50 d. £40 e. £8 f. 21p
10. a. 0·37 b. 0·04 c. 0·125
11. a. 13 b. – 5 c. 7 d. – 16 e. – 14 f. – 10 g. 7 h. 4 i. 17 j. – 42 k. – 45
12. a. 0845 b. 1420 c. 0015
13. a. 6 hr 40 mins b. 4 hr 25 mins
14. 8·55 pm
15. a. 31 b. 30 c. 28

Answers to Chapter 3

Ex 1

1.



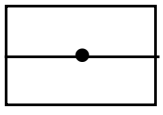
2. See drawings
3. a. A B C D E M T U V W Y
   b. H I O X
   c. F G J K L N P Q R S Z
   d. X – 4, O - lots and lots
4. See drawings
5. See drawings

Ex 2

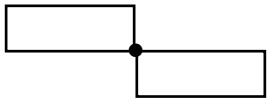
1. a. yes b. yes c. yes d. yes e. yes f. no g. yes h. no i. yes j. no k. no l. yes m. no n. yes o. yes p. no
2. a. H, I, N, O, S, X, Z
   b. S,N,Z
3. a. $^1/_3$ b. $^1/_5$ c. $^1/_4$ d. $^1/_6$ e. $^1/_2$ f. $^1/_4$ (not $^1/_8$) g. $^1/_4$ h. $^1/_5$ i. $^1/_2$ j. $^1/_6$ k. $^1/_3$ l. $^1/_2$

Ex 3

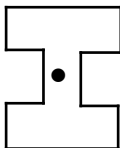
1.



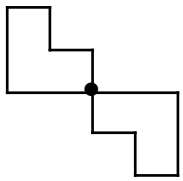
2.



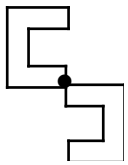
3.



4. a.

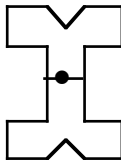


b.

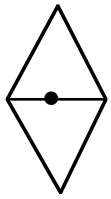


c.

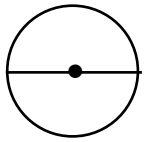
d.



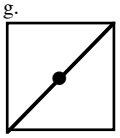
e.



f.

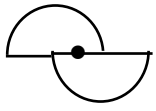


g.



h.

i.



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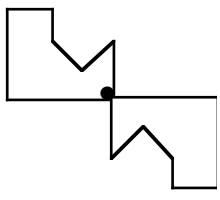
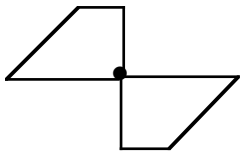
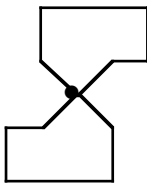


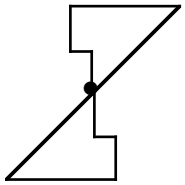
6. a.



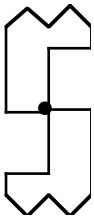
b.



c.



d.



Review 3 — Percentages

1. a. $^{57}/_{100}$ b. 57%
2. a. $^{7}/_{10}$ b. $^{7}/_{20}$ c. $^{6}/_{25}$
3. a. 0·46 (46%) b. 0·52 (52%)
   c. 0·666... (66·7%)
4. 90%
5. a. £101·50 b. £232·50
   c. £2·46 d. £286
   e. £11·22 f. £20
   g. £112 h. £252
   i. £40290
6. a. £33 b. £187
7. 4·4 kg
8. Brian up by 2·4 kg, Pete up by 2·24 kg
9. Geog – 85%, Science – 80%, Tech – 75%

Answers to Chapter 4

Ex 1

1. 64
2. a. 125 b. 81 c. 16 d. 1000
   e. 256 f. 36 g. 512 h. 64
   i. 343 j. 1000000 k. 5
   l. 1
3. a. all answers = 1 b. 1
4. a. 3^2 by 1 b. 3^4 by 17
   c. 2^5 by 7 d. 3^6 by 513
   e. 5^1 by 4 f. 4^5 by 399
   g. 3^5 by 118 h. 2^7 by 79
   i. 2^{10} by 924
5. a. 25 b. 85 c. 245 d. 95
   e. 500 f. 365
6. a. $4^3 = 4$ "cubed"
7. a. 8 b. 125 c. 343
8. a. 100 b. 1000 c. 10000 d. 100000
   e. 1000000
9. a. 10000000 b. 10 c. 1
10. a. 2187 b. 2187
11. a. 81 b. 3125 c. 10000 d. 512
    e. 81 f. 243 g. 65536 h. 1296
    i. 1 j. 0 k. 4096 l. 2401
    m. 729 n. 78125 o. 1000000
    p. 15625
12. a. i) 2 ii) 4 iii) 8 iv) 16
    v) 32 vi) 64
    b. 2, 4, 8, 16, 32, 64
    c. 128
    d. 1

Ex 2

1. $1{\cdot}9 \times 10^3$
2. a. $4{\cdot}6 \times 10^3$ b. $9{\cdot}8 \times 10^2$
   c. $2{\cdot}4 \times 10^4$ d. $3{\cdot}25 \times 10^5$
3. a. $7{\cdot}9 \times 10^3$ b. $6{\cdot}72 \times 10^3$
   c. $1{\cdot}5 \times 10^4$ d. $2{\cdot}49 \times 10^4$
   e. $6{\cdot}385 \times 10^4$ f. $4{\cdot}5 \times 10^5$
   g. $2{\cdot}97 \times 10^5$ h. $8{\cdot}076 \times 10^5$
   i. $6{\cdot}8 \times 10^6$ j. $1{\cdot}8 \times 10^6$
   k. $7{\cdot}35 \times 10^6$ l. $2{\cdot}6 \times 10^7$

Ex 3

1. $2{\cdot}6 \times 10^4$
2. a. $4{\cdot}5 \times 10^4$ b. $7{\cdot}8 \times 10^3$
   c. $8{\cdot}15 \times 10^5$ d. $4{\cdot}75 \times 10^2$
   e. $9{\cdot}871 \times 10^3$ f. $1{\cdot}5 \times 10^5$
   g. 6×10^3 h. $5{\cdot}4 \times 10^4$
   i. 9×10^4 j. $1{\cdot}86 \times 10^6$
   k. $7{\cdot}9 \times 10^6$ l. $1{\cdot}46 \times 10^7$
3. a. Mercury $5{\cdot}79 \times 10^7$
   b. Venus $1{\cdot}082 \times 10^8$
   c. Earth $1{\cdot}496 \times 10^8$
   d. Mars $2{\cdot}279 \times 10^8$
   e. Jupiter $7{\cdot}783 \times 10^8$
   f. Saturn $1{\cdot}427 \times 10^9$
   g. Uranus $2{\cdot}8696 \times 10^9$
   h. Neptune $4{\cdot}4967 \times 10^9$
   i. Pluto $5{\cdot}8999 \times 10^{10}$
4. a. $1{\cdot}3 \times 10^7$ b. $4{\cdot}8 \times 10^6$
   c. $2{\cdot}75 \times 10^6$ d. $1{\cdot}5 \times 10^6$
   e. 6×10^6 f. $4{\cdot}5 \times 10^7$
   g. $6{\cdot}3 \times 10^6$ h. $4{\cdot}15 \times 10^6$
   i. $3{\cdot}5 \times 10^6$ j. $1{\cdot}05 \times 10^7$
   k. $6{\cdot}875 \times 10^6$ l. $1{\cdot}25 \times 10^6$
   m. $4{\cdot}75 \times 10^6$
5. a. $£8{\cdot}5 \times 10^6$ b. $1{\cdot}42 \times 10^6$
   c. 7×10^8 d. $2{\cdot}65 \times 10^7$
   e. 5×10^5
   f. i) $7{\cdot}73692 \times 10^5$ ii) $3{\cdot}56648 \times 10^8$
6. a. $1{\cdot}8 \times 10^4$ b. $2{\cdot}4 \times 10^4$
   c. $1{\cdot}6 \times 10^5$ d. $2{\cdot}9 \times 10^5$
   e. $6{\cdot}8 \times 10^3$ f. $5{\cdot}0 \times 10^3$
   g. $1{\cdot}5 \times 10^6$ h. $6{\cdot}2 \times 10^6$
   i. $3{\cdot}8 \times 10^7$
7. a. $6{\cdot}59 \times 10^4$ b. $1{\cdot}39 \times 10^5$
   c. $4{\cdot}77 \times 10^3$ d. $1{\cdot}24 \times 10^6$
   e. $3{\cdot}64 \times 10^6$ f. $4{\cdot}53 \times 10^7$

Ex 4

1. 387000
2. a. 1650 b. 48100 c. 369 d. 581300
   e. 1600000 f. 721000
   g. 9120 h. 36200000
   i. 19700 j. 2134000
   k. 9000 l. 86400000
   m. 200000
3. 4920
4. a. 18000 b. 260 c. 387000 d. 1950
   e. 84610 f. 70
   g. 9000000 h. 5500000
   i. 41350 j. 60000000
   k. 38700000 l. 222200000
5. a. Mercury 5972000
   b. Venus 408500
   c. Earth 328900
   d. Mars 3099000
   e. Jupiter 1047
   f. Saturn 3500
   g. Uranus 22760
   h. Neptune 19330
   i. Pluto 3000000
6. a. 1800000 b. 42300
   c. 60200000
7. a. 598000000000000000000000 (22 zero's)
   b. 149000000000
   c. 30000000000
   d. 190000000000000000000000000
   e. 8000000000
   f. 1720000000000

Review 4 — Pythagoras

1. a. 289 b. 484 c. 342·25 d. 45369
2. a. 961 cm^2
3. a. 5·48 b. 8·49 c. 4·42 d. 44·90
4. a. 13·9 cm b. 17·9 cm
   c. 127·5 cm d. 8·0 cm
5. 4·37 cm
6. 174·6 cm

Non Calculator Exercise No. 2

1. a. 945 b. 63 c. 126000 d. 8632
   e. 5771 f. 17 g. 64 h. 14
2. a. 156·72 b. 86·71 c. 76·4 d. 964·2
   e. 3·42 f. 3·613 g. 93·637 h. 1·36
3. a. 21 b. 60 c. 452
4. a. $^{2}/_{5}$ b. $^{1}/_{2}$ c. $^{3}/_{4}$
5. a. $^{5}/_{7}$ b. $^{7}/_{8}$ c. $^{1}/_{2}$ d. $3^{3}/_{8}$
   e. $16^{1}/_{4}$ f. $^{1}/_{3}$ g. $8^{5}/_{6}$ h. $41/_{4}$
6. a. $5^{1}/_{2}$ b. $2^{5}/_{6}$ c. $6^{2}/_{5}$
7. a. $^{3}/_{10}$ b. $^{3}/_{4}$ c. $^{1}/_{20}$
8. a. £6·50 b. 42 m c. 100 mm d. 24 g
   e. £77 f. £270
9. a. 70% b. 25% c. $33^{1}/_{3}$% d. 47%
10. a. 6 b. – 14 c. – 63 d. – 24
    e. 14 f. – 24 g. – 5 h. 51
    i. 0 j. 18 k. – 4
11. a. 0,1,2,3,4 b. -4,-3,-2,-1,0,1
    c. -4,-3,-2 d. 0,1,2,3,4
12. a. 2 hr 25 mins b. 2 hr 50 mins
13. a. 15 mins b. 2 hr 30 mins
    c. 5 hr 45 mins

