CUMBERNAULD ACADEMY

Faculty of Mathematics & Numeracy

4th Level / National 5

Block 3 – homework booklet

Chapter 6
Gradients and Lines

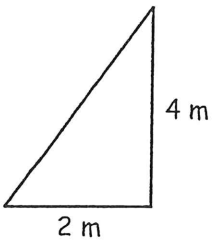
Exercise 1

1. Copy and complete the formula -

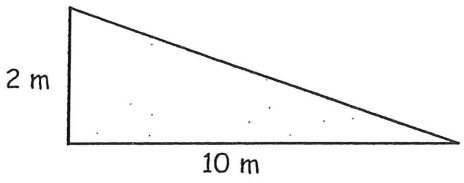
$$\text{gradient} = \frac{\text{ver..... distance}}{\text{..... distance}}$$

2. Write the gradient of each (as a fraction) and simplify :-

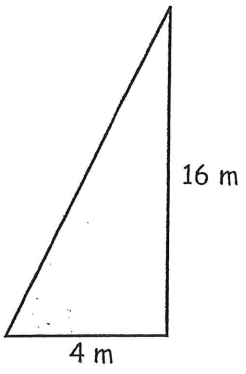
(a)



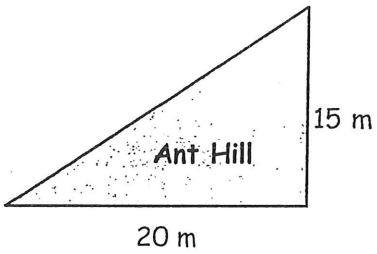
(b)

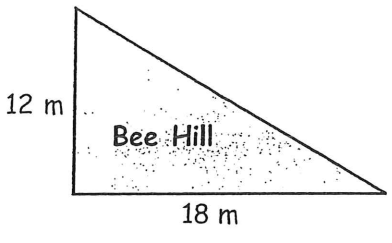


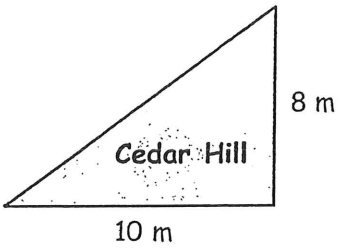
(c)



3. (a) Write the gradients of each of the following hills :-





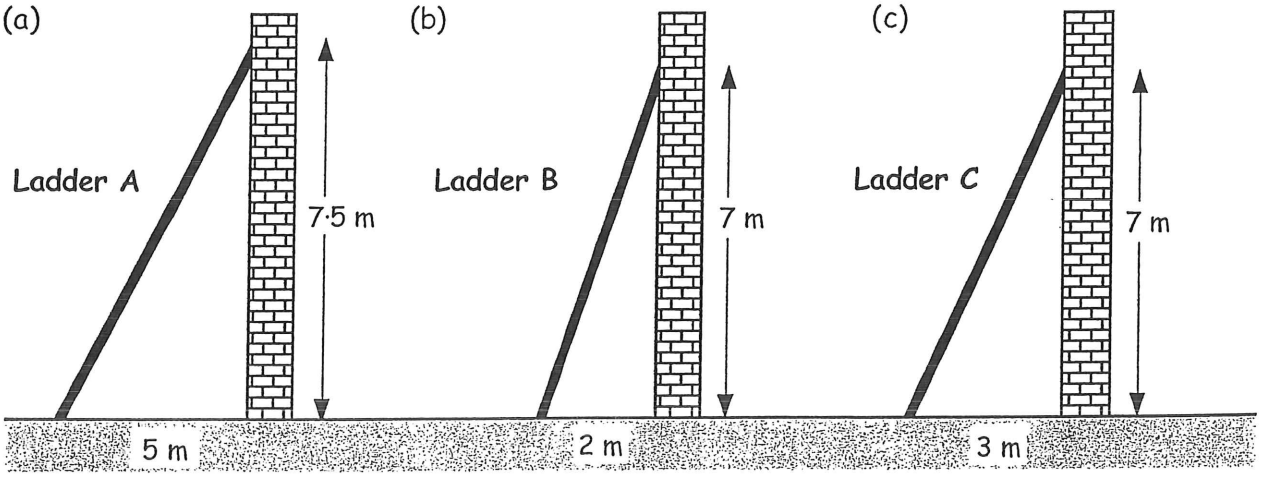


(b) Change each of your fractional answers to part (a) to a decimal.

(c) List the gradients in order (steepest first).

4. Find the gradient of each of these ladders:

(a) (b) (c)



5. A ladder is "SAFE" if it has a gradient with a value between 3 and 4.

Which of the above three ladders is safe and which is unsafe ?

Exercise 2

1. (a) Find the gradient of the line in diagram 1.

(b) Copy and complete :-

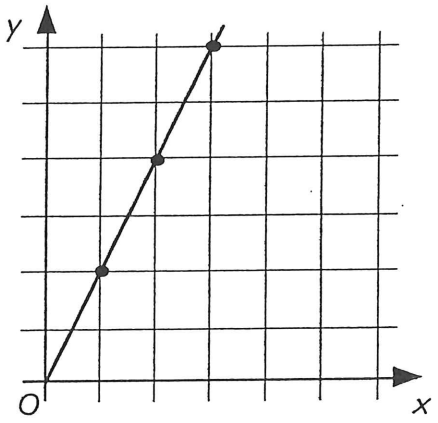
For every point on the line,

"the y - coordinate = ..?.. x the x - coordinate".

(c) The equation of the line is :-

$y =$ x

Diagram 1



2. (a) Find the gradient of the line in diagram 2.

(b) Copy and complete :-

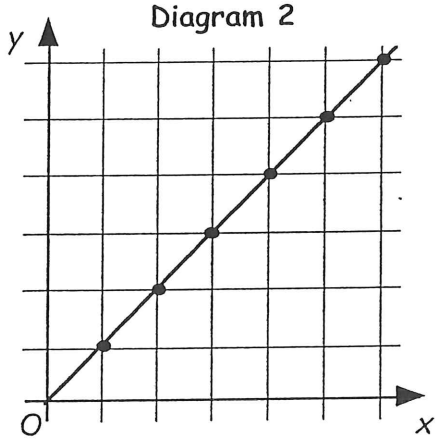
For every point on the line,

"the y - coordinate = ..?.. x the x - coordinate".

(c) The equation of the line is :-

$y =$ x

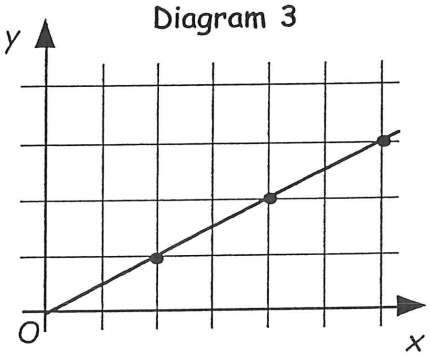
Diagram 2



3. (a) Find the gradient of the line in diagram 3.

(b) Write the equation of the line.

Diagram 3



4. Draw a coordinate diagram like diagram 4.

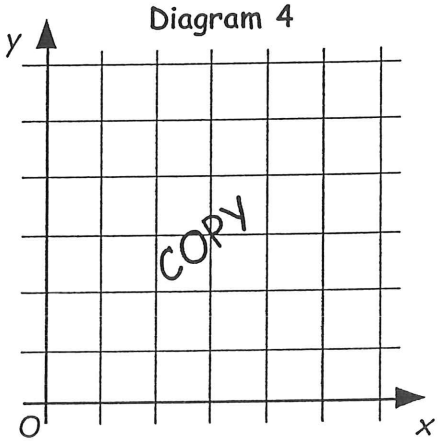
(a) Plot these points on your diagram.

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

(b) Draw a line through the points and calculate the gradient of the line.

(c) Now write the equation of this line.

Diagram 4



5. (a) Draw another set of axes and plot these points.

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

(b) Draw the line through the points, calculate the gradient of the line and write down the equation of the line.

Exercise 3

1. (a) Look at the table for the line $y = 2x$.

x	0	1	2	3	4
$y = 2x$	0	2	4	...	...

(b) Copy and complete the list of coordinates: (0, 0), (1, 2), (2, 4), (.....), (.....).

(c) Draw a coordinate diagram, plot the 5 points and complete the line.

2. (a) Look at the table for the line $y = 3x$.

x	0	1	2	3	4
$y = 3x$	0	3	6	...	...

(b) Copy and complete the list of coordinates: (0, 0), (.....), (.....), (.....), (.....).

(c) Draw a coordinate diagram, plot the 5 points and show the line.

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

x	0	2	4	6	8
$y = \frac{1}{2}x$	0	1	2	...	...

(b) List the coordinates of the 5 points.

(c) Draw a coordinate diagram, plot the points and show the line.

4. Make a table, list and plot the coordinates on a diagram and draw the line $y = 4x$.

5. Draw the line $y = \frac{1}{3}x$.

Exercise 4

1. Draw the line $y = 2x + 1$ as follows:

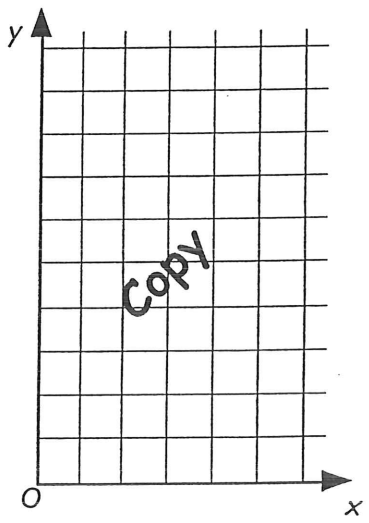
(a) Copy and complete this table:

x	0	1	2	3	4
$y = 2x + 1$	2 x 0 + 1	2 x 1 + 1	2 x 2 + 1	....	.....

(b) Copy and complete the list of coordinates:

(0, 1), (1, 3), (2, 5), (3,....), (..., ...).

(c) Copy the coordinate diagram, plot the points and draw the line. Label the line $y = 2x + 1$ on your diagram.



2. Draw the following lines by repeating the process from question 1.

(a) $y = 3x + 1$

x	0	1	2	3	4
$y = 3x + 1$	$3\times0+1$	$3\times1+1$	$3\times2+1$	....	.....

(b) $y = 2x - 1$

x	0	1	2	3	4
$y = 2x - 1$	$2\times0-1$	$2\times1-1$	$2\times2-1$	....	.....

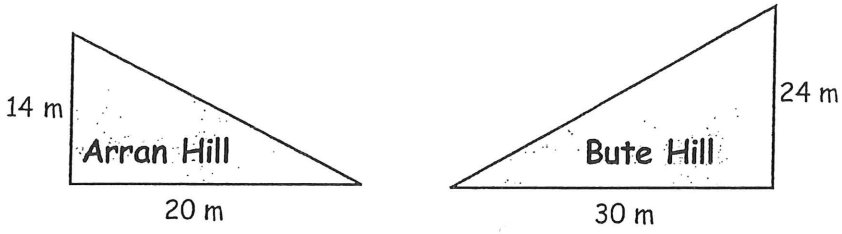
(c) $y = \frac{1}{2}x + 1$

x	0	2	4	6	8
$y = \frac{1}{2}x + 1$	$\frac{1}{2}$ of $0+1$	$\frac{1}{2}$ of $2+1$	$\frac{1}{2}$ of $4+1$	....	.....

3. Draw the lines: (a) $y = 2x + 2$ (b) $y = 3x - 2$ (c) $y = \frac{1}{3}x - 1$

Exercise 5 Revision exercise

1. (a) Calculate the gradients of each hill.



(b) Simplify each fraction.

(c) Change each fraction to a decimal. (d) Which of the two hills is steeper ?

2. (a) Copy and complete the table for the line $y = 4x$.

x	0	1	2	3	4
$y = 4x$	0	4	...	...	...

(b) List the coordinates of the 5 points.

(c) Draw a coordinate grid, plot the 5 points, join them up to show the line $y = 4x$.