Answers to Chapter 5

Ex 1

1. 12 cm
2. a. 13·7 cm b. 9·4 cm
   c. 29·5 mm d. 4·8 m
3. 4·75 m
4. 111 m
5. 9·3 cm
6. a. 23·0 cm b. 46·0 cm
7. 2·09 m
8. 3·4 m
9. 34·6 cm

Ex 2

1. a. A(1,4) B(8,7) b. See figures
   c. See figures d. 7·6 units
2. a. C(3,1) D(8,9) d. 9·4
3. a. J(2,9) K(6,1) c. 8·9
4. a-c. See diagrams d. 7·3
5. a-b. See diagrams c. 9·4
6. a. See diagrams b. 6·4
   c. See diagrams d. 6·4
   e. isosceles

Ex 3

1. a. 10·8 cm b. 17·9 cm
   c. 10·7 m d. 20·4 mm
   e. 66·2 cm f. 4·2 m
2. x must be smaller than the hypotenuse
3. 19·6 = t must be smaller than 23
4. 6·3 cm
5. 146 cm
6. 250 m
7. 40·3 cm
8. a. 48 ft b. 40 ft c. 8 ft
9. a. 2500 + 1400 + 2865 = 6765 m
10. 2·67 m

Review 5 — Algebra

1. a. 8a b. 7f
   c. 9t d. 13d + 3
   e. 4w – 5 f. 2y + 11
   g. 13m + 8n h. u
   i. 2g + 7h j. 4a + 1
   k. t l. $5x^2$
   m. p^2 n. $5a^2 + 7a$
   o. 0
2. a. 5x + 5 b. 6x – 24
   c. 3x – 6 d. 7x + 56
   e. 2a + 2b f. 5p – 5q
   g. 6x + 8 h. 8w – 4
   i. 10x + 10y + 20z j. 6a – 9b + 3c
   k. 15p – 10q + 20r l. 7a + 14b – 35
   m. 3t – 4s n. 3a + 2b + c
   o. 3a + 2b – 4c
3. a. 4x + 10 b. 7y
   c. 9t + 6 d. 6m + n
   e. 4x + 14 f. 3x + 1
   g. 6x + 1 h. 11x + 8y
   i. 11g + 2h
4. a. 7 b. 15 c. 10 d. 9
   e. 3·5 f. 7 g. 6 h. 5
   i. 5 j. 8 k. 6 l. 3·5
   m. 7 n. 10 o. 6 p. 0
   q. 11 r. 3

Answers to Chapter 6

Ex 1

1. a. $^1/_{12}$ b. since $^1/_{12} > {}^1/_{20}$, it is steeper
2. $^1/_5$
3. a. $^3/_{40}$ b. $^1/_{16}$ c. 0·075, 0·0625
   Pembroke is the steeper
4. a. $^6/_{120} = 0{\cdot}05$ b. $^{15}/_{240} = 0{\cdot}0625$
   c. $^{10}/_{250} = 0{\cdot}04$ d. $^{30}/_{300} = 0{\cdot}10$
   Gorse – Ainsley – Grove – Elm
5. 3·5
6. a. $^6/_2 = 3$ b. $^{9{\cdot}6}/_3 = 3{\cdot}2$ c. longer
7. 4·63
8. 0·3
9. 0·125
10. A – 0·3, B – 0·35, C – 0·25, D – 0·4
    –> steepest = D, shallowest = C

Ex 2

1. a. y = 2 x x coordinate
   b. yes (each time)
   c. a = 10 d. b = 16
2. a. (0,0) (1,3) (2,6) (3,9) b. * = 3
   c. y = 3 x x or y = 3x d. * = 12
3. a. (0,0) (1,1) (2,2) (3,3) (4,4) (5,5) (6,6)
   b. y = 1 x x
   c. y = x
4. a. (0,0) (2,1) (4,2) (6,3)
   b. works c. $y = {}^1/_2x$
5. i) a. (0,0) (3,1) (6,2) , $y = {}^1/_3x$
   ii) a. (0,0) (1,4) (2,8) , y = 4x

Ex 3

1. a. 0,2,4,6
   b. (0,0) (1,2) (2,4) (3,6)
   c. See diagram
2. a. 1,3,5,7
   b. (1,1) (3,3) (5,5) (7,7)
   c. See diagram
3. a. 0,1,2,3
   b. (0,0) (2,1) (4,2) (6,3)
   c. See diagram
4. a. 0,3,6,9
   b. (0,0) (1,3) (2,6) (3,9)
   c. See diagram
5. a. 0,1,2,3
   b. (0,0) (4,1) (8,2) (12,3)
   c. See diagram
6. a. 0,4,8,12
   b. (0,0) (1,4) (2,8) (3,12)
   c. See diagram
7. a. 0,6,12,18
   b. (0,0) (1,6) (2,12) (3,18)
   c. See diagram
8. a. 0,3,6,9
   b. (0,0) (2,3) (4,6) (6,9)
   c. See diagram
9. a. 0,10,20,30
   b. (0,0) (1,10) (2,20) (3,30)
   c. See diagram

Ex 4

1. a. 3,5,7,9
   b. (0,3) (1,5) (2,7) (3,9)
   c. See diagram
2. a. 2,5,8,11
   b. (0,2) (1,5) (2,8) (3,11)
   c. See diagram
3. a. –2,0,2,4
   b. (0,–2) (1,0) (2,2) (3,4)
   c. See diagram
4. a. 4,5,6,7
   b. (1,4) (2,5) (3,6) (4,7)
   c. See diagram
5. a. (0,1) (1,2) (2,5) (3,8) – graph
   b. (0,–1) (1,5) (2,9) (3,13) – graph
   c. (0,–2) (2,0) (4,2) (6,4) – graph
   d. (0,–3) (1,2) (2,7) (3,12) – graph
6. a. 2,3,4,5
   b. (0,2) (2,3) (4,4) (6,5)
   c. See diagram
7. a. –6 b. –12 c. –5 d. –20
   e. 1 f. 2 g. –6 h. –2
   i. –11 j. 2 k. –7 l. –5
8. a. –5,–3,–1,1,3
   b. (–2,–5) (–1,–3) (0,–1) (1,1) (2,3)
   c. See diagram
9. a. (–1,0) (0,2) (1,4) (2,6) – see diagram
   b. (–1,–2) (1,4) (3,10) (5,16) – see diagram
   c. (–2,2) (0,4) (2,6) (4,8) – see diagram
   d. (–4,–1) (–2,0) (0,1) (2,2) – see diagram

Review 6 — Areas

1. a. 13 cm^2 b. 20 cm^2
2. a. 77 cm^2 b. 800 mm^2 c. 66 m^2
3. a. 20 cm^2 b. 10 cm^2
4. a. 33 cm^2 b. 105 cm^2 c. 26 cm^2
5. a. 154 cm^2 b. 210 cm^2

Non Calculator Exercise No. 3

1. a. 11134 b. 2725 c. 1389000 d. 2952
   e. 60 f. 81 g. 11 h. 65
2. a. 4·15 b. 54·311 c. 43·88 d. 58·29
   e. 10258 f. 0·01122
3. a. 1085 g b. 2·36 m c. 9650 ml
4. a. 12 b. 6
5. a. $6^1/_2$ b. $3^3/_5$ c. $7^1/_4$ d. $10^2/_5$
   e. 8 f. 7
6. a. $^3/_5$ b. $^3/_4$ c. $^7/_8$
7. a. 0·86 b. 0·04 c. 0·172
8. a. £35 b. 18 kg c. 142 d. 60p
   e. 36p f. 39p
9. 32 males
10. a. –10, –5, –1, 0, 7 b. –42, –17, 35, 44
11. a. 15 b. – 11 c. – 6 d. – 65
    e. –27 f. – 13 g. 10 h. –2
    i. 0 j. –40 k. – 10
12. –£15
13. a. 2·05 pm b. 11·55 am
    c. 2·10 am
14. a. $1^1/_2$ b. $3^1/_4$ c. $^1/_5$
15. a. 30 b. 12
16. 16·55, 18·8, 21·81, 22·4

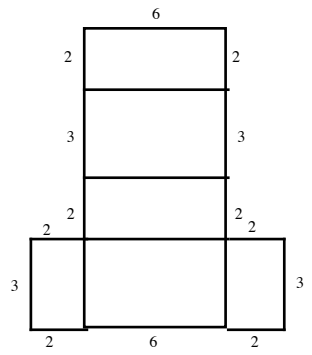
Answers to Chapter 7

Ex 1

1. Total = 10 + 10 + 15 + 15 + 6 + 6 = 62 cm^2
2. a. = 15 + 15 + 18 + 18 + 30 + 30 = 126 cm^2
   b. = 40 + 40 + 20 + 20 + 8 + 8 = 136 cm^2
   c. = 18 + 18 + 18 + 18 + 9 + 9 = 90 cm^2
   d. = 72 + 72 + 6 + 6 + 3 + 3 = 162 cm^2
3. a. same b. 25 cm^2 c. no d. 150 cm^2
4. a. 96 cm^2 b. 54 cm^2
   c. 600 cm^2 d. 6 cm^2
   e. 294 cm^2
5. 35 + 35 + 21 + 21 + 15 + 15 = 142 m^2
6. 240 + 120 + 120 + 200 + 200 = 880 cm^2
7. a. = 165 + 150 + 150 + 110 + 110 = 685 cm^2
   b. = 64 + 120 + 120 + 120 + 120 = 544 cm^2
   c. = 400 + 50 + 50 + 50 + 50 = 600 cm^2
8. a. 110 cm^2 b. 9 cm^2
   c. 74 cm^2 d. O.K.
9. a. 10 x 7 =70 cm^2 b. 4 cm^2
   c. 54 cm^2
10. a. 6 b. 12 c. 8 d. 1
11. a. 24 b. 24 c. 8 d. 8
12. 24 + 32 + 40 + 6 + 6 = 108 cm^2
13. a. = 70 + 42 + 56 + 24 + 24 = 216 cm^2
    b. = 130 + 50 + 120 + 30 + 30 = 360 cm^2

Ex 2

1. a. See net



   b/c. = 18 + 18 + 12 + 12 + 6 + 6 = 72 cm^2
2. a. See net
   b. = 12 + 12 + 12 + 12 + 9 + 9 = 66 cm^2
3. a. See net
   b. 9 x 6 = 54 cm^2
4. a. 96 cm^2 b. 64 cm^2
   c. 88 cm^2 d. 148 cm^2
5. a/b. See net
   c/d. = 30 + 24 + 18 + 6 + 6 = 84 cm^2

Review 7 — Wages/Salaries

1. £20104·80
2. £225
3. a. £12·40 b. £9·30
4. £74·40
5. a. £183·60 b. £32·40
   c. £216
6. a. £495 b. £16995
7. £252
8. £357·40
9. £800·28 – £217·69 = £582·59

Answers to Chapter 8

Ex 1

1. a. 4 cm^3 b. 6 cm^3 c. 6 cm^3 d. 12 cm^3
   e. 14 cm^3
2. a. 8 cm^3 b. 3 c. 24 cm^3
3. a. 15 cm^3 b. 2 c. 30 cm^3
4. a. 12 cm^3 b. 36 cm^3 c. 42 cm^3 d. 36 cm^3
   e. 60 cm^3
5. a. 45 cm^3 b. 40 cm^3 c. 48 cm^3 d. 150 cm^3
   e. 54 cm^3
6. a. 5 cm^3 b. 8 cm^3 c. 14 cm^3 d. 16 cm^3
   e. 14 cm^3
7. a. see sketches
   b. i) 24 cm^3 ii) 18 cm^3
   iii) 12 cm^3 iv) 35 cm^3
   v) 27 – 8 = 19 cm^3

Ex 2

1. 120 cm^3
2. 160 cm^3
3. 120 cm^3
4. a. 140 cm^3 b. 96 cm^3
   c. 216 cm^3 d. 240 cm^3
   e. 3600 cm^3 f. 1000 cm^3
5. a. 564 cm^3 b. 1440 cm^3
   c. 810 cm^3 d. 3100 cm^3
   e. 1844 cm^3
6. 4 cm
7. a. 4 cm b. 3 cm c. 10 cm

Ex 3

1. a. 300 cm^3 b. 300 ml
2. a. 1200 cm^3 b. 1200 ml
3. a. 1000 cm^3 b. 1000 ml
   c. 1 litre
4. a. 3 l b. 5 l c. 17 l d. 2·5 l
   e. 1·6 l f. 14·75 l g. 0·8 l h. 0·5 l
   i. 0·25 l
5. a. 1·2 litres b. 2 litres
   c. 15 litres
6. a. 480000 cm^3 b. 480 l
   c. 96
7. a. 135000 cm^3 b. 135000 ml
   c. 135 litres
8. a. 6000 cm^3 b. 6 litres
   c. 540000 cm^3 d. 540 litres
   e. 90 times
9. a. 192 b. 96 c. 64 d. 144
10. a. 576000 cm^3 b. 576 l
    c. 192 minutes
11. a. 30000 ml b. 15 cm
12. a. 24 m^3 b. 45 m^3 c. 18 m^3
13. a. 1 m^3 b. 1000000 cm^3
    c. 1 m^3 = 1000000 cm^3
14. a. 6 ÷ 20 = 0·3 m b. 30 cm
15. a. 2·5 m b. 3·5 m

Review 8 — Money

1. It gains interest in a bank
2. a. £840 b. £24840
3. a. £196 b. £16·33 c. £81·65
4. £98
5. £178·66
6. £55·62
7. a. £1·70 b. £110 c. 40p d. £40
   e. 3p f. £15
8. £24840
9. £1250
10. £5·05
11. a. £459·90 b. £84·90
12. a. £236·50 b. £131·25
13. 15 x 3·05 = £45·75
14. a. 546 eoros b. £375·46

Non Calculator Exercise No. 4

1. a. 4055 b. 8 c. 17 d. 6
   e. 100 f. 7 g. 96000 h. 900
2. a. 7·317 b. 2·88 c. 10·5 d. 4·8
   e. 67·5 f. 0·037 g. 172·88 h. 2·3
3. £474·24
4. a. $4\frac{2}{3}$ b. $2\frac{4}{9}$ c. $7\frac{3}{5}$ d. $21/2$
5. a. 18 b. 18 c. 22
6. a. $4\frac{9}{10}$ b. $3\frac{3}{4}$ c. $4\frac{4}{5}$ d. $71/7$
   e. $7\frac{1}{4}$ f. $1/3$
7. $3/4$ hour
8. a. $3/20$ b. $9/25$ c. $1/50$
9. a. £6 b. 180 c. 111 d. 30 m
   e. 56p f. 84
10. £420
11. see diagram
12. a. –20 b. –1 c. –72 d. 14
    e. –18 f. 6 g. 8 h. –140
    i. –88
13. a. 10·40 am b. 6·20 pm
14. 15 days

Answers to Chapter 9

Ex 1

1. A - H, B - F, C - I, D - G, E - J
2. Q
3. a. 8 cm and 4 cm b. 8 ÷ 4 = 2
   c. 4 cm and 2 cm d. 4 ÷ 2 = 2
   e. yes
4. a. 3 b. i) 3 iii) 3 iii) 3
5. a. 2 b. 16 cm
6. a. 2·5 b. 5 cm
7. a. 1·5 b. 36 cm
8. a. 5, 35 cm b. 4, 36 cm
   c. 2·5, 30 cm d. 3·5, 175 cm
9. a. 4·5 b. 72 cm
10. a. 6 b. 210 mm
11. a. 3·5 b. 140 cm
12. a. ($1/4$ or 0·25) b. 9 cm

Ex 2

1. a. 3 b. 21 cm
2. a. 1·8 b. 9 cm
3. 1·75 —> 14 cm
4. a. 2·5, 30 cm b. 2·25, 7·75 cm
   c. 3·5, 35 cm d. 6, 42 cm
5. 1·5 —> 15 cm
6. 12 —> 96 cm
7. a. ($1/4$ or 0·25) b. 5 cm
8. a. 0·4 b. 6 cm
9. a. 0·2 b. 5 cm
10. a. 0·8 b. 24 cm
11. a. 0·7 b. 0·6 c. no
    d. not similar

Review 9 — Circumferences

1. 8·5 cm
2. 14·6 cm
3. 32·97 cm
4. 144·44 cm
5. a. 7 cm b. 22 cm
6. 18·84 cm
7. a. 40 cm b. 62·8 cm c. 251·2 cm

Answers to Chapter 10

Ex 1

1. a. 94·2 cm b. 109·9 cm
2. 12·56 cm
3. a. 15·072 cm b. 3·768 cm
   c. 8·568 cm
4. a. 376·8 cm = 3·768 m
   b. 753·6 m c. 500
5. a. 62·27 mm b. 237·75 cm
6. 51·275 cm
7. Rect = 24 cm, Circle = 22 cm (Rectangle)
8. 242·8 cm
9. a. 188·4 m b. 68·4 m

Ex 2

1. a. 100 cm b. 3 m
   c. 600 mm
2. a. 14·3 cm b. 26·1 cm
3. a. 11 cm b. 12·5 cm
   c. 1200 cm
4. 6·5 cm
5. 25 mm
6. 42·0 cm
7. a. 12·7 m b. 19·1 m c. 31·8 m
8. 12·7 cm ÷ 2 = 6·35 cm
9. 5·41 cm

Ex 3

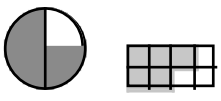
1. 50·24 cm^2
2. 254·34 cm^2
3. 153·86 cm^2
4. a. 28·26 cm^2 b. 530·66 cm^2
   c. 1962·5 cm^2 d. 63·585 cm^2
   e. 336·4 cm^2 f. 1·1304 cm^2
5. 706·5 cm^2
6. 254·34 cm^2
7. 4·52 m^2
8. a. 12·56 cm^2 b. 153·86 cm^2
   c. 1962·5 cm^2 d. 38·465 cm^2
   e. 1256 cm^2 f. 63·585 mm^2
9. 706·5 cm^2
10. 66·44 cm^2
11. 1017·36 mm^2
12. 1923 cm^2
13. 2462 mm^2
14. 1134 cm^2

Ex 4

1. a. 452·16 cm^2 b. 226·08 cm^2
2. 25·12 m^2
3. a. 6 m^2 b. 2 m
   c. 1·57 m^2 d. 7·57 m^2
4. 2806·5 m^2
5. a. 153·86 cm^2 b. 38·47 cm^2
6. 379·9 m^2
7. a. 240 cm^2 b. 200·96 cm^2
   c. 440·96 cm^2
8. a. 450 cm^2 b. 39·25 cm^2
   c. 410·75 cm^2
9. a. 1017·36 mm^2 b. 153·86 mm^2
   c. 863·5 mm^2
10. a. 350 cm^2 b. 113·05 cm^2
    c. 236·96 cm^2

Review 10 — Fractions

1. a. $2/5$ b. $3/10$
2. a. b.



3. a. $8/18$ b. $6/20$, $9/30$
4. a. $4/5$ b. $3/5$ c. $4/5$ d. $2/3$
5. a. 13 b. 14 c. 21 d. 50p
6. a. 24 b. 18 c. 20 d. £560
7. 35
8. a. $1/5$ b. $3/4$ c. $3/10$ d. $1/20$
9. a. 80 b. £9 c. 33 d. £2·40
   e. £60 f. £30 g. £3·50 h. 60p
   i. £2·37 j. £1·20
10. 32 11. 40 km

Non Calculator Exercise No. 5

1. a. 2048 b. 324 c. 2 d. 37
   e. 8600 f. 7 g. 169 h. 6
2. a. 65·22 b. 194·04 c. 4·2 d. 0·1728
3. £44·15
4. a. 4·02 tonnes b. 0·075 km
   c. 1·2 litres
5. a. $^2/_3$ b. $^1/_4$ c. $^4/_7$
6. a. 24 b. $3^1/_4$ c. $^5/_8$ d. $^1/_{28}$
   e. $8^3/_4$ f. $4^1/_6$
7. $^3/_5$
8. a. £72·50 b. £3·60
   c. 7·2 d. 154 ml
   e. £4·21 f. 5·6
9. £2080
10. a. -5 < 6 b. 6 > -9
    c. -11 < -9 d. 0 > -4
11. a. -4 b. -30 c. -3 d. 4
    e. 23 f. 99 g. -54 h. -26
    i. -40 j. -25 k. -80
12. a. 1200 b. 1245 c. 2355
13. a. 5 hr 45 mins b. 2 hr 30 mins
    c. 2 hr 50 mins
14. 1355

Answers to Chapter 11

Ex 1

1. a. 7:3 b. 3:7
2. a. 3:4 b. 4:3
3. a. 17:22 b. 22:17
4. a. 9:5 b. 5:9
5. a. 400:117 b. 500:77
   c. 500:400 d. 77:117
6. a. 3:1 b. 3:7 c. 3:9 d. 1:3
   e. 7:3 f. 3:9 g. 1:7
7. a. 7 cm by 4 cm
   b. 7:4 c. 4:7 d. 7:22 e. 22:28
8. a. 43:17 b. 43:60
9. a. 36:61 b. 36:25 c. 25:61