3. Copy the table below, list the coordinates, draw a coordinate grid and show the line $y = \frac{1}{4}x$.

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

4. Make up a table as shown above, and use the coordinates to help draw the line corresponding to :-

(a) $y = x + 3$ (b) $y = x - 4$

5. Draw the following lines by using the above process :-

(a) $y = 2x + 5$ (b) $y = 3x - 1$ (c) $y = \frac{1}{4}x + 1$

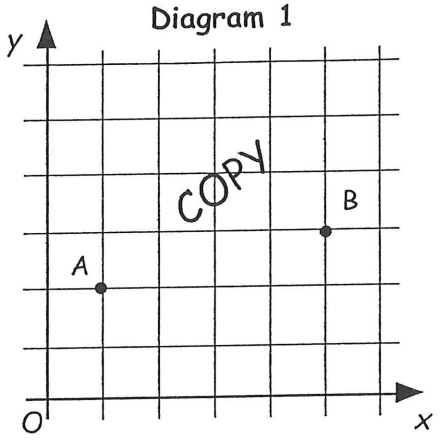
Exercise 6E

1. (a) Copy diagram 1 into your jotter.

   (b) Write the coordinates of A and B and join them with a line.

   (c) Form an appropriate right angled triangle and calculate the gradient of the line AB.

Diagram 1



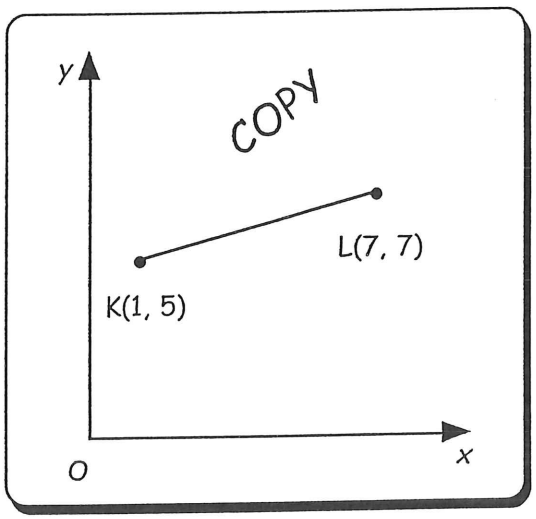
2. (a) Make a coordinate diagram and plot the points C(2, 1) and D(3, 5).

   (b) Form a right angled triangle and calculate the gradient of the line CD.

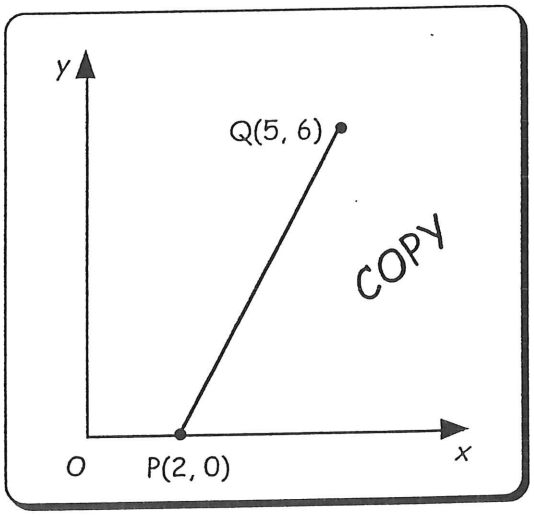
3. Make an accurate copy of each of the following diagrams into your jotter (squared paper).

   Calculate the gradient of each line :-

(a)



(b)



4. (a) Draw a set of axes and plot the two points E(0, 2) and F(5, 3).

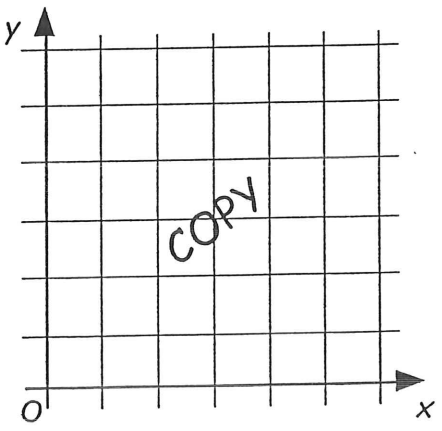
   (b) Calculate the gradient of the line EF.

5. G is the point (1, 3) and H is the point (5, 6).

   Calculate the gradient of the line GH.

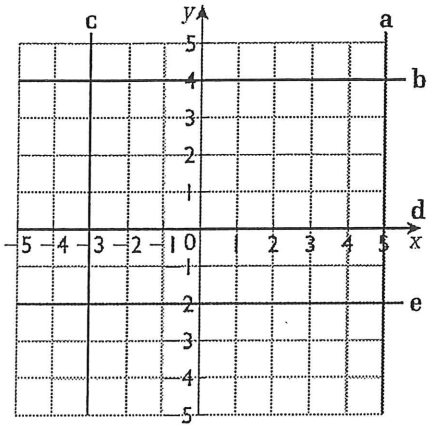
6. Draw a set of axes like those shown opposite.

   A line joins the points S(1, 2) and T(?, 3).
   The gradient of ST is $\frac{1}{3}$.
   Find the value of ?.



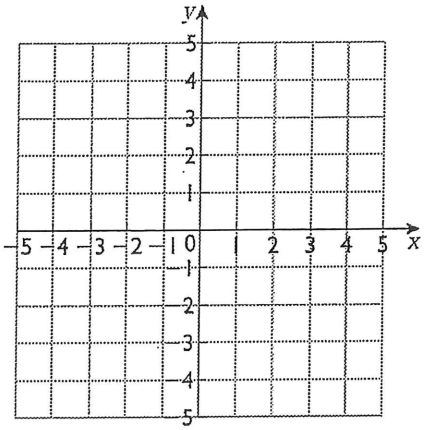
Homework 1

1 Give the equation of each labelled line in the diagram.



2 **a** On the grid provided draw the lines:

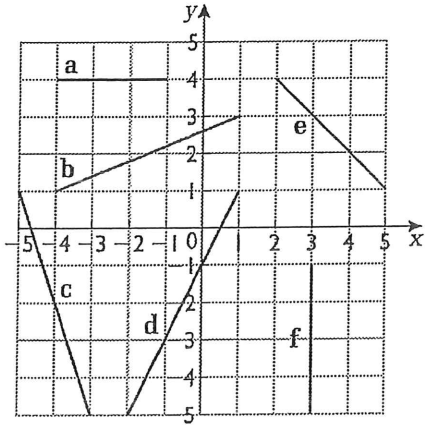
i $x = 4$ **ii** $x = -1$ **iii** $y = 3$ **iv** $y = -3$



b **i** Shade in the rectangle defined by these four lines.

ii Calculate its area.

3 State the gradient of each line segment in the diagram.



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Homework 2

1 Calculate the gradient of the line which passes through:

a (1, 3) and (3, 7)

b (–2, 1) and (2, 13)

c (–3, –2) and (5, 2)

d (4, –3) and (8, –2)

e (2, 3) and (3, 1)

f (–2, 2) and (–4, 12)

g (2, –4) and (–4, –2)

h (3, 1) and (13, –1)

2 **a** Draw the line $y = 2x + 3$ by first completing the table.

x	0	1	2	3	4
$y = 2x + 3$					

b What is the gradient of the line?

3 By first making a table, draw the line with equation $y = -3x - 4$.

4 State the gradient of the line with equation:

a $y = 3x + 1$

b $y = -2x + 5$

c $y = -x - 2$

d $y = 4$

e $x = 2$

f $y = x$

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Homework 3

1 For each line state: **i** its gradient **ii** its y-intercept.

a $y = 2x + 4$ **b** $y = -3x + 1$ **c** $y = 4x - 3$

d $y = 2x$ **e** $y = \frac{1}{2}x + 4$ **f** $y = -\frac{1}{4}x - 1$

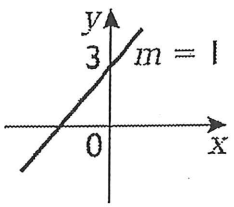
2 Make a rough sketch of each of the following, identifying the y-intercept and gradient.

a $y = x + 1$ **b** $y = -x + 3$ **c** $y = 4x - 3$

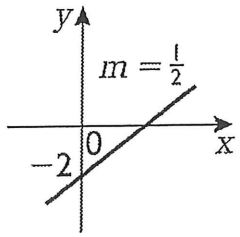
d $y = 2x$ **e** $y = \frac{1}{2}x + 4$ **f** $y = -\frac{1}{4}x - 1$

3 Examine each sketch. The lines have an equation of the form $y = ax + b$.
Find the value of a and b and state the equation of each.

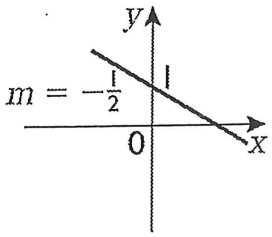
a



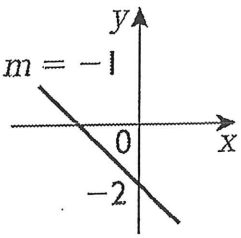
b



c



d



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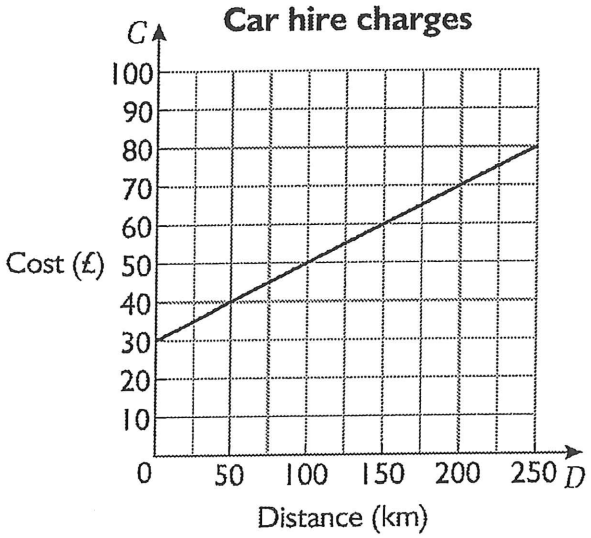
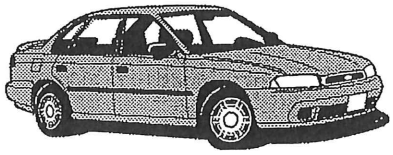
Homework 4

1 The graph shows the charges for hiring a car.
There is a basic charge plus a mileage charge.



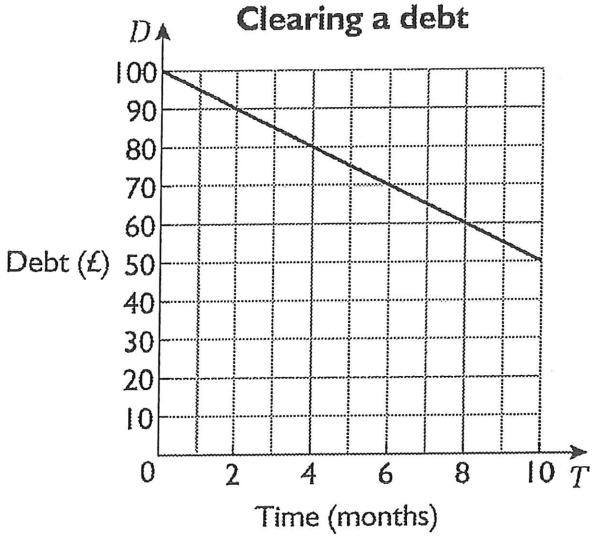


a Work out the equation of the line.

b Use the equation to work out the cost of car hire when the distance travelled is 400 km.

c What distance corresponds to a cost of £90?

2 Melanie is clearing off a debt. The graph shows how the debt is reduced as time passes.



a Work out the equation of the line.

b Use the equation to work out when the debt will be paid off.

c What was the size of the original debt?

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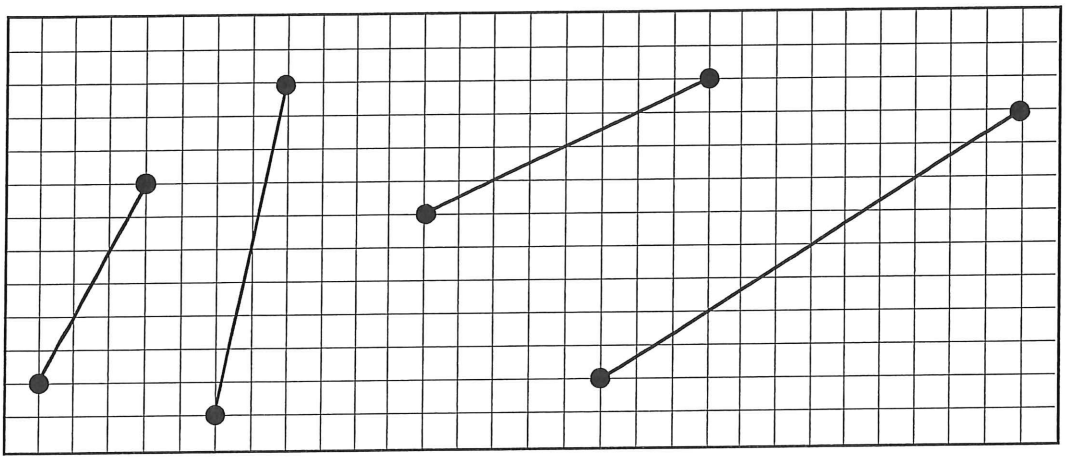
LINEAR RELATIONSHIPS

A. The Gradient of a Line

Exercise 1

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

1. Find the gradient of each line using the formula:



2. For each of the following pairs of points:
   (i) draw a (small) coordinate diagram,
   (ii) plot the two points and join them to form a straight line,
   (iii) calculate the gradient of the line joining the two points.

   (a) P(1,1), Q(3,9)
   (b) A(3,0), B(5,6)
   (c) R(–3,1), S(5,5)
   (d) L(–4,–1), M(2,3)

3. Calculate the gradients of the lines joining the following pairs of points:

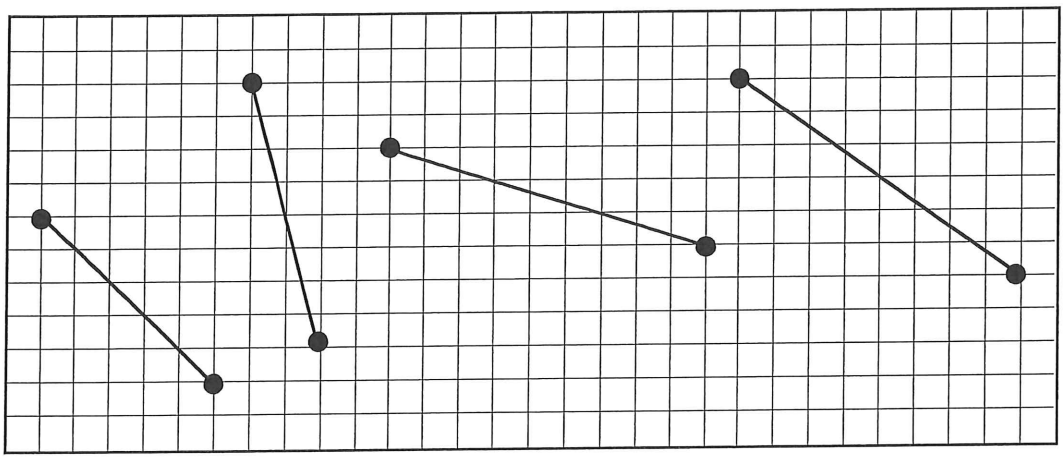
   (a) C(1,5), D(7,7)
   (b) U(0,3), V(12,7)
   (c) J(–1,–6), K(1,6)
   (d) O(0,0), T(5,15)

   So far, all the lines you have met in this exercise have had gradients which were positive.

4. Describe how a line with a negative gradient differs in shape from that of a line with a positive gradient.

cont'd .....

5. Calculate the gradient of each line.



6. Calculate the gradients of the lines joining the following points.
(Some are positive, some negative).

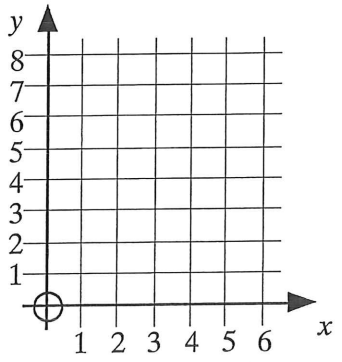
(a) A(1,6), B(6,1)	(b) D(0,7), E(2,3)	(c) G(–2,5), H(1,–4)
(d) J(–6,–3), K(3,0)	(e) M(–6,0), N(0,–4)	(f) P(1,–1), Q(3,1)
(g) S(–1,10), T(3,–2)	(h) V(–6,–10), W(2,–6)	(i) Y(–12, 5), Z(3,0)

7. (a) On a small coordinate diagram plot the two points A(1,3) and B(6,3).
(b) Find the gradient of the line joining A and B using your formula.
(c) Comment on the connection between the shape (slope) of the line drawn in part (a) and the corresponding value of its gradient as calculated in part (b).

B. Sketching Lines in the form $y = ax + b$

Exercise 2

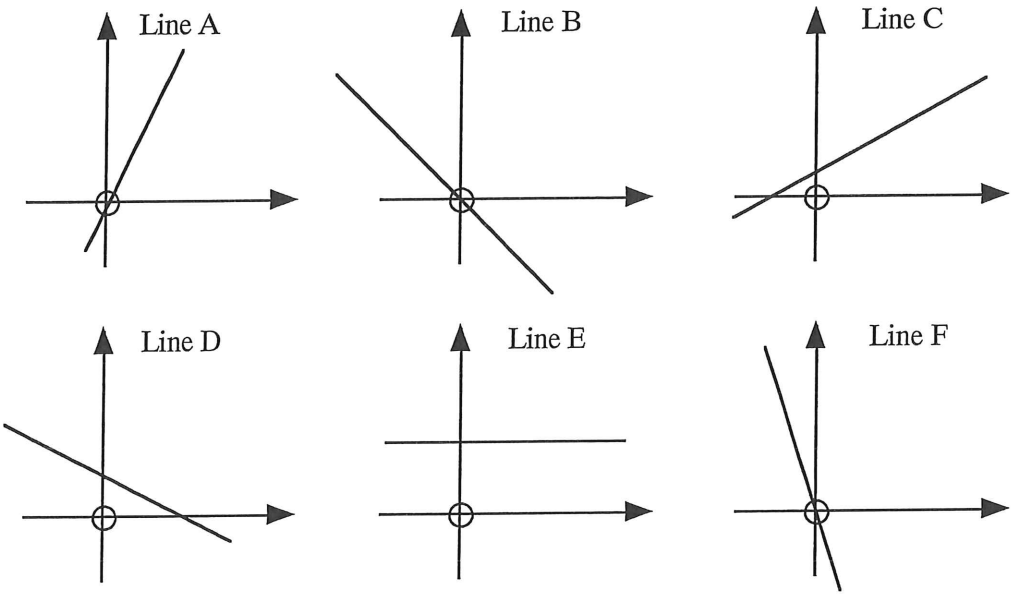
1. Drawing the line $y = 2x + 1$:
   (a) Make a copy of this coordinate diagram.
   (b) Where does the line $y = 2x + 1$ cut the y - axis? (plot this point).
   (c) The gradient of the line is $\underline{2}$. From your first plotted point, move **1** box right and $\underline{2}$ boxes up. Plot this 2nd point.
   (d) Join your 2 points and extend the line.
   (e) Label the line $y = 2x + 1$.



2. Draw the following lines, labelling each one carefully.

(a)	$y = 3x + 2$	(b)	$y = 4x - 3$
(c)	$y = x + 5$	(d)	$y = {}^1/_2x + 4$
(e)	$y = -2x + 1$	(f)	$y = -3x - 5$
(g)	$y = -x + 3$	(h)	$y = {}^3/_4x + 1$

3. Look at the 6 lines shown and the list of 6 gradients given below

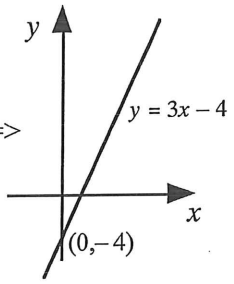


Gradients: $a_1 = {}^1/_2$, $a_2 = -3$, $a_3 = -{}^1/_2$, $a_4 = 0$, $a_5 = -1$, $a_6 = 2$

Match up the lines (A, B, C, D, E, F) with the gradients (a_1, a_2, a_3, a_4, a_5, a_6).

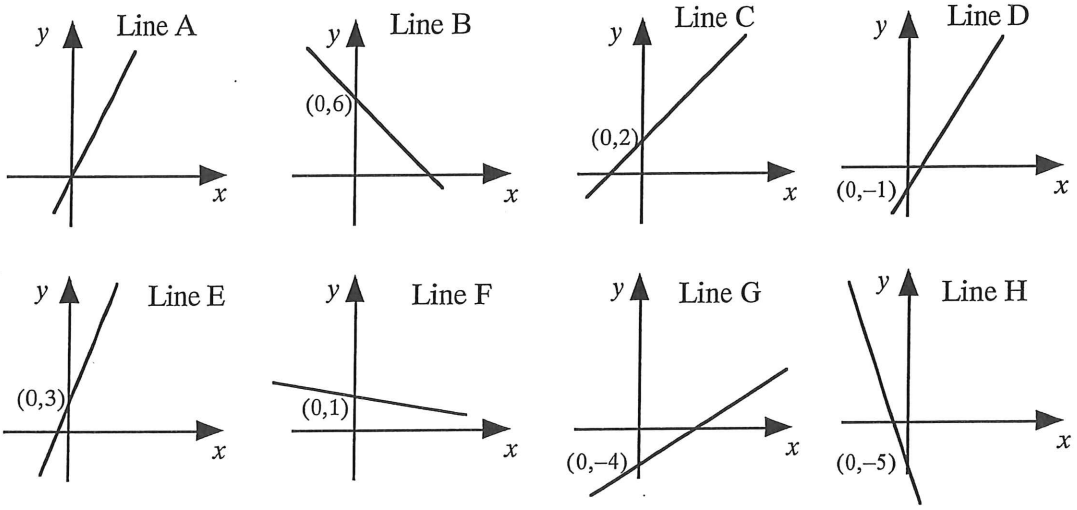
4. This time, simply make a neat <u>sketch</u> of the given line, indicating where it cuts the y - axis.

example: $y = 3x - 4$ =>



(a)	$y = x + 3$	(b)	$y = 2x - 3$
(c)	$y = {}^1/_2x + 6$	(d)	$y = -2x + 3$
(e)	$y = -x - 4$	(f)	$y = 6x - 6$
(g)	$y = {}^1/_5x + 2$	(h)	$y = -{}^1/_2x + 4$
(i)	$y = -4x - 3$	(j)	$y = {}^4/_3x - 1$

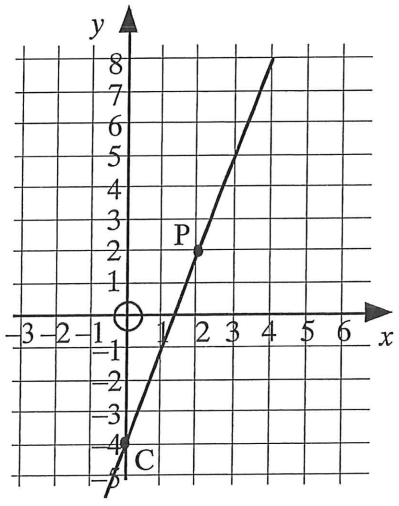
5. Look at the following sketches of 8 lines and the list of 8 equations.
Match each line to its corresponding equation.