Ex 2

1. 3:2
2. 5:7
3. a. 3:5 b. 3:5 c. 1:5 d. 5:14
   e. 1:1 f. 3:1 g. 4:3 h. 9:5
   i. 2:1 j. 3:8 k. 4:5 l. 4:7
   m. 8:5 n. 11:3 o. 12:1 p. 1:5
   q. 1:100 r. 100:1 s. 1:2 t. 2:1
   u. 1:1000 v. 1:2000000000000000
4. a. 2:1 b. 5:1 c. 4:1 d. 2:1
5. a. 5:100 b 1:20
6. a. 18:6 b. 3:1
7. a. 10:1 b. 1:10
8. a. 180:150 b. 6:5
9. a. 30000:18000 b. 5:3
10. a. 960:880 b. 12:11
11. a. 120:24 b. 5:1
12. a. 40:28 b. 10:7

Ex 3

1. a. 12 b. 21 c. 6
2. a. 30 b. 32
3. a. 3 b. 10 c. 10
4. a. 9 b. 45 c. 60 d. 160
5. a. 35 b. i) 30 ii) 100
6. a. £350 b. £420
7. 42 kg
8. 100 mph
9. 630000
10. a. very dark orange b.light orange
    c. mid orange d. dark orange
    e. very light orange

Ex 4

1. Lucy – £120, Jane – £60
2. Carol – 200, Mike – 150
3. a. Iain – £400, Alex – £600
   b. Ann – £90, Jill – £30
   c. Sue – £3000, Davie – £12000
   d. Eric – £6, Andy – £15
   e. Dan – £16000, Judy – £12000
   f. Bob – £37500, Eva – £62500
   g. Pat – £175000, Mick – £75000
   h. Jennifer – 35p, Mary – 28p
   i. Lucy – £500, Jane – £700
4. a. 25:20 b. 5:4
   c. Will – £150000, Duncan – £120000
5. a. 2:3 b. Gregor – £180, Peter – £270
6. a. 3:2 b. Angela – £900, Carol – £600
7. a. 30:24:18 b. 5:4:3
   c. Louis – £1000000, Hugo – £800000, Stephano – £600000

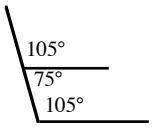
Review 11 — Angles

1. a. acute b. right c. obtuse d. reflex
   e. straight
2. a. <GNV b. <PZH c. <NDH d. <IWR
3. a. 30° b. 55° c. 140°
4. See drawings of
   a. <CAB = 75° b. <MPQ = 130°
5. w = 32°, x = 45°, y = 53°, z = 62°
6. a. 59° b. 70°, 40°
   c. 31°, 31°

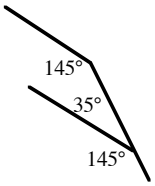
Answers to Chapter 12

Ex 1

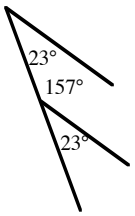
1. a. 135 b. 65 c. 120 d. 70
   e. 50 f. 136 g. 37 h. 122
   i. 52 j. 113 k. $24^1/_2$ l. 90
   m. 50 n. 120 p. 37
   q. 40 r. 70 s. 50 t. 65
   u. 30 v. 67
2. a.



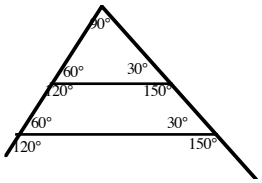
b



c.



d.



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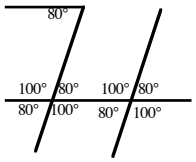

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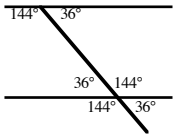
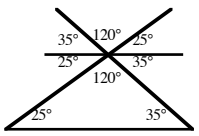


g.



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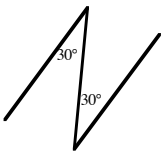

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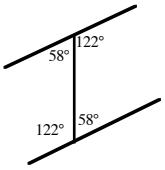

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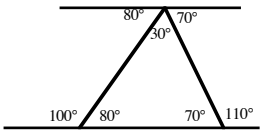
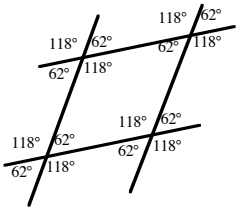
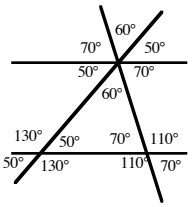


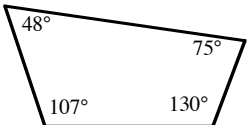
k.



l.



m.



Exploratory Exercises

1. all are 90°
2. all are 90°
3. Angle = 90°

Ex 2

1. a. 90° b. 65°
2. a. 90° b. 31°
3. a. 90° b. 48°
4. a. 69° b. 20° c. 45° d. 12°
5. a. 90°, 90° b. x = 59, y = 47
6. a. 40° b. 90° c. 50°
7. a. 55° b. 90° c. 35°
8. a. 90° b. 60° c. 120°
9. a. 25, 90, 65 b. 90, 18, 162
   c. 90, 10, 100 d. 40, 90, 50
   e. 35, 90, 55 f. 90, 32, 32, 148

Ex 3

1. a. right angled triangle b. 5 cm
2. a. right angled triangle b. 13 cm
3. a. 15 cm b. 26 cm
   c. 14·1 cm d. 11·4 cm
   e. 8·5 m f. 30·2 m
4. 12 cm
5. a. right angled triangle b. 8 cm

6. a. right angled triangle b. 28·6 cm

7. a. 4·6 cm b. 19·2 cm
c. 9·2 cm d. 22·3 m
e. 11·4 m f. 10·7 cm

8. a. 24 cm b. 216 cm^2

9. a. right angled triangle b. 26 cm
c. right angled triangle d. 22·5 cm

10. 25·6 cm
11. a. 26·4 m b. 8·1 m c. 39·1 mm
12. p = 5·7 cm, q = 9·4 cm, r = 6·9 cm, s = 105 mm
13. a. 2·18 m b. 4·28 m
14. x = 21·2 cm

Review 12 — Trigonometry

1. a. 0·466 b. 1·732 c. 1·313
2. a. 8·29 cm b. 28·9 nn
c. 11·5 cm
3. 31·7 mm
4. a. 28° b. 75° c. 55·5°
5. a. 24° b. 31·9° c. 36·5°
6. 24°

Non Calculator Exercise No. 6

1. a. 1855 b. 703 c. 100 d. 1792
e. 13500 f. 5 g. 70 h. 616
2. £3900
3. a. 2·75 b. 2·536 c. 1·15 d. 0·018
e. 0·0054 f. 121·056 g. 21·66 h. 5·48
4. 23
5. a. 15 b. 91 c. 240

6. a. $^{3}/_{20}$ b. $5^{1}/_{6}$ c. $4^{1}/_{2}$ d. $22^{2}/_{5}$

e. 1 f. $3^{3}/_{8}$

7. £25

8. a. 50% b. 60%
9. a. 1·6 b. £4·80 c. 0·012 d. 7
e. 146 f. 20p
10. £128 + £3200 = £3328
11. a. -1 b. -36 c. -50 d. -36
e. 9 f. 37
12. 18°C
13. a. 16 days b. 26th April

Answers to Chapter 13

Ex 1

1. a. 0·342 b. 0·883 c. 0·946 d. 0·276
e. 0·559 f. 0·819 g. 0·500 h. 0·522
i. 0·960 j. 0·934 k. 1·000 l. 0·969
2. 11·35 cm
3. a. 10·5 cm b. 7·97 cm
c. 21·15 cm d. 28·03 cm
e. 5·92 m f. 108·15 m
g. 15·51 cm h. 17·19 cm
i. 10·06 cm
4. 2·97 m
5. 2·56 m
6. 1·65 m
7. 10·39 cm

Ex 2

1. a. 22° b. 34° c. 51° d. 81°
e. 12° f. 44° g. 36·5° h. 54·5°
i. 27·8° j. 72·4° k. 87·4° l. 3·5°
2. 23·6°
3. 45·1°
4. a. 48·6° b. 51·8° c. 30° d. 50·9°
e. 59° f. 47·5° g. 44·7° h. 58·6°
i. 39·5°
5. a. any 2, but let us use 10·5 and 17·5
b. 36·9°
6. 57·1°
7. a. AB = 6 cm b. x = 30°
8. 61·6°
9. a. 6·76 cm b. 37·9°

Ex 3

1. a. 0·866 b. 0·5 c. 0·309 d. 0·105
e. 0·906 f. 0·669 g. 0·656 h. 0·511
i. 0·568 j. 0·790 k. 0·233 l. 0·967
2. 16·6 cm
3. a. 8·43 cm b. 10·97 cm
c. 15·51 cm d. 7·42 m
e. 2·80 cm f. 22·0 m
g. 64·01 mm h. 72·3 cm
i. 2·50 cm
4. 37·3 cm
5. 6·74 cm
6. a. 75° b. 41° c. 33° d. 30°
e. 15° f. 63° g. 70·5° h. 62·5°
i. 84° j. 72·3° k. 18·4° l. 38·1°
7. 47·2°
8. 35·7°
9. a. 41·4° b. 46·2° c. 32·2° d. 37·4°
e. 40·8° f. 60·5° g. 32·9° h. 55·2°
i. 45° j. 42·4° k. 33·8° l. 63·6°

Ex 4

1. a. adj b. opp c. tan d. 7·46 cm
2. a. hyp b. opp c. sin d. 12·62 cm
3. a. hyp b. adj c. cos d. 6·37 cm
4. a. 8·12 cm b. 8·73 cm
c. 15·89 cm d. 4·23 cm
e. 6·80 cm f. 10·82 cm
g. 23·14 m h. 102·3 m
i. 3·13 cm
5. a. opp, adj b. tan c. 37·9°
6. a. opp, hyp b. sin c. 61·0°
7. a. adj, hyp b. cos c. 22·8°
8. a. 55° b. 33·6° c. 37·1° d. 46·8°
e. 46·3° f. 26·2° g. 40·7° h. 41·4°
i. 40·1°
9. 50·3°
10. 2·52 m
11. a. 12·0 cm b. 35 cm
c. 420 cm^2
12. a. 3·63 cm b. 7·13 cm
c. 10·10 cm
d. 14·26 cm by 13·73 cm

Review 13 — Time/Dist/Speed

1. 212 miles
2. Yes (doing 80 mph)
3. 98 km (hr)
4. 5 hr 30 mins
5. 1515
6. a. 11·00 am
b. i) 60 miles ii) 40 miles
c. 1 hour d. 20 miles
e. 60 mph f. 50 mph

Answers to Chapter 14

Ex 1

1. a. 9 b. 1 c. 20 d. 40
e. 24 f. 40 g. 60 h. 1
i. 2·5 j. 10 k. 2 l. 3
2. a. 15 b. 3 c. 54 d. 54
e. 60 f. 36 g. 36 h. 81
i. 2916 j. 12 k. 27 l. 1
3. a. 16 b. 5 c. 9 d. 14
e. 14 f. 14 g. 5 h. 50
i. 10 j. 50 k. 10 l. 7

m. 90 n. 5 o. 1 p. $^{1}/_{2}$

q. 11 r 29 s. 7 t. 10
u. 2 v. 100 w 25 x. 1

4. a. $1^{1}/_{2}$ b. 1 c. $^{1}/_{2}$ d. 0

e. 9 f. 18 g. 36 h. 4
i. 6 j. 36 k. 6 l. 36
m. 0 n. 0 o. 4 p. 2
5. a. 86p b. 88p c. £1·15 d. £2
6. a. 2100 g b. 2525 g