Lines: $y = 2x - 1$, $y = 5x + 3$, $y = 3x$, $y = \frac{1}{2}x - 4$,
$y = -2x - 5$, $y = -x + 6$, $y = -\frac{1}{4}x + 1$, $y = x + 2$.

C. Determining the equation of a line in the form $y = ax + b$

Exercise 3



1. Determine the equation of the line shown opposite

Step 1 Start always with the general equation of any line:

=> $y = ax + b$

Step 2 Pick out the coordinates of where the line cuts the y - axis – (0,...)

Use this to begin to write down the line's equation:

=> $y = ax - ...$

Step 3 Find the gradient of the line by using <u>any</u> two points on the line e.g. C and P.

Use this to complete your equation:

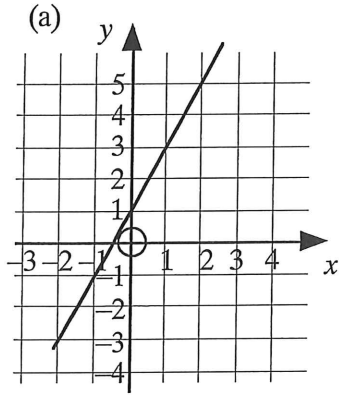
=> $y = ..x - ...$

2. On the next page there are drawings of six lines.
Use the technique shown in question 1 to determine their nature.

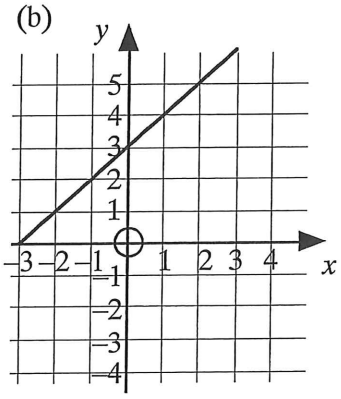
cont'd ...

2. cont'd...

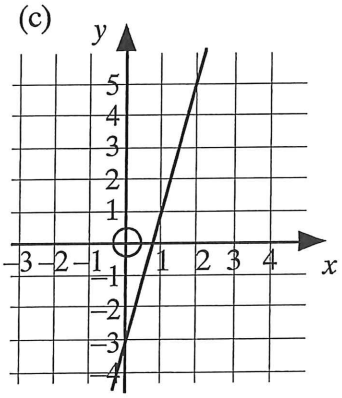
(a)



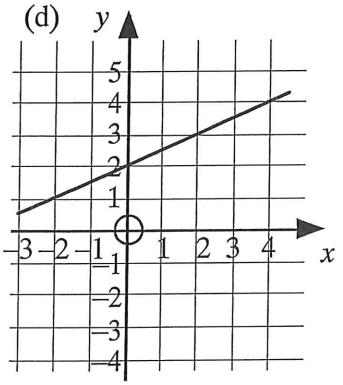
(b)



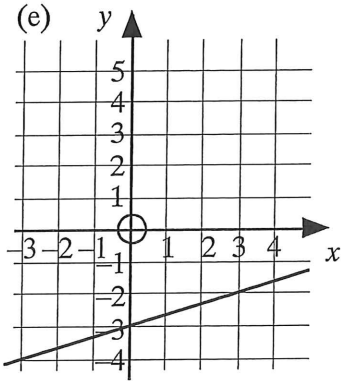
(c)



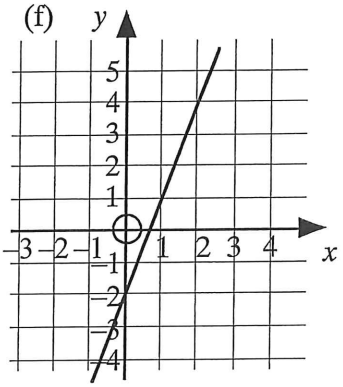
(d)



(e)

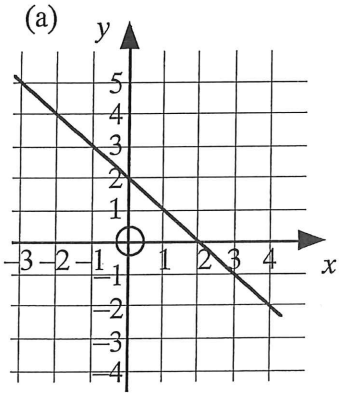


(f)

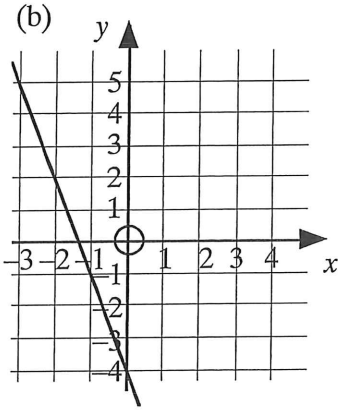


3. The following lines all have negative gradients. Use the same technique as shown in question 1 to determine their equations.

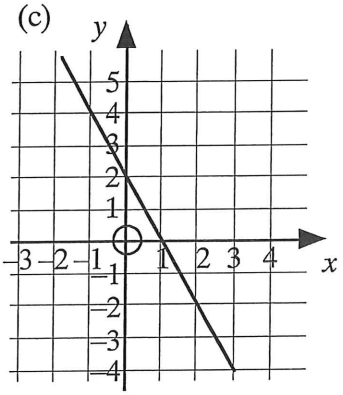
(a)



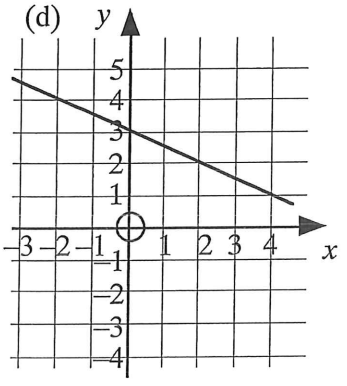
(b)



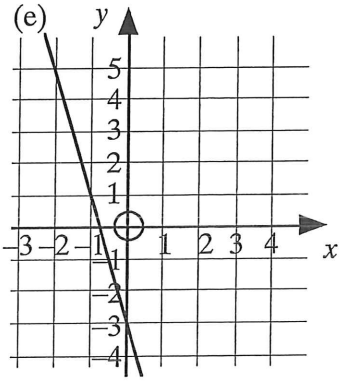
(c)



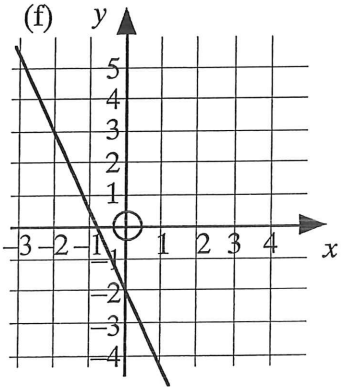
(d)



(e)

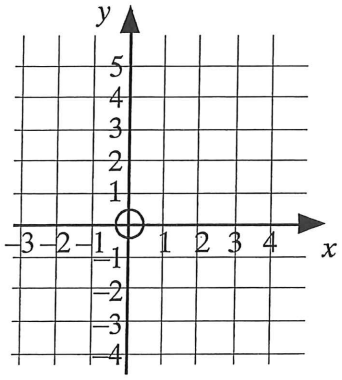


(f)



Checkup for Linear Relationships

1. (a) Given the two points A(2,–1) and B(4,7), calculate the gradient of the line AB.
   (b) Repeat for the line joining C(–7,2) and D(1,–4).

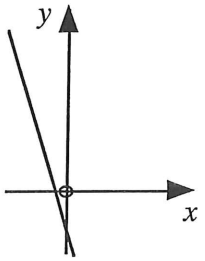


2. Make a copy of this coordinate diagram and draw the line $y = 2x - 2$.

3. Sketch the line $y = \frac{1}{2}x + 1$.

4. Sketch the line $y = -x - 1$.

5. Which of the following is most likely to be the equation of the line shown opposite?



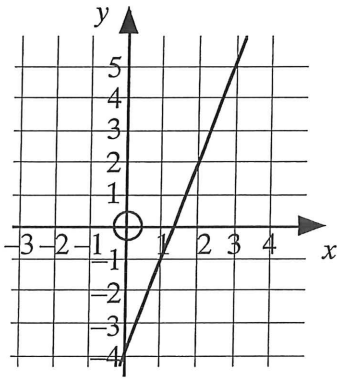
   (a) $y = 3x - 2$ (b) $y = -3x - 2$

   (c) $y = \frac{1}{3}x - 2$ (d) $y = \frac{1}{3}x + 2$

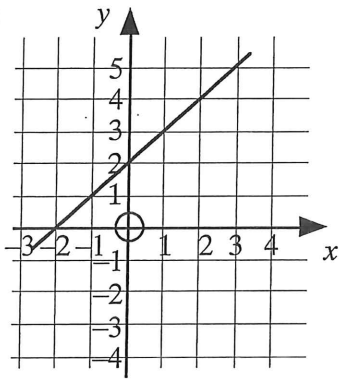
   (e) $y = -3x + 2$ (f) $y = -\frac{1}{3}x - 2$

6. Determine the equations of the following four lines in the form $y = ax + b$:

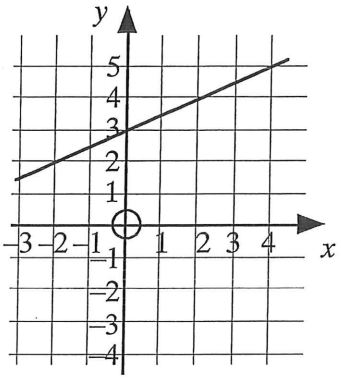
(a)



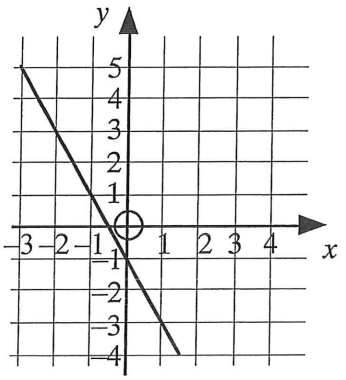
(b)



(c)



(d)



Chapter 23

Calculators may be used in this Chapter **where appropriate.**

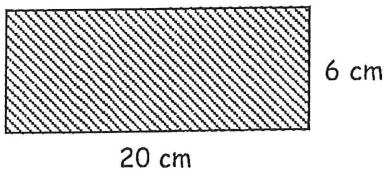
Areas

Exercise 1

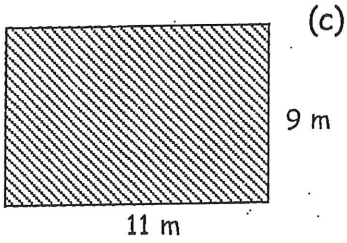
1. Write down the formula for the area of a rectangle.

2. Find the area of each shape below (show formula and working) :-

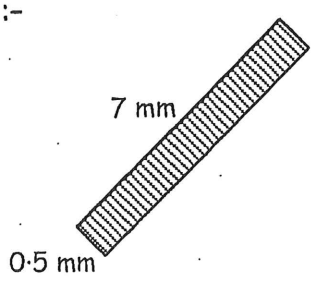
(a)



(b)



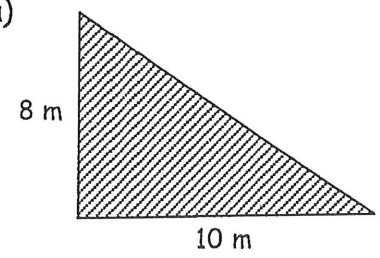
(c)



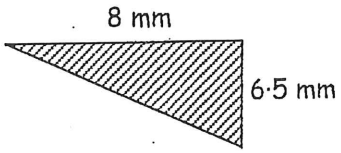
3. Explain how you would find the area of a right angled triangle.