Ex 2

1. 80
2. a. 30 b. i) 3 ii) 4
3. 40
4. £12·50
5. no (loss of £10)
6. 400
7. 240 miles
8. 5 cm
9. 40 cm^2
10. a. £25 b. £35 c. £55
11. a. £49 b. possibly postage
12. 215 minutes
13. 68°F
14. 12 cm

Ex 3

1. a. 3 b. 225 c. 90 d. 410
e. 51 f. 1950 g. 3140 h. 16
i. 48 j. 45 k. 10 l. 45
m. 35 n. 64 o. 77 p. 10
q. 26 r 225 s. 4500 t. 80
u. 100 v. 6280 w 46
2. 38 cm
3. a. 16°C b. 25°C c. 43°C d. 70%
4. 15
5. 84
6. 150
7. 28
8. 16
9. 8
10. 42
11. 5
12. 40
13. 1000

Review 14 — Patterns

1. a. 8 b. S = 8 x C
2. S = 5 x P
3. a. 3 b. C = 3T + 4
4. T = 6 x w + 1

Non Calculator Exercise No. 7

1. a. 7062 b. 2276 c. 2680 d. 697
e. 196 f. 6750 g. 54 h. 6
2. a. 9·77 b. 3·42 c. 24·78 d. 8·79
e. 72·6 f. 91·8 g. 0·441 h. 0·013
3. a. 2750 b. 40 c. 7·05 d. 2060
e. 4·015 f. 6·75 g. 437 h. 80
4. a. 48 b. 100 c. 2070

5. a. $^{2}/_{3}$ b. $^{1}/_{4}$ c. $^{1}/_{3}$

6. a. 1 b. $^{5}/_{8}$ c. $10^{1}/_{4}$ d. $^{5}/_{8}$

e. $^{8}/_{21}$ f. 17

7. a. $3^{4}/_{5}$ b. $4^{4}/_{7}$ c. $6^{2}/_{3}$

8. a. $^{7}/_{20}$ b. $^{9}/_{10}$ c. $^{1}/_{25}$

9. a. £4·50 b. 18 c. 16 d. 2000
e. 27 f. £0·24
10. a. 0·72 b. 0·03 c. 0·175
11. a. 34 b. -4 c. 9 d. -14
e. -9 f. -35 g. 10 h. 1
i. 11 j. -24 k. -56
12. a. 1·45 am b. 10·15 pm
c. 1·59 pm
13. a. 1 hr 5 mins b. 4 hr

Answers to Chapter 15

Ex 1

1. a. 3x + 3 b. 4x – 12
c. 2x + 18 d. 6x – 30
e. 5t – 10 f . 7p – 21
g. 10b + 80 h. 15m + 30
i. 11h + 11 j. 4x + 4y
k. 6a – 6b l. 3f – 3g
m. 9e + 9f n. 3a + 3b + 12
o. 5x + 5y – 15 p. 10x – 10y – 10
q. 12x + 20 r. 12a – 9
s. 20p – 35 t. 35t + 14
u. 30m – 12
2. a. 3x + 7 b. 2x + 13
c. 5p + 4 d. 5h + 16
e. 5m – 12 f. 2x – 7
g. 7y – 12 h. 13x + 10
i. 8d – 9 j. 2x + 5
k. 3x + 10 l. 8x + 1
m. 15t + 4 n. 5x + 11
o. 9g + 21 p. 6w
q. 21b + 13 r. 17n + 9

Ex 2

1. a. yes b. no c. no d. yes
e. yes f. no g. yes h. no
i. yes
2. a. 1,2,5,10 b. 1,2,13,16
c. 1,2,3,4,6,12
d. 1,2,4,5,10,20
e. 1,2,3,4,6,8,12,24
3. a. 1,2,4,8 b. 1,2,7,14
c. 1,17
d. 1,2,3,5,6,10,15,30
e. 1,2,3,4,6,9,12,18,36
f. 1,2,5,10,25,50 g. 1,23
h. 1,2,4,5,10,20,25,50,100
i. 1,2,3,4,5,6,10,12,15,20,30,60
j. 1,3,9,27

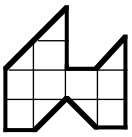
4. a. 1,2,3,6,9,18 b. 1,3,9,27
c. 1,3,9 d. 9
5. a. 3 b. 5 c. 3 d. 10
e. 6 f. 7 g. 5 h. 5
i. 4 j. 5 k. 10 l. 9
m. 12

Ex 3

1. a. 4(x + 5) b. 3(x + 7)
c. 5(x – 3) d. 2(x + 9)
e. 7(p + 5) f. 10(m + 7)
g. 6(a – 6) h. 9(t + 2)
i. 15(m + 2) j. 8(d + 5)
k. 3(f + 12) l. 11(z – 5)
2. a. 5(x – 3) b. 7(x + 1)
c. 3(x – 8) d. 2(x + 20)
e. 10(t – 2) f. 4(a + 2b)
g. 6(m – 3n) h. 5(g + 5h)
i. 6(p – 7q) j. 7(d + e)
k. 8(x – 10y) l. 15(b + 2c)
3. a. 4(2x – 3) b. 3(3x + 5)
c. 2(2x – 9) d. 3(2x + 1)
e. 4(3x – 2) f. 5(2x + 5)
g. 10(2x – 3) h. 8(2x + 5)
i. 4(3x – 5) j. 7(3x + 2y)
k. 9(2x – 3y) l. 5(3x + 11y)
4. a. 2(2x + 9) b. 6(2x – 1)
c. 4(2x + 5) d. 3(3x + 7)
e. 3(2a + 3) f. 5(2p + 7)
g. 4(3c + 4) h. 2(4n + 5)
i. 3(5h – 4) j. 4(5t + 6)
k. 5(5w + 9) l. 4(4f – 5)
m. 5(3m + 3) n. 7(2d – 5)
o. 4(2x + 9) p. 10(5s + 4t)
q. 3(3m – 7n) r. 5(3u – 7)
s. 6(2g + 3h) t. 5(5c + 19d)
u. 2(3r – 10s) v. 5(3m – 8n)
w. 8(3d – 4e) x. 11(4m + 7n)
5. a. a(b + c) b. p(m – n)
c. x(t + s) d. m(n + 1)
e. u(v – 1) f. d(e + f)
g. a(b + c + d) h. p(i + j + k)
i. w(a + b + 1) j. a(b + 2)
k. p(q + 3) l. m(5 + n)
m. a(6 + b) n. e(f – 7)
o. a(a + b)
6. a. 2(x + y + z) b. 3(a – b + c)
c. 2(p + 2q + 3r) d. 5(m – 2n + 4)
e. 6(s + 3t + 4) f. 10(a – 4b + 8c)
g. 2(3x + 4y + 5) h. 3(4a – 3b + 2c)
i. 5(3p – 2q + 5r) j. a(b + c + d)
k. p(r – s + 1)
l. 2a(b + 2c + 3d)

Review 15 — Scales/Enlargement

1. Two times enlargement



2. 175 cm
3. a. 2·5 cm by 4·5 cm
b. 50ft by 90 ft
4. Scale drawing 6 cm by 2·5 cm
5. a. Scale drawing b. 18 cm c. 90 m
6. a. S.W. b. 135° clockwise c. S.E.

Answers to Chapter 16

Ex 1

1. a. 57 mm b. 63 mm
2. a. 19 – 21 b. 30 – 40
c. 14 – 18 d. 12 – 18
e. 146 – 154 f. 73 – 77
g. 340 – 360 h. 105 – 135
i. 80 – 120 j. 9·5 – 9·7
k. 7·3 – 7·7 l. 19·4 – 20·0
m. 23·1 – 23·3 n. 9·7 – 10·3
o. 29·5 – 30·5 p. 84·5 – 85·5
q. 3·9 – 4·5 r. 48·5 – 51·5
3. a. 9·22 – 9·24 b. 6·42 – 6·48
c. 18·2 – 18·3 d. 0·80 – 0·88
e. 10·18 – 10·28 f. 24·54 – 24·60
g. 4·96 – 5·00 h. 3·145 – 3·149
i. 8·060 – 8·066
4. a. (42 – 48) mm
b. i) OK ii) OK iii) reject
iv) reject v) reject vi) OK
vii) OK viii) OK
5. a. (6·3 – 6·7) cm b. No
6. a. yes b. yes c. yes d. no e. no
7. a. 10·21 secs b. 10·25 secs
8. a. 0·120 kg b. 0·130 kg
9. a. (145 – 155) ml b. yes

Ex 2

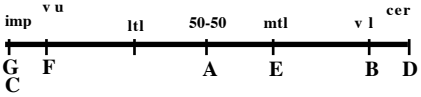
1. (90±10) m
2. (23±3)°C
3. a. (19±1) cm b. (55±5) cm
c. (10·5±0·5) cm d. (130±10) m
e. (4·5±0·5) kg f. (40±3) mm
g. (6·4±0·2) m h. (10·3±0·2) cm
i. (1±0·1) cm j. (20·5±0·3)cm
k. (10±0·2) cm l. (800±100) km
4. a. (6·33±0·01) cm b. (8·07±0·02) cm
c. (0·26±0·02) cm d. (10·74±0·03) cm
e. (9·4±0·02) cm f. (0·07±0·02) cm
g. (1±0·05) m h. (0·065±0·003)cm
5. a. (6·5±0·3) decibels
b. i) too quiet ii) just right
iii) just right iv) too loud
6. (32000±2000) feet
7. (106±6) words per minute
8. (70±5) grams
9. a. £(8±0·20) b. no
10. (56±4) seconds
11. a. (3·27±0·03) grams
b. i) yes ii) no iii) yes iv) no
12. a. (350±10) ml b. no

Review 16 — Statistics/Probability

1. a. Sydney b. 48 mm
c. 38 mm d. 51 mm
e. Glasgow
f. New York & London – 64 mm
g. London
2. a. i) 65p ii) £1·10
b. 2002 c. dropped in price
d. CD by 90p instead of 40p
e. 90p f. 4p
3. a. 30° b. $^1/_4$
c, i) 9 ii) 3 iii) 15
4. a. 5,7,7,7,9,10,12,12,13,13,14,15
b. 11 c. 7
5. a.

2	4 6 8
3	0 1 5 7 8 9
4	1 2 2 2 3 5 6 6 8 8 9
5	0 1 1 1 2 2 3 4 5 6 7 9
6	0

b. 46 c. 16
6.



7. a. $^1/_{12}$ b. $^1/_2$ c. $^{11}/_{12}$ d. $^1/_3$
e. 0 f. 1
8. a. $^1/_8$ b. $^1/_2$ c. $^5/_8$
9. a. $^2/_5$ b. 18 women - 12 men
10. a. $^1/_5$ ($^4/_{20}$)

Non Calculator Exercise No. 8

1. a. 612 b. 95 c. 120900 d. 6321
e. 5955 f. 3 g. 625 h. 34
2. a. 123·2 b. 93·42 c. 18·8 d. 8264
e. 22·1 f. 10·543 g. 40·905 h. 1·04
3. a. 1800 b. 200 c. 323
4. a. $^3/_4$ b. $^4/_5$ c. $^3/_4$
5. a. $^1/_2$ b. $1^1/_4$ c. $^7/_{20}$ d. $3^1/_2$
e. $22^1/_2$ f. $^8/_{11}$ g. $3^1/_{10}$ f. $11^1/_6$
6. a. $2^1/_6$ b. $3^1/_8$ c. $7^1/_7$
7. a. $^1/_5$ b. $^3/_5$ c. $^2/_3$
8. a. £30 b. £1·50 c. 600 d. 77
e. 18 f. 250
9. a. 50% b. 25% c. 20% d. 80%
10. a. 47% b. 6% c. $62^1/_2$%
11. a. 13 b. 6 c. 8 d. 14
e. -17 f. -15 g. -21 h. 11
i. 17 j. 9 k. -49
12. a. 18 b. Oct 23rd
13. a. 2 hr 30 mins b. 1 hr 15 mins
c. 3 hr 12 mins
14. a. 2 hr 30 mins b. 1 hr 25 mins

Answers to Chapter 17

Ex 1

1. a. £6 b. £42
2. a. 1·56€ b. 10·92€
3. 3200 m
4. £200
5. a. 1·5 b. 15 c. 30 d. 90
6. 144 cm
7. £12·00
8. 5·4 kg

Ex 2

1. a. C = Kt b. K = 35 –> £175
2. a. W = Kp b. K = 60 –> 540 g
3. a. V = Kt b. K = 4 –> 100 l
4. a. H = kt b. k = 120 –> 1800 m
5. a. g = kn b. K = 2·5 c. 112·5 g
6. a. T = kt b. K = 9 c. 99°C
7. a. C = kn b. K = 3·5 c. £63
8. a. D = kh b. K = 32 –> 768 km
9. a. V = ki b. K = 4 –> 32 volts
10. a. w = Kn –> K = 4·2 b. 50·4 cm
11. a. d = Kt –> d = 3·2t b. 192 m

Non Calculator Exercise No. 9

1. a. 10592 b. 2641 c. 1641200 d. 874
e. 6 f. 64 g. 10 h. 76
2. a. 44·317 b. 11·815 c. 2·6 d. 0·25
e. 45·44 f. 8538 g. 0·2307 h. 0·32
3. a. 2095 b. 470 c. 5·04 d. 1015
4. a. 20 b. 12
5. a. $2^1/_2$ b. $2^1/_7$ c. $4^3/_5$ d. $11^1/_2$
e. 27 f. $2^5/_8$ g. $^1/_4$
6. a. $^5/_6$ b. $^6/_7$ c. $^5/_8$
7. a. 0·95 b. 0·08 c. 0·147
8. a. 70p b. £11·50 c. £0·80 d. 48p
e. £600 f. £12
9. a. 60% b. 126
10. -15, -12, -7, -6, 2, 5, 7, 13
11. a. 6 b. -10 c. -4 d. -56
e. -56 f. -44 g. -12 h. 7
i. -1 j. 0 k. -30
12. a. 2·45 pm b. 10·12 am
c. 11·58 pm
13. a. 3·25 b. 2·75
14. 48 days

Non Calculator Exercise No. 10

1. a. 1512 b. 319 c. 13 d. 29
e. 81000 f. 80 g. 32 h. $^{14}/_5$
2. a. 69·23 b. 175·86 c. 8·4 d. 0·966
3. 21·72 m
4. a. 0·085 b. 2075 c. 250
d. 3 mins 20 secs
5. a. $^7/_8$ b. $^4/_5$ c. $^{13}/_{15}$
6. a. 160 b. $4^3/_4$ c. $^1/_8$ d. $^1/_2$
e. $15^3/_4$ f. $4^3/_{10}$ g. $^1/_9$
7. $^3/_4$
8. a. 9 b. 34p c. 150 d. 35p
e. 86 f. 150
9. £36 –> £84
10. a. -2 b. -50 c. 0 d. 12
e. 22 f. 51 g. -32 h. -120
i. -12 j. 20 k. -170
11. a. 1155 b. 0555 c. 1445
12. a. 3 hr 55 mins b. 3 hr 15 mins
13. a. no b. yes c. no

TeeJay's Tables

Tables of Tangents, Sines and Cosines of all angles from 0° to 90°

Tangents (0° - 44·9°)

Angle	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9
0	0·000	0·002	0·003	0·005	0·007	0·009	0·010	0·012	0·014	0·016
1	0·017	0·019	0·021	0·023	0·024	0·026	0·028	0·030	0·031	0·033
2	0·035	0·037	0·038	0·040	0·042	0·044	0·045	0·047	0·049	0·051
3	0·052	0·054	0·056	0·058	0·059	0·061	0·063	0·065	0·066	0·068
4	0·070	0·072	0·073	0·075	0·077	0·079	0·080	0·082	0·084	0·086
5	0·087	0·089	0·091	0·093	0·095	0·096	0·098	0·100	0·102	0·103
6	0·105	0·107	0·109	0·110	0·112	0·114	0·116	0·117	0·119	0·121
7	0·123	0·125	0·126	0·128	0·130	0·132	0·133	0·135	0·137	0·139
8	0·141	0·142	0·144	0·146	0·148	0·149	0·151	0·153	0·155	0·157
9	0·158	0·160	0·162	0·164	0·166	0·167	0·169	0·171	0·173	0·175
10	0·176	0·178	0·180	0·182	0·184	0·185	0·187	0·189	0·191	0·193
11	0·194	0·196	0·198	0·200	0·202	0·203	0·205	0·207	0·209	0·211
12	0·213	0·214	0·216	0·218	0·220	0·222	0·224	0·225	0·227	0·229
13	0·231	0·233	0·235	0·236	0·238	0·240	0·242	0·244	0·246	0·247
14	0·249	0·251	0·253	0·255	0·257	0·259	0·260	0·262	0·264	0·266
15	0·268	0·270	0·272	0·274	0·275	0·277	0·279	0·281	0·283	0·285
16	0·287	0·289	0·291	0·292	0·294	0·296	0·298	0·300	0·302	0·304
17	0·306	0·308	0·310	0·311	0·313	0·315	0·317	0·319	0·321	0·323
18	0·325	0·327	0·329	0·331	0·333	0·335	0·337	0·338	0·340	0·342
19	0·344	0·346	0·348	0·350	0·352	0·354	0·356	0·358	0·360	0·362
20	0·364	0·366	0·368	0·370	0·372	0·374	0·376	0·378	0·380	0·382
21	0·384	0·386	0·388	0·390	0·392	0·394	0·396	0·398	0·400	0·402
22	0·404	0·406	0·408	0·410	0·412	0·414	0·416	0·418	0·420	0·422
23	0·424	0·427	0·429	0·431	0·433	0·435	0·437	0·439	0·441	0·443
24	0·445	0·447	0·449	0·452	0·454	0·456	0·458	0·460	0·462	0·464
25	0·466	0·468	0·471	0·473	0·475	0·477	0·479	0·481	0·483	0·486
26	0·488	0·490	0·492	0·494	0·496	0·499	0·501	0·503	0·505	0·507
27	0·510	0·512	0·514	0·516	0·518	0·521	0·523	0·525	0·527	0·529
28	0·532	0·534	0·536	0·538	0·541	0·543	0·545	0·547	0·550	0·552
29	0·554	0·557	0·559	0·561	0·563	0·566	0·568	0·570	0·573	0·575
30	0·577	0·580	0·582	0·584	0·587	0·589	0·591	0·594	0·596	0·598
31	0·601	0·603	0·606	0·608	0·610	0·613	0·615	0·618	0·620	0·622
32	0·625	0·627	0·630	0·632	0·635	0·637	0·640	0·642	0·644	0·647
33	0·649	0·652	0·654	0·657	0·659	0·662	0·664	0·667	0·669	0·672
34	0·675	0·677	0·680	0·682	0·685	0·687	0·690	0·692	0·695	0·698
35	0·700	0·703	0·705	0·708	0·711	0·713	0·716	0·719	0·721	0·724
36	0·727	0·729	0·732	0·735	0·737	0·740	0·743	0·745	0·748	0·751
37	0·754	0·756	0·759	0·762	0·765	0·767	0·770	0·773	0·776	0·778
38	0·781	0·784	0·787	0·790	0·793	0·795	0·798	0·801	0·804	0·807
39	0·810	0·813	0·816	0·818	0·821	0·824	0·827	0·830	0·833	0·836
40	0·839	0·842	0·845	0·848	0·851	0·854	0·857	0·860	0·863	0·866
41	0·869	0·872	0·875	0·879	0·882	0·885	0·888	0·891	0·894	0·897
42	0·900	0·904	0·907	0·910	0·913	0·916	0·920	0·923	0·926	0·929
43	0·933	0·936	0·939	0·942	0·946	0·949	0·952	0·956	0·959	0·962
44	0·966	0·969	0·972	0·976	0·979	0·983	0·986	0·990	0·993	0·997

Tangents (45° - 89·9°)