4. Find the area of each right angled triangle below :-

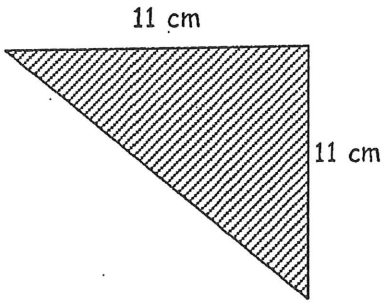
(a)



(b)

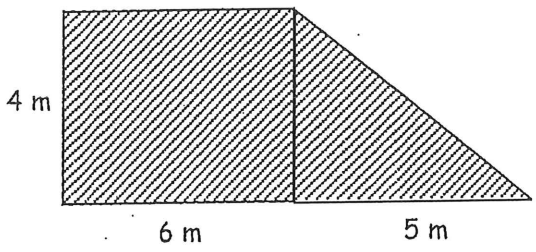


(c)

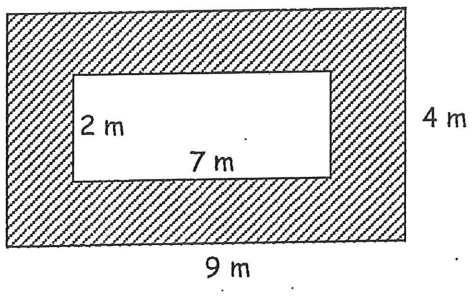


5. Calculate the shaded area each time here :-

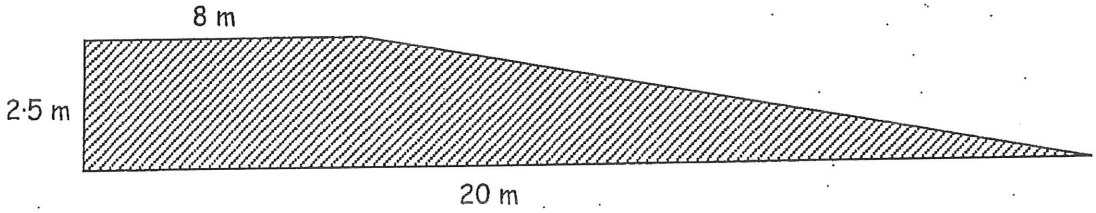
(a)



(b)



(c)

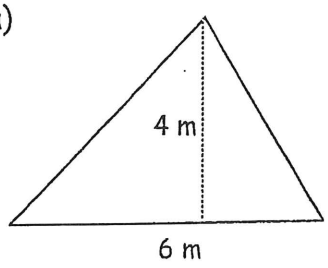


Exercise 2

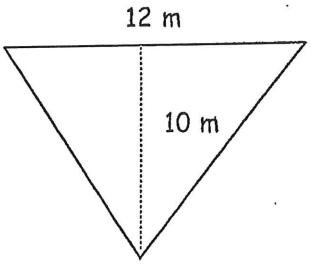
1. Write down the formula for the area of any triangle.

2. Use the formula each time to calculate the area of : -

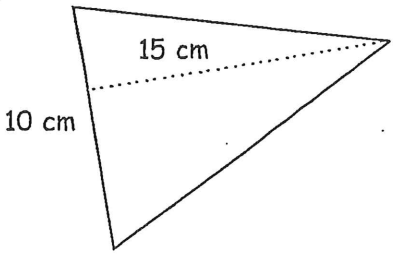
(a)



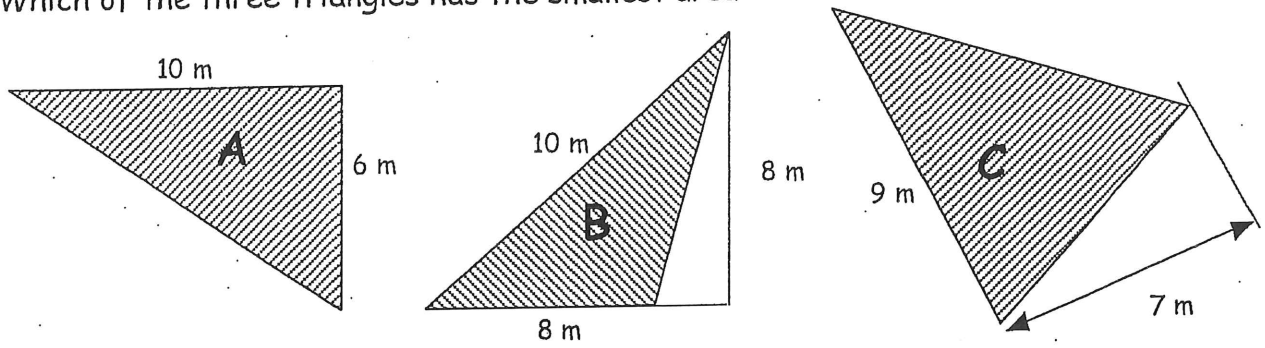
(b)



(c)

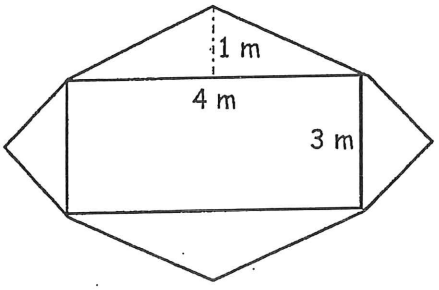


3. Which of the three triangles has the smallest area :-

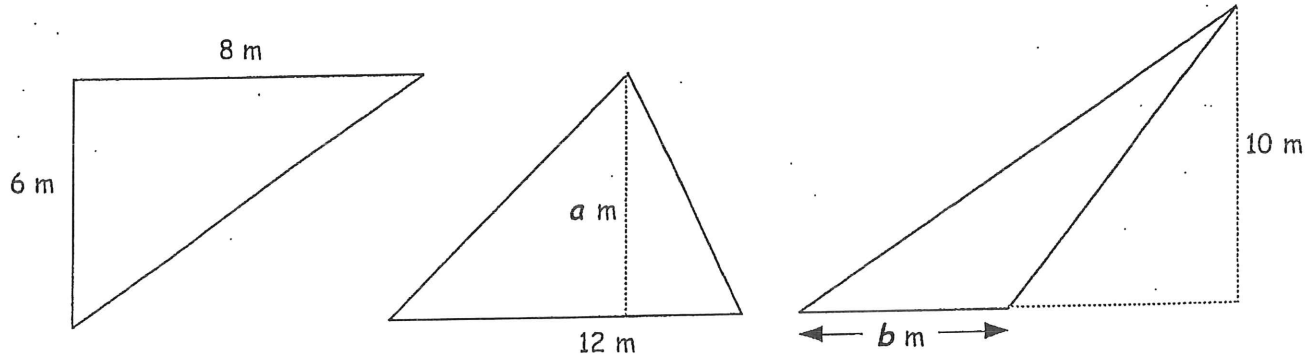


4. A company logo uses a rectangle (4 metres by 3 metres) and two pairs of isosceles triangles, each with height 1 metre, as shown.

Calculate the **total area** of the logo.



5. Given that all three triangles below have the same area, find the values of a and b.

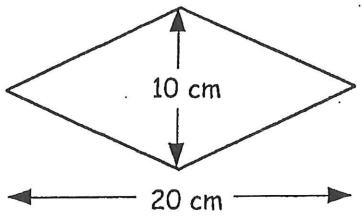


Exercise 3

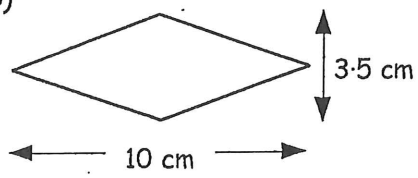
1. Write down the formula for the area of a Rhombus or Kite.

2. Use your formula to calculate the area of each shape.

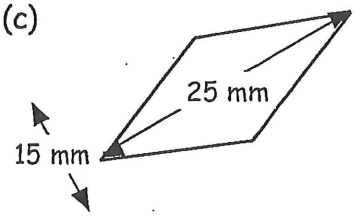
(a)



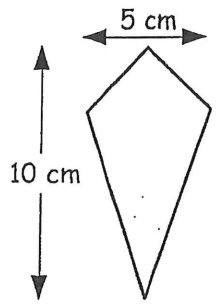
(b)



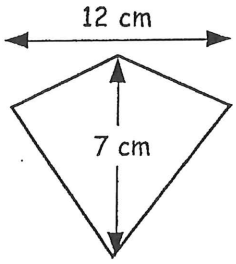
(c)



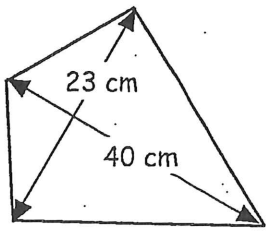
(d)



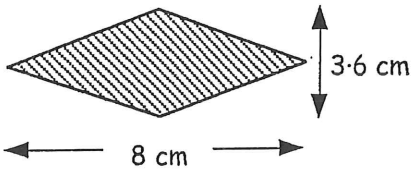
(e)

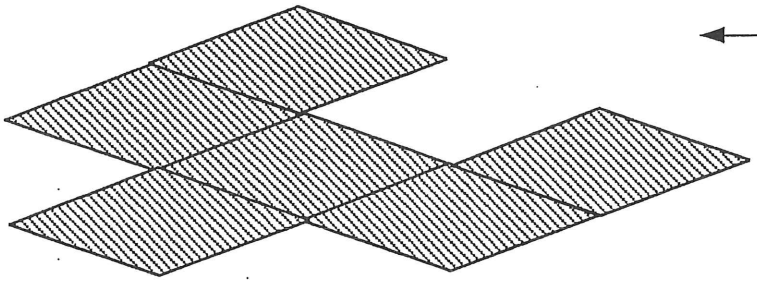


(f)



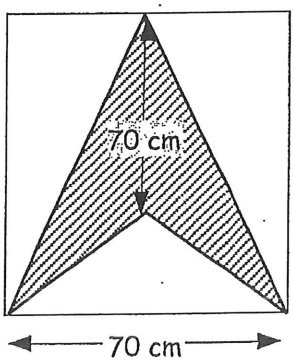
3. Six identical silver rhombi (like the one shown) are made into a pendant below.





Find the total area of the pendant.

4. Calculate the shaded area of the V-kite shown. →



5. A rhombus has the **same area** as the V-kite in question 4.

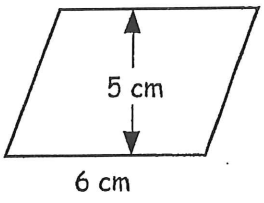
   If the rhombus has one diagonal length of 100 centimetres, find the length of the other diagonal.

Exercise 4

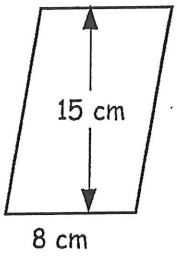
1. Write down the formula for the area of a parallelogram.

2. Calculate the area of each parallelogram below :-

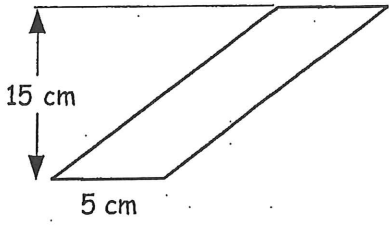
(a)



(b)

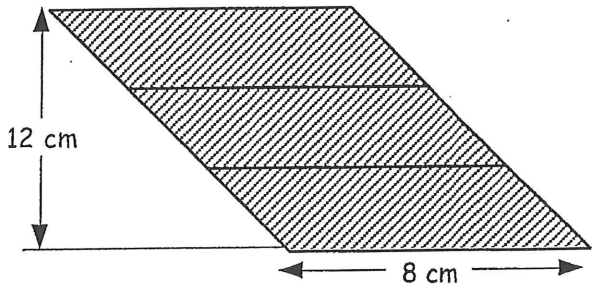


(c)



3. Three identical parallelograms are put together as shown.

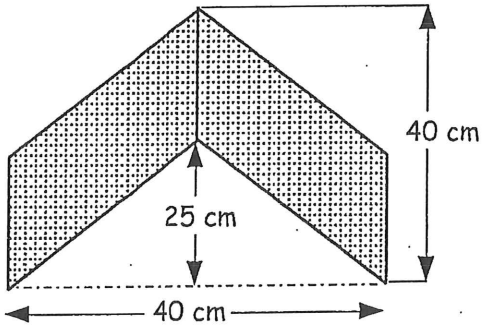
Find the area of **one** of the parallelograms.