Angle	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9
45	1·000	1·003	1·007	1·011	1·014	1·018	1·021	1·025	1·028	1·032
46	1·036	1·039	1·043	1·046	1·050	1·054	1·057	1·061	1·065	1·069
47	1·072	1·076	1·080	1·084	1·087	1·091	1·095	1·099	1·103	1·107
48	1·111	1·115	1·118	1·122	1·126	1·130	1·134	1·138	1·142	1·146
49	1·150	1·154	1·159	1·163	1·167	1·171	1·175	1·179	1·183	1·188
50	1·192	1·196	1·200	1·205	1·209	1·213	1·217	1·222	1·226	1·230
51	1·235	1·239	1·244	1·248	1·253	1·257	1·262	1·266	1·271	1·275
52	1·280	1·285	1·289	1·294	1·299	1·303	1·308	1·313	1·317	1·322
53	1·327	1·332	1·337	1·342	1·347	1·351	1·356	1·361	1·366	1·371
54	1·376	1·381	1·387	1·392	1·397	1·402	1·407	1·412	1·418	1·423
55	1·428	1·433	1·439	1·444	1·450	1·455	1·460	1·466	1·471	1·477
56	1·483	1·488	1·494	1·499	1·505	1·511	1·517	1·522	1·528	1·534
57	1·540	1·546	1·552	1·558	1·564	1·570	1·576	1·582	1·588	1·594
58	1·600	1·607	1·613	1·619	1·625	1·632	1·638	1·645	1·651	1·658
59	1·664	1·671	1·678	1·684	1·691	1·698	1·704	1·711	1·718	1·725
60	1·732	1·739	1·746	1·753	1·760	1·767	1·775	1·782	1·789	1·797
61	1·804	1·811	1·819	1·827	1·834	1·842	1·849	1·857	1·865	1·873
62	1·881	1·889	1·897	1·905	1·913	1·921	1·929	1·937	1·946	1·954
63	1·963	1·971	1·980	1·988	1·997	2·006	2·014	2·023	2·032	2·041
64	2·050	2·059	2·069	2·078	2·087	2·097	2·106	2·116	2·125	2·135
65	2·145	2·154	2·164	2·174	2·184	2·194	2·204	2·215	2·225	2·236
66	2·246	2·257	2·267	2·278	2·289	2·300	2·311	2·322	2·333	2·344
67	2·356	2·367	2·379	2·391	2·402	2·414	2·426	2·438	2·450	2·463
68	2·475	2·488	2·500	2·513	2·526	2·539	2·552	2·565	2·578	2·592
69	2·605	2·619	2·633	2·646	2·660	2·675	2·689	2·703	2·718	2·733
70	2·747	2·762	2·778	2·793	2·808	2·824	2·840	2·856	2·872	2·888
71	2·904	2·921	2·937	2·954	2·971	2·989	3·006	3·024	3·042	3·060
72	3·078	3·096	3·115	3·133	3·152	3·172	3·191	3·211	3·230	3·251
73	3·271	3·291	3·312	3·333	3·354	3·376	3·398	3·420	3·442	3·465
74	3·487	3·511	3·534	3·558	3·582	3·606	3·630	3·655	3·681	3·706
75	3·732	3·758	3·785	3·812	3·839	3·867	3·895	3·923	3·952	3·981
76	4·011	4·041	4·071	4·102	4·134	4·165	4·198	4·230	4·264	4·297
77	4·331	4·366	4·402	4·437	4·474	4·511	4·548	4·586	4·625	4·665
78	4·705	4·745	4·787	4·829	4·872	4·915	4·959	5·005	5·050	5·097
79	5·145	5·193	5·242	5·292	5·343	5·396	5·449	5·503	5·558	5·614
80	5·671	5·730	5·789	5·850	5·912	5·976	6·041	6·107	6·174	6·243
81	6·314	6·386	6·460	6·535	6·612	6·691	6·772	6·855	6·940	7·026
82	7·115	7·207	7·300	7·396	7·495	7·596	7·700	7·806	7·916	8·028
83	8·144	8·264	8·386	8·513	8·643	8·777	8·915	9·058	9·205	9·357
84	9·514	9·677	9·845	10·02	10·20	10·39	10·58	10·78	10·99	11·20
85	11·43	11·66	11·91	12·16	12·43	12·71	13·00	13·30	13·62	13·95
86	14·30	14·67	15·06	15·46	15·89	16·35	16·83	17·34	17·89	18·46
87	19·08	19·74	20·45	21·20	22·02	22·90	23·86	24·90	26·03	27·27
88	28·64	30·14	31·82	33·69	35·80	38·19	40·92	44·07	47·74	52·08
89	57·29	63·66	71·62	81·85	95·49	114·6	143·2	191·0	286·5	578·0

Sines (0° - 44·9°)

Angle	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9
0	0·000	0·002	0·003	0·005	0·007	0·009	0·010	0·012	0·014	0·016
1	0·017	0·019	0·021	0·023	0·024	0·026	0·028	0·030	0·031	0·033
2	0·035	0·037	0·038	0·040	0·042	0·044	0·045	0·047	0·049	0·051
3	0·052	0·054	0·056.	0·058	0·059	0·061	0·063	0·065	0·066	0·068
4	0·070	0·071	0·073	0·075	0·077	0·078	0·080	0·082	0·084	0·085
5	0·087	0·089	0·091	0·092	0·094	0·096	0·098	0·099	0·101	0·103
6	0·105	0·106	0·108	0·110	0·111	0·113	0·115	0·117	0·118	0·120
7	0·122	0·124	0·125	0·127	0·129	0·131	0·132	0·134	0·136	0·137
8	0·139	0·141	0·143	0·144	0·146	0·148	0·150	0·151	0·153	0·155
9	0·156	0·158	0·160	0·162	0·163	0·165	0·167	0·168	0·170	0·172
10	0·174	0·175	0·177	0·179	0·181	0·182	0·184	0·186	0·187	0·189
11	0·191	0·193	0·194	0·196	0·198	0·199	0·201	0·203	0·204	0·206
12	0·208	0·210	0·211	0·213	0·215	0·216	0·218	0·220	0·222	0·223
13	0·225	0·227	0·228	0·230	0·232	0·233	0·235	0·237	0·239	0·240
14	0·242	0·244	0·245	0·247	0·249	0·250	0·252	0·254	0·255	0·257
15	0·259	0·261	0·262	0·264	0·266	0·267	0·269	0·271	0·272	0·274
16	0·276	0·277	0·279	0·281	0·282	0·284	0·286	0·287	0·289	0·291
17	0·292	0·294	0·296	0·297	0·299	0·301	0·302	0·304	0·306	0·307
18	0·309	0·311	0·312	0·314	0·316	0·317	0·319	0·321	0·322	0·324
19	0·326	0·327	0·329	0·331	0·332	0·334	0·335	0·337	0·339	0·340
20	0·342	0·344	0·345	0·347	0·349	0·350	0·352	0·353	0·355	0·357
21	0·358	0·360	0·362	0·363	0·365	0·367	0·368	0·370	0·371	0·373
22	0·375	0·376	0·378	0·379	0·381	0·383	0·384	0·386	0·388	0·389
23	0·391	0·392	0·394	0·396	0·397	0·399	0·400	0·402	0·404	0·405
24	0·407	0·408	0·410	0·412	0·413	0·415	0·416	0·418	0·419	0·421
25	0·423	0·424	0·426	0·427	0·429	0·431	0·432	0·434	0·435	0·437
26	0·438	0·440	0·442	0·443	0·445	0·446	0·448	0·449	0·451	0·452
27	0·454	0·456	0·457	0·459	0·460	0·462	0·463	0·465	0·466	0·468
28	0·469	0·471	0·473	0·474	0·476	0·477	0·479	0·480	0·482	0·483
29	0·485	0·486	0·488	0·489	0·491	0·492	0·494	0·495	0·497	0·498
30	0·500	0·502	0·503	0·505	0·506	0·508	0·509	0·511	0·512	0·514
31	0·515	0·517	0·518	0·520	0·521	0·522	0·524	0·525	0·527	0·528
32	0·530	0·531	0·533	0·534	0·536	0·537	0·539	0·540	0·542	0·543
33	0·545	0·546	0·548	0·549	0·550	0·552	0·553	0·555	0·556	0·558
34	0·559	0·561	0·562	0·564	0·565	0·566	0·568	0·569	0·571	0·572
35	0·574	0·575	0·576	0·578	0·579	0·581	0·582	0·584	0·585	0·586
36	0·588	0·589	0·591	0·592	0·593	0·595	0·596	0·598	0·599	0·600
37	0·602	0·603	0·605	0·606	0·607	0·609	0·610	0·612	0·613	0·614
38	0·616	0·617	0·618	0·620	0·621	0·623	0·624	0·625	0·627	0·628
39	0·629	0·631	0·632	0·633	0·635	0·636	0·637	0·639	0·640	0·641
40	0·643	0·644	0·645	0·647	0·648	0·649	0·651	0·652	0·653	0·655
41	0·656	0·657	0·659	0·660	0·661	0·663	0·664	0·665	0·667	0·668
42	0·669	0·670	0·672	0·673	0·674	0·676	0·677	0·678	0·679	0·681
43	0·682	0·683	0·685	0·686	0·687	0·688	0·690	0·691	0·692	0·693
44	0·695	0·696	0·697	0·698	0·700	0·701	0·702	0·703	0·705	0·706

Sines (45° - 89·9°)

Angle	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9
45	0·707	0·708	0·710	0·711	0·712	0·713	0·714	0·716	0·717	0·718
46	0·719	0·721	0·722	0·723	0·724	0·725	0·727	0·728	0·729	0·730
47	0·731	0·733	0·734	0·735	0·736	0·737	0·738	0·740	0·741	0·742
48	0·743	0·744	0·745	0·747	0·748	0·749	0·750	0·751	0·752	0·754
49	0·755	0·756	0·757	0·758	0·759	0·760	0·762	0·763	0·764	0·765
50	0·766	0·767	0·768	0·769	0·771	0·772	0·773	0·774	0·775	0·776
51	0·777	0·778	0·779	0·780	0·782	0·783	0·784	0·785	0·786	0·787
52	0·788	0·789	0·790	0·791	0·792	0·793	0·794	0·795	0·797	0·798
53	0·799	0·800	0·801	0·802	0·803	0·804	0·805	0·806	0·807	0·808
54	0·809	0·810	0·811	0·812	0·813	0·814	0·815	0·816	0·817	0·818
55	0·819	0·820	0·821	0·822	0·823	0·824	0·825	0·826	0·827	0·828
56	0·829	0·830	0·831	0·832	0·833	0·834	0·835	0·836	0·837	0·838
57	0·839	0·840	0·841	0·842	0·842	0·843	0·844	0·845	0·846	0·847
58	0·848	0·849	0·850	0·851	0·852	0·853	0·854	0·854	0·855	0·856
59	0·857	0·858	0·859	0·860	0·861	0·862	0·863	0·863	0·864	0·865
60	0·866	0·867	0·868	0·869	0·869	0·870	0·871	0·872	0·873	0·874
61	0·875	0·875	0·876	0·877	0·878	0·879	0·880	0·880	0·881	0·882
62	0·883	0·884	0·885	0·885	0·886	0·887	0·888	0·889	0·889	0·890
63	0·891	0·892	0·893	0·893	0·894	0·895	0·896	0·896	0·897	0·898
64	0·899	0·900	0·900	0·901	0·902	0·903	0·903	0·904	0·905	0·906
65	0·906	0·907	0·908	0·909	0·909	0·910	0·911	0·911	0·912	0·913
66	0·914	0·914	0·915	0·916	0·916	0·917	0·918	0·918	0·919	0·920
67	0·921	0·921	0·922	0·923	0·923	0·924	0·925	0·925	0·926	0·927
68	0·927	0·928	0·928	0·929	0·930	0·930	0·931	0·932	0·932	0·933
69	0·934	0·934	0·935	0·935	0·936	0·937	0·937	0·938	0·938	0·939
70	0·940	0·940	0·941	0·941	0·942	0·943	0·943	0·944	0·944	0·945
71	0·946	0·946	0·947	0·947	0·948	0·948	0·949	0·949	0·950	0·951
72	0·951	0·952	0·952	0·953	0·953	0·954	0·954	0·955	0·955	0·956
73	0·956	0·957	0·957	0·958	0·958	0·959	0·959	0·960	0·960	0·961
74	0·961	0·962	0·962	0·963	0·963	0·964	0·964	0·965	0·965	0·965
75	0·966	0·966	0·967	0·967	0·968	0·968	0·969	0·969	0·969	0·970
76	0·970	0·971	0·971	0·972	0·972	0·972	0·973	0·973	0·974	0·974
77	0·974	0·975	0·975	0·976	0·976	0·976	0·977	0·977	0·977	0·978
78	0·978	0·979	0·979	0·979	0·980	0·980	0·980	0·981	0·981	0·981
79	0·982	0·982	0·982	0·983	0·983	0·983	0·984	0·984	0·984	0·985
80	0·985	0·985	0·985	0·986	0·986	0·986	0·987	0·987	0·987	0·987
81	0·988	0·988	0·988	0·988	0·989	0·989	0·989	0·990	0·990	0·990
82	0·990	0·991	0·991	0·991	0·991	0·991	0·992	0·992	0·992	0·992
83	0·993	0·993	0·993	0·993	0·993	0·994	0·994	0·994	0·994	0·994
84	0·995	0·995	0·995	0·995	0·995	0·995	0·996	0·996	0·996	0·996
85	0·996	0·996	0·996	0·997	0·997	0·997	0·997	0·997	0·997	0·997
86	0·998	0·998	0·998	0·998	0·998	0·998	0·998	0·998	0·998	0·999
87	0·999	0·999	0·999	0·999	0·999	0·999	0·999	0·999	0·999	0·999
88	0·999	0·999	1·000	1·000	1·000	1·000	1·000	1·000	1·000	1·000
89	1·000	1·000	1·000	1·000	1·000	1·000	1·000	1·000	1·000	1·000

Cosines (0° - 44·9°)

Angle	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9
0	1·000	1·000	1·000	1·000	1·000	1·000	1·000	1·000	1·000	1·000
1	1·000	1·000	1·000	1·000	1·000	1·000	1·000	1·000	1·000	0·999
2	0·999	0·999	0·999	0·999	0·999	0·999	0·999	0·999	0·999	0·999
3	0·999	0·999	0·998	0·998	0·998	0·998	0·998	0·998	0·998	0·998
4	0·998	0·997	0·997	0·997	0·997	0·997	0·997	0·997	0·996	0·996
5	0·996	0·996	0·996	0·996	0·996	0·995	0·995	0·995	0·995	0·995
6	0·995	0·994	0·994	0·994	0·994	0·994	0·993	0·993	0·993	0·993
7	0·993	0·992	0·992	0·992	0·992	0·991	0·991	0·991	0·991	0·991
8	0·990	0·990	0·990	0·990	0·989	0·989	0·989	0·988	0·988	0·988
9	0·988	0·987	0·987	0·987	0·987	0·986	0·986	0·986	0·985	0·985
10	0·985	0·985	0·984	0·984	0·984	0·983	0·983	0·983	0·982	0·982
11	0·982	0·981	0·981	0·981	0·980	0·980	0·980	0·979	0·979	0·979
12	0·978	0·978	0·977	0·977	0·977	0·976	0·976	0·976	0·975	0·975
13	0·974	0·974	0·974	0·973	0·973	0·972	0·972	0·972	0·971	0·971
14	0·970	0·970	0·969	0·969	0·969	0·968	0·968	0·967	0·967	0·966
15	0·966	0·965	0·965	0·965	0·964	0·964	0·963	0·963	0·962	0·962
16	0·961	0·961	0·960	0·960	0·959	0·959	0·958	0·958	0·957	0·957
17	0·956	0·956	0·955	0·955	0·954	0·954	0·953	0·953	0·952	0·952
18	0·951	0·951	0·950	0·949	0·949	0·948	0·948	0·947	0·947	0·946
19	0·946	0·945	0·944	0·944	0·943	0·943	0·942	0·941	0·941	0·940
20	0·940	0·939	0·938	0·938	0·937	0·937	0·936	0·935	0·935	0·934
21	0·934	0·933	0·932	0·932	0·931	0·930	0·930	0·929	0·928	0·928
22	0·927	0·927	0·926	0·925	0·925	0·924	0·923	0·923	0·922	0·921
23	0·921	0·920	0·919	0·918	0·918	0·917	0·916	0·916	0·915	0·914
24	0·914	0·913	0·912	0·911	0·911	0·910	0·909	0·909	0·908	0·907
25	0·906	0·906	0·905	0·904	0·903	0·903	0·902	0·901	0·900	0·900
26	0·899	0·898	0·897	0·896	0·896	0·895	0·894	0·893	0·893	0·892
27	0·891	0·890	0·889	0·889	0·888	0·887	0·886	0·885	0·885	0·884
28	0·883	0·882	0·881	0·880	0·880	0·879	0·878	0·877	0·876	0·875
29	0·875	0·874	0·873	0·872	0·871	0·870	0·869	0·869	0·868	0·867
30	0·866	0·865	0·864	0·863	0·863	0·862	0·861	0·860	0·859	0·858
31	0·857	0·856	0·855	0·854	0·854	0·853	0·852	0·851	0·850	0·849
32	0·848	0·847	0·846	0·845	0·844	0·843	0·842	0·842	0·841	0·840
33	0·839	0·838	0·837	0·836	0·835	0·834	0·833	0·832	0·831	0·830
34	0·829	0·828	0·827	0·826	0·825	0·824	0·823	0·822	0·821	0·820
35	0·819	0·818	0·817	0·816	0·815	0·814	0·813	0·812	0·811	0·810
36	0·809	0·808	0·807	0·806	0·805	0·804	0·803	0·802	0·801	0·800
37	0·799	0·798	0·797	0·795	0·794	0·793	0·792	0·791	0·790	0·789
38	0·788	0·787	0·786	0·785	0·784	0·783	0·782	0·780	0·779	0·778
39	0·777	0·776	0·775	0·774	0·773	0·772	0·771	0·769	0·768	0·767
40	0·766	0·765	0·764	0·763	0·762	0·760	0·759	0·758	0·757	0·756
41	0·755	0·754	0·752	0·751	0·750	0·749	0·748	0·747	0·745	0·744
42	0·743	0·742	0·741	0·740	0·738	0·737	0·736	0·735	0·734	0·733
43	0·731	0·730	0·729	0·728	0·727	0·725	0·724	0·723	0·722	0·721
44	0·719	0·718	0·717	0·716	0·714	0·713	0·712	0·711	0·710	0·708

Cosines (45° - 89·9°)

Angle	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9
45	0·707	0·706	0·705	0·703	0·702	0·701	0·700	0·698	0·697	0·696
46	0·695	0·693	0·692	0·691	0·690	0·688	0·687	0·686	0·685	0·683
47	0·682	0·681	0·679	0·678	0·677	0·676	0·674	0·673	0·672	0·670
48	0·669	0·668	0·667	0·665	0·664	0·663	0·661	0·660	0·659	0·657
49	0·656	0·655	0·653	0·652	0·651	0·649	0·648	0·647	0·645	0·644
50	0·643	0·641	0·640	0·639	0·637	0·636	0·635	0·633	0·632	0·631
51	0·629	0·628	0·627	0·625	0·624	0·623	0·621	0·620	0·618	0·617
52	0·616	0·614	0·613	0·612	0·610	0·609	0·607	0·606	0·605	0·603
53	0·602	0·600	0·599	0·598	0·596	0·595	0·593	0·592	0·591	0·589
54	0·588	0·586	0·585	0·584	0·582	0·581	0·579	0·578	0·576	0·575
55	0·574	0·572	0·571	0·569	0·568	0·566	0·565	0·564	0·562	0·561
56	0·559	0·558	0·556	0·555	0·553	0·552	0·550	0·549	0·548	0·546
57	0·545	0·543	0·542	0·540	0·539	0·537	0·536	0·534	0·533	0·531
58	0·530	0·528	0·527	0·525	0·524	0·522	0·521	0·520	0·518	0·517
59	0·515	0·514	0·512	0·511	0·509	0·508	0·506	0·505	0·503	0·502
60	0·500	0·498	0·497	0·495	0·494	0·492	0·491	0·489	0·488	0·486
61	0·485	0·483	0·482	0·480	0·479	0·477	0·476	0·474	0·473	0·471
62	0·469	0·468	0·466	0·465	0·463	0·462	0·460	0·459	0·457	0·456
63	0·454	0·452	0·451	0·449	0·448	0·446	0·445	0·443	0·442	0·440
64	0·438	0·437	0·435	0·434	0·432	0·431	0·429	0·427	0·426	0·424
65	0·423	0·421	0·419	0·418	0·416	0·415	0·413	0·412	0·410	0·408
66	0·407	0·405	0·404	0·402	0·400	0·399	0·397	0·396	0·394	0·392
67	0·391	0·389	0·388	0·386	0·384	0·383	0·381	0·379	0·378	0·376
68	0·375	0·373	0·371	0·370	0·368	0·367	0·365	0·363	0·362	0·360
69	0·358	0·357	0·355	0·353	0·352	0·350	0·349	0·347	0·345	0·344
70	0·342	0·340	0·339	0·337	0·335	0·334	0·332	0·331	0·329	0·327
71	0·326	0·324	0·322	0·321	0·319	0·317	0·316	0·314	0·312	0·311
72	0·309	0·307	0·306	0·304	0·302	0·301	0·299	0·297	0·296	0·294
73	0·292	0·291	0·289	0·287	0·286	0·284	0·282	0·281	0·279	0·277
74	0·276	0·274	0·272	0·271	0·269	0·267	0·266	0·264	0·262	0·261
75	0·259	0·257	0·255	0·254	0·252	0·250	0·249	0·247	0·245	0·244
76	0·242	0·240	0·239	0·237	0·235	0·233	0·232	0·230	0·228	0·227
77	0·225	0·223	0·222	0·220	0·218	0·216	0·215	0·213	0·211	0·210
78	0·208	0·206	0·204	0·203	0·201	0·199	0·198	0·196	0·194	0·193
79	0·191	0·189	0·187	0·186	0·184	0·182	0·181	0·179	0·177	0·175
80	0·174	0·172	0·170	0·168	0·167	0·165	0·163	0·162	0·160	0·158
81	0·156	0·155	0·153	0·151	0·150	0·148	0·146	0·144	0·143	0·141
82	0·139	0·137	0·136	0·134	0·132	0·131	0·129	0·127	0·125	0·124
83	0·122	0·120	0·118	0·117	0·115	0·113	0·111	0·110	0·108	0·106
84	0·105	0·103	0·101	0·099	0·098	0·096	0·094	0·092	0·091	0·089
85	0·087	0·085	0·084	0·082	0·080	0·078	0·077	0·075	0·073	0·071
86	0·070	0·068	0·066	0·065	0·063	0·061	0·059	0·058	0·056	0·054
87	0·052	0·051	0·049	0·047	0·045	0·044	0·042	0·040	0·038	0·037
88	0·035	0·033	0·031	0·030	0·028	0·026	0·024	0·023	0·021	0·019
89	0·017	0·016	0·014	0·012	0·010	0·009	0·007	0·005	0·003	0·002