4. A large parallelogram has an area of 125 square centimetres.

If the parallelogram has a height of 10 centimetres, find the length of its base.

5.



An "ARROW" sign is formed from 2 identical parallelograms.

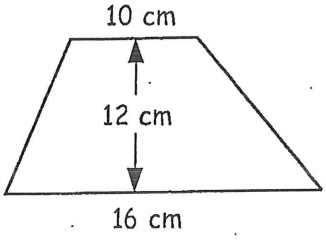
Calculate the area of the sign.

Exercise 5

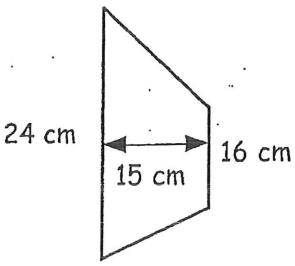
1. Write down the formula for the area of a trapezium.

2. Use the formula to calculate the area of each trapezium below :-

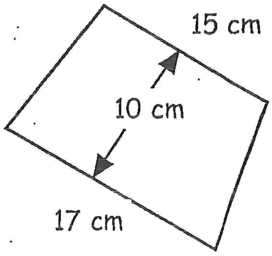
(a)



(b)

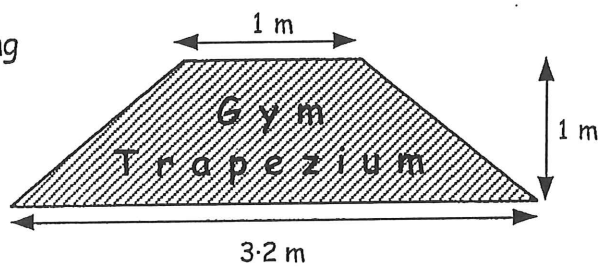


(c)

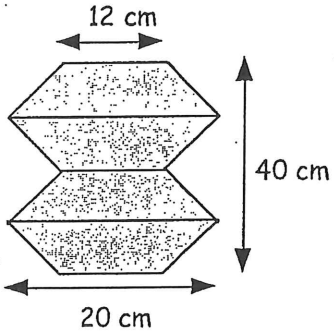


3. At the *Gym Trapezium*, a sign has been hung over the doorway with dimensions shown.

   Calculate the area of the sign.



4.

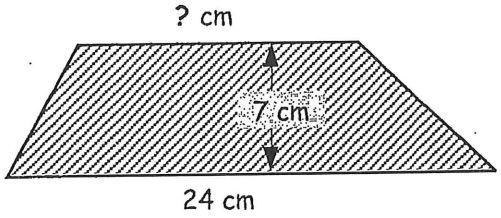


Four identical trapezia are joined together as shown for a company logo.

Calculate the area of the sign.

5. The area of the trapezium shown is 154 cm^2.

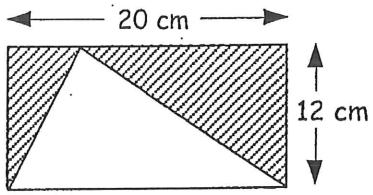
   Calculate the length of the missing dimension.



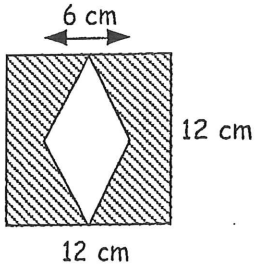
Exercise 6

For each shape below, use an appropriate formula and calculate the **shaded** areas :-
(Show <u>all</u> your formulae and working)

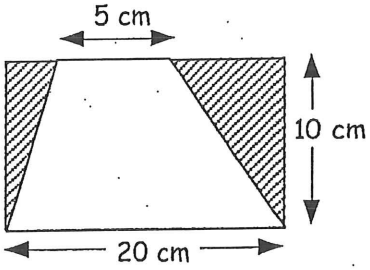
1.



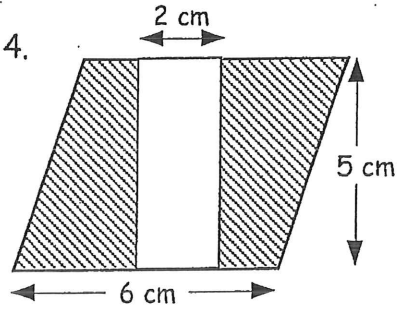
2.



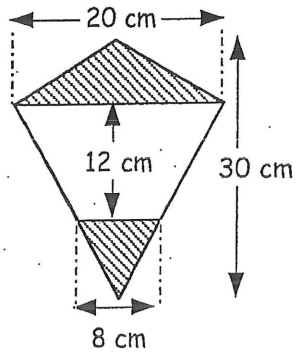
3.



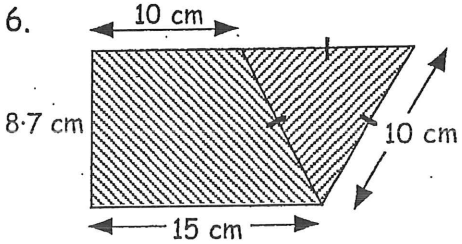
4.



5.



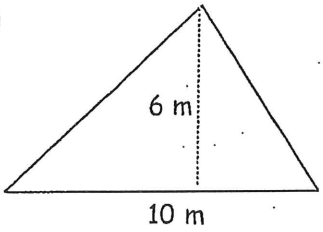
6.



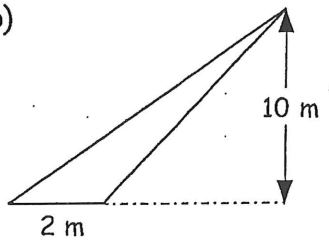
Revision Exercise

1. Calculate the area of each of the following shapes (show <u>all</u> formulae and working) :-

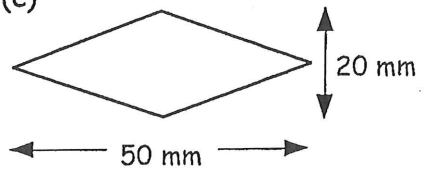
(a)



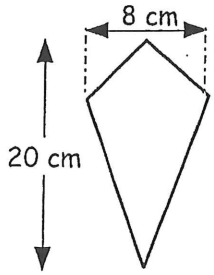
(b)



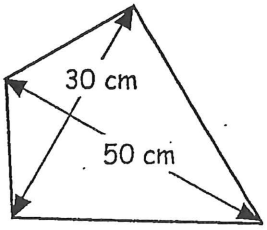
(c)



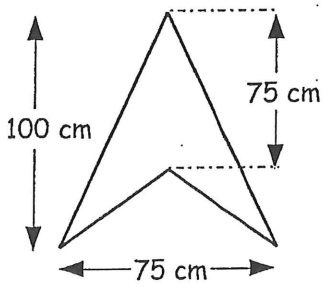
(d)



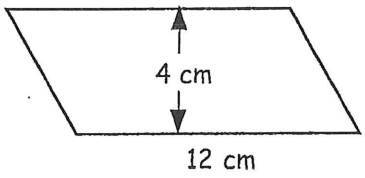
(e)



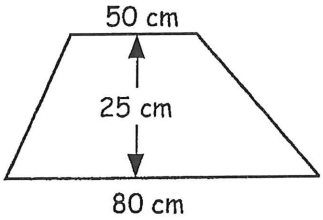
(f)



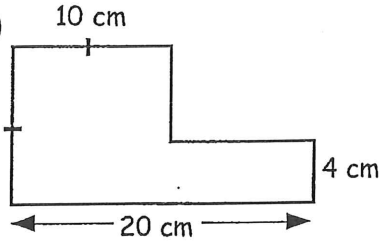
(g)



(h)

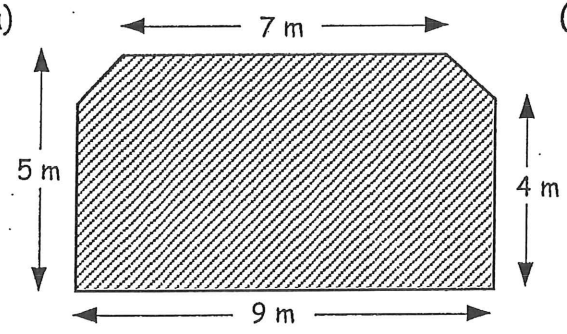


(i)

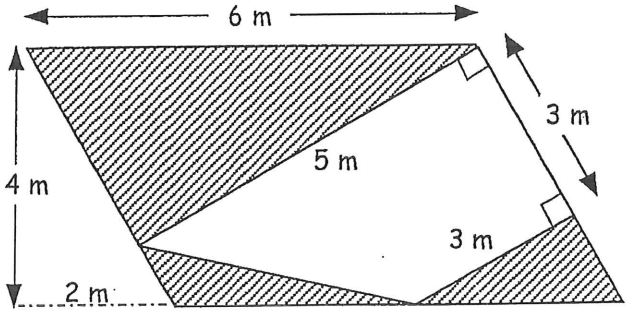


2. Calculate the **shaded** area of each of the following composite shapes :-

(a)

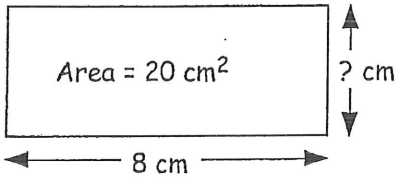


(b)

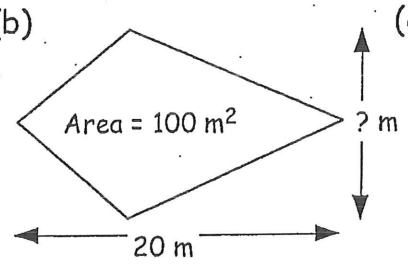


3. Calculate the length of the missing dimension in each of the following shapes :-

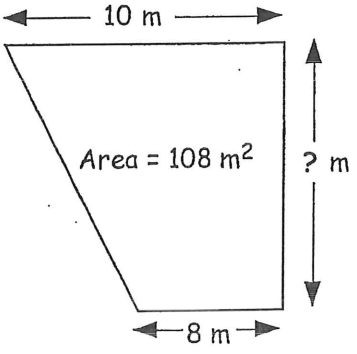
(a)



(b)



(c)



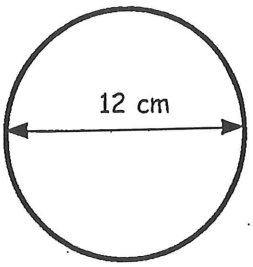
Chapter 29

Circle Work

Use $\pi = 3{\cdot}14$ throughout this chapter

Exercise 1

1. Calculate the circumference of this circle with diameter 12 cm.



Copy and complete : -

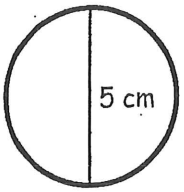
$\Rightarrow \quad C = \pi D$

$\Rightarrow \quad C = 3{\cdot}14 \times 12$

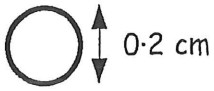
$\Rightarrow \quad C = \ldots\ldots\ldots$ cm.

2. Showing 3 lines of working for each case, calculate the circumference of each of these circles :-

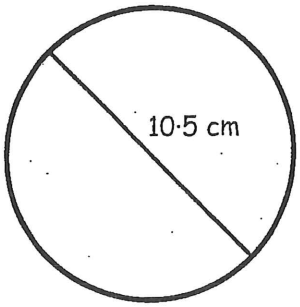
(a)



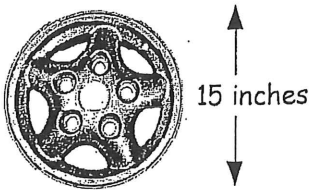
(b)



(c)



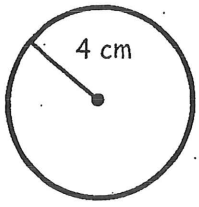
3.



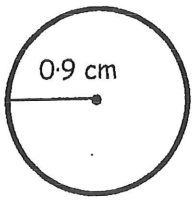
Calculate the circumference of the alloy wheel-trim shown opposite.

4. Calculate the circumference of each of these circles, showing your 3 lines of working each time :-

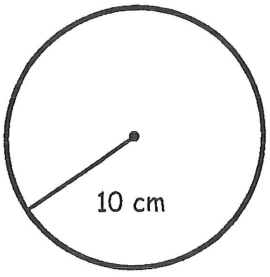
(a)



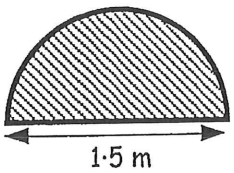
(b)



(c)



5.

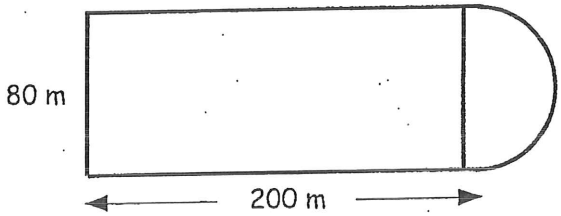


A semi-circular doorstep has a diameter of 1·5 metres.

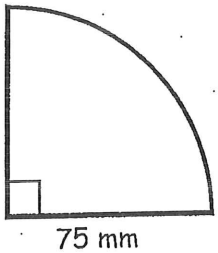
Calculate the perimeter of the doorstep.

6. Calculate the perimeter of both shapes :-

(a)



(b)



Exercise 2

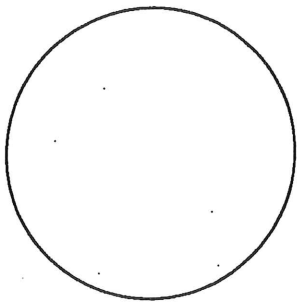
1. Find the diameter of the circle with circumference 78·5 cm.

   Copy and complete :-

$$D = \frac{C}{\pi}$$

$$\Rightarrow D = \frac{78{\cdot}5}{3{\cdot}14}$$

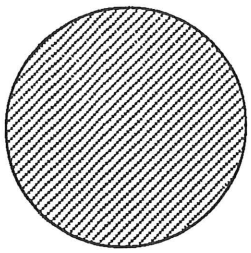
$$\Rightarrow D = \ldots\ldots \text{ cm}$$



C = 78·5 cm

2. Calculate the diameter of each circle below :-
   (You **must** set down 3 lines of working)

(a)

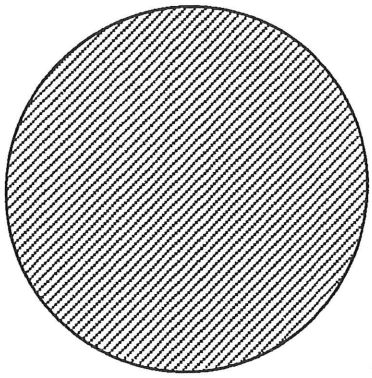


C = 25·12 cm

(b)

C = 1·57 cm

(c)



C = 59·66 cm

3. For a circle with circumference 69·08 cm, calculate its :-

   (a) diameter (b) radius.

4. The circumference of a tyre from a child's toy motorbike is 7·85 centimetres.

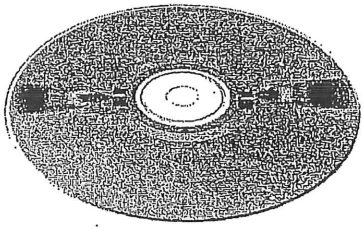
   Find the radius of the tyre.

5. This CD has an outer circumference of 40 centimetres. The hole has a 0·5 centimetre radius.

   Calculate :-

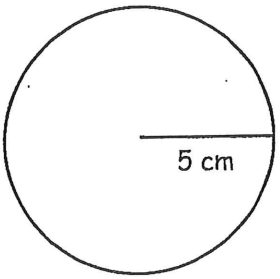
   (a) the radius of the CD.

   (b) the circumference of the hole.



Exercise 3

1. Find the area of a circle with radius 5 cm.



COPY and complete :-

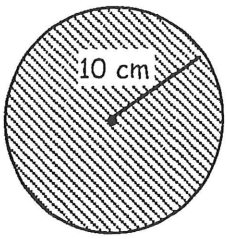
$A = \pi r^2$

$\Rightarrow A = 3{\cdot}14 \times 5 \times 5$

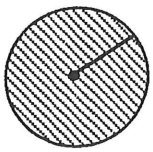
$\Rightarrow A = \ldots\ldots\ cm^2$

2. Calculate the area of each circle below :-
(You **should** set down 3 lines of working)

(a)

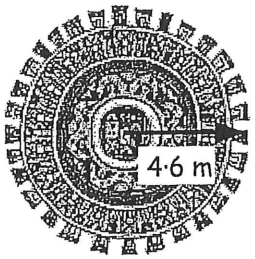


(b)



radius = 22·5 mm

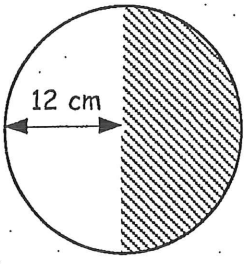
3. Calculate the area of the circular carpet shown.
It has a radius of 4·6 metres.
(Round your answer to 1 dec. pl.)

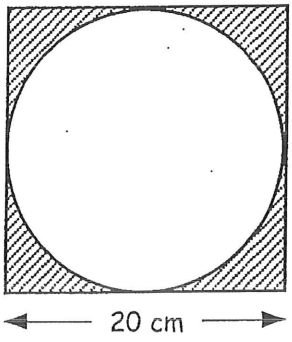


4. 

Work out the area of this coloured counter which has diameter 1·8 metres. (Round your answer to 2 dec. pl.)

5. This circular sign has been split into 2 semi-circles.
If the radius of the circle is 12 cm, find the area of the shaded part of the circle.



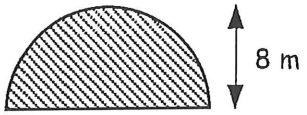
6. 

Calculate the **total** shaded area here.

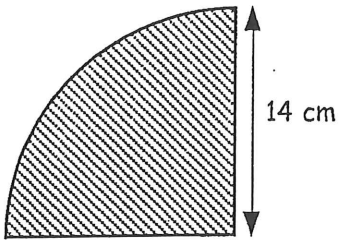
Exercise 4

1. Calculate the area of these shapes :-

(a)

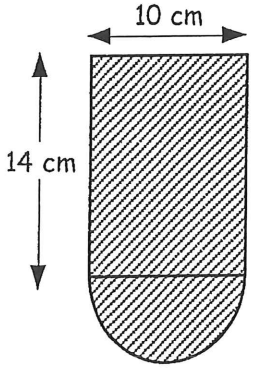


(b)

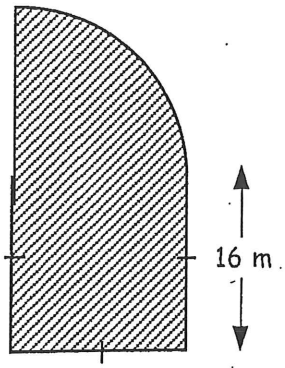


2. Calculate the area of these shapes :-

(a)

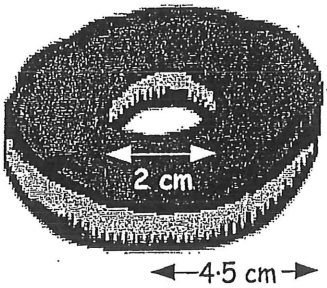


(b)

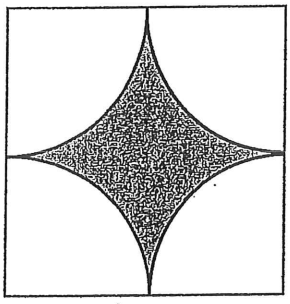


3. This doughnut has an outer radius of 4·5 cm and the hole in the centre has a diameter of 2 cm.

Calculate the (approximate) area of chocolate required to cover the top part of the doughnut.



4.

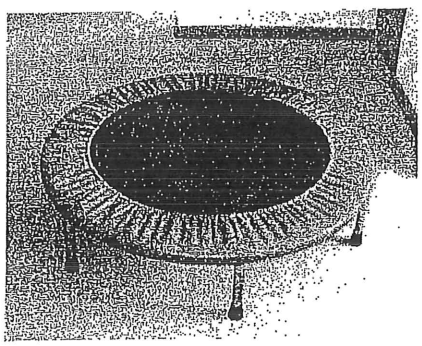


A square with side 20 centimetres has four identical quarter circles cut out from each corner as shown.

Work out the shaded area.

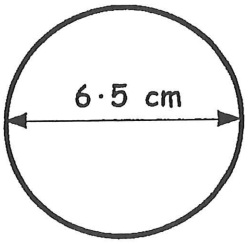
5. A circular trampoline has a circumference of 10·99 m.

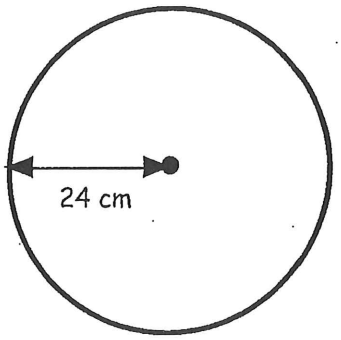
Calculate its area, to the nearest m^2.



Revision Exercise

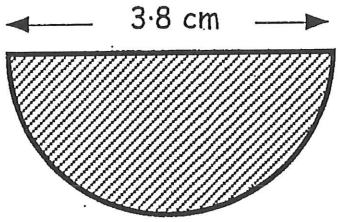
1. Calculate the circumference of this circle with diameter 6·5 cm.

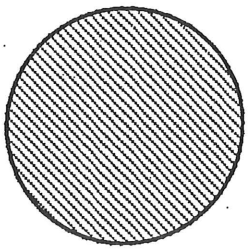


2. 

Work out the circumference of a circle with radius 24 cm.

3. Calculate the perimeter of this shape :-



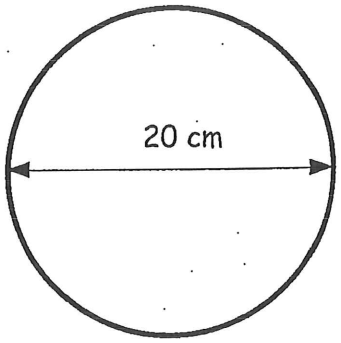
4. 

A circle has a circumference of 125·6 mm.

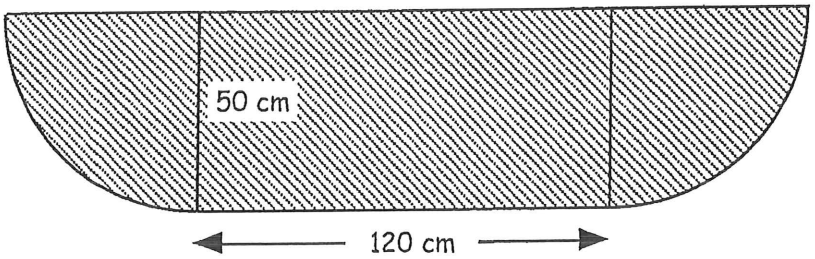
Calculate its :-

(a) diameter (b) radius.

5. Calculate the area of a circle with **diameter** 20 cm.



6. Work out the total area of this shape :-



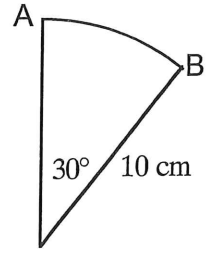
PROPERTIES OF THE CIRCLE

A. Finding the length of an arc

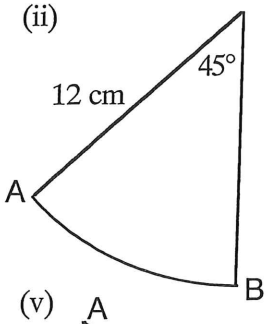
Exercise 1

1. In each diagram, calculate the length of the arc AB of the sector.

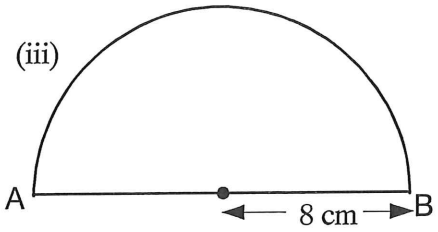
(i)



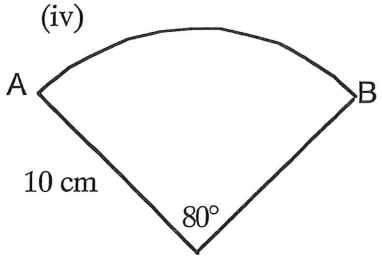
(ii)



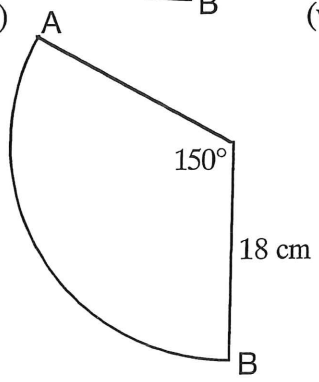
(iii)



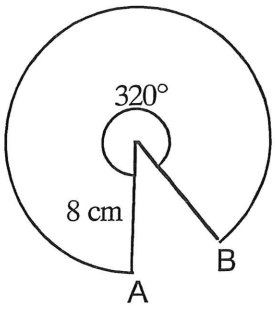
(iv)



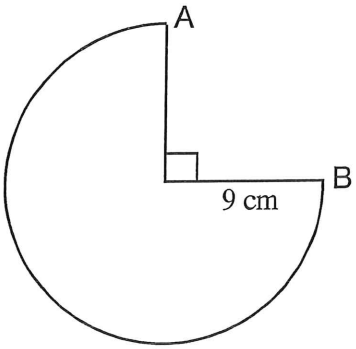
(v)



(vi)

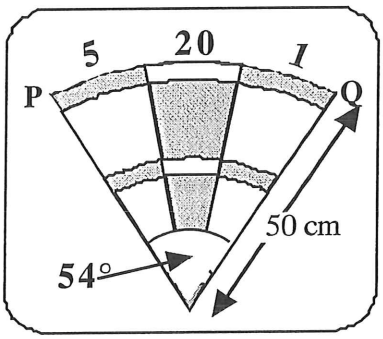


(vii)

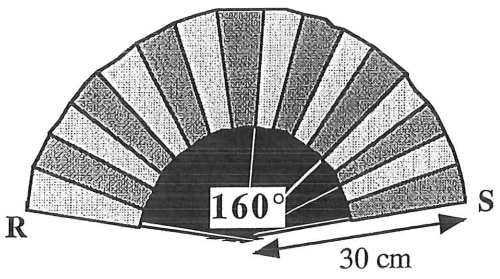


2. As the T.V. camera zoomed in on the dart board the sector involving the numbers 5, 20 and 1 was focused.

   Calculate the length of the arc PQ.

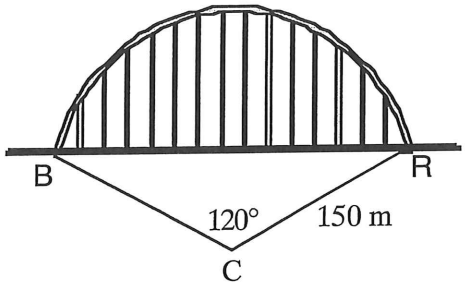


3.



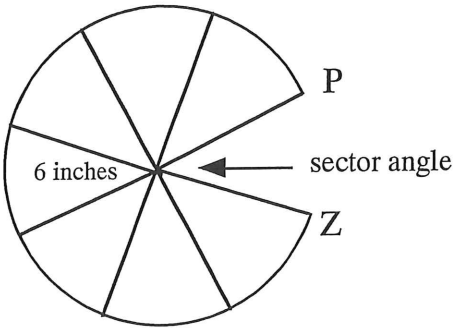
Calculate the length of the curved edge RS of the fan which is in the shape of a sector of a circle.

4. Calculate the length of the arch BR of the bridge which is the arc of a circle, centre C.

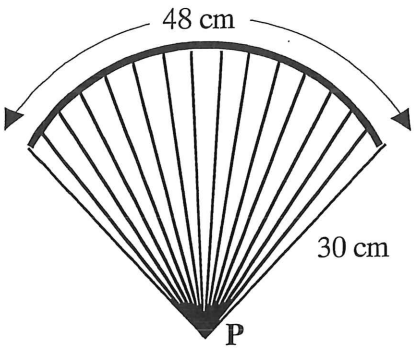


5. This circular pizza has been sliced into 8 pieces.
Calculate:

(a) the size of the sector angle of one piece.
(b) the length of the **major** arc PZ.



6.



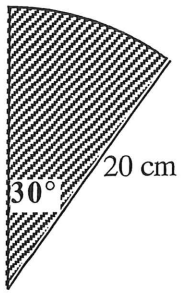
The lace edge of this fan is 48 cm long.
It is an arc of a circle, centre P.
Calculate the size of the angle at P.
(Answer to the nearest whole degree.)

B. Finding the area of a sector

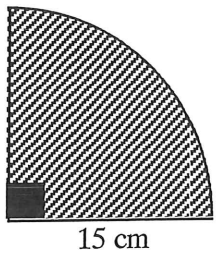
Exercise 2

1. Calculate the area of each sector (to the nearest square centimetre):

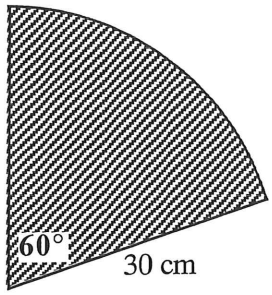
(a)



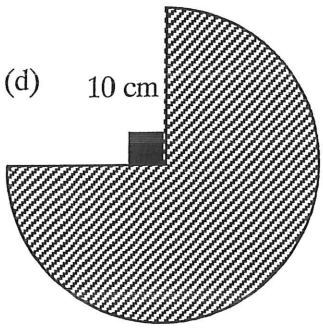
(b)



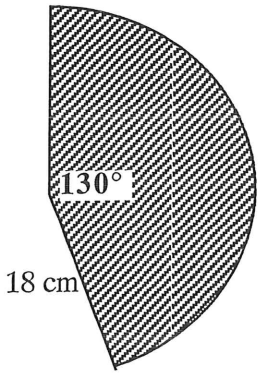
(c)



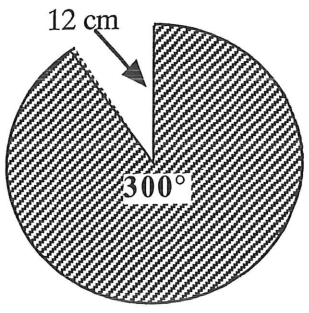
(d)



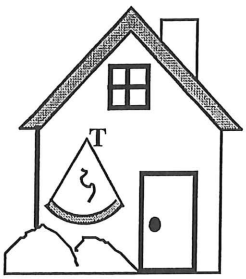
(e)



(f)



2.

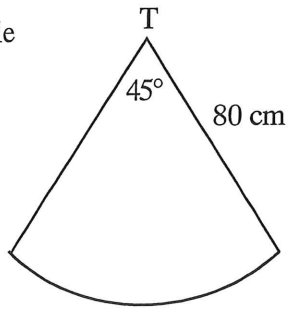


This house has an unusually shaped living room window.

It is in the shape of a sector of a circle with radius 80 cm.

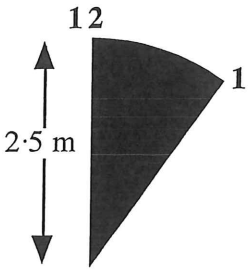
Unfortunately there is a crack in the glass and a new pane is required.

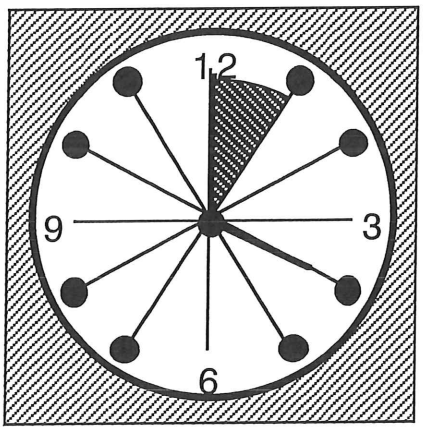
If the angle at T is 45°, calculate the area of glass to be replaced.



3. The face of a large town clock was in need of repair.
Workmen were replacing the rusted sector between the numbers 12 and 1 on the clock face.

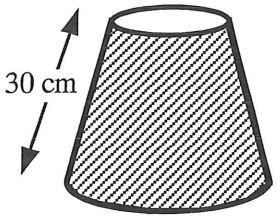
Calculate the area of this sector.

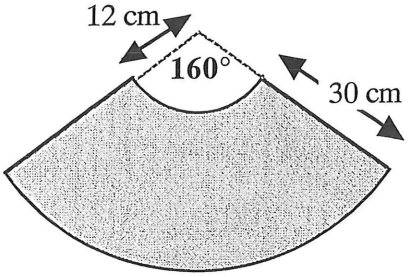




4. A light shade is made up from the sector of a large circle with a smaller sector removed.

Calculate the area of the shade.



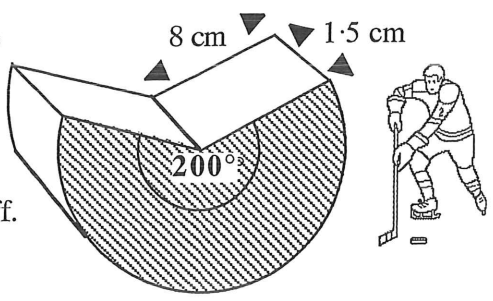


5. A <u>cylindrical</u> ice hockey puck of radius 8 cm and height 1·5 cm hits a goal post with such force that it splits, leaving a perfect sector as shown.

Calculate:

(a) the shaded area.

(b) the volume of the <u>smaller</u> part which broke off.

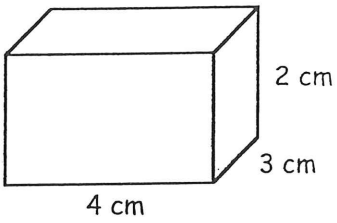


Chapter 7
Surface Area

Remember : To calculate the **surface area**, you find the area of each face and add them together.

Exercise 1

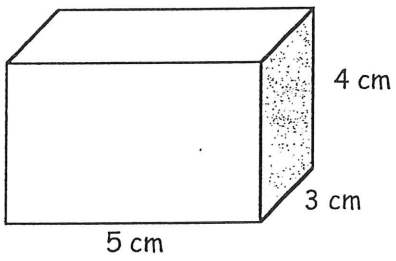
1. Copy and complete to find the total **surface area** of this cuboid.



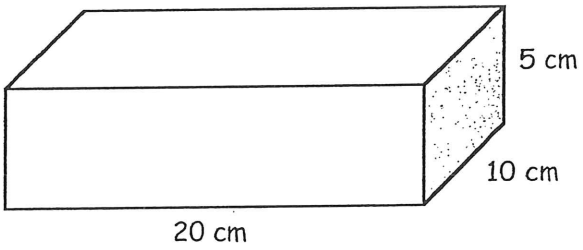
Area of front	$= l \times b$	$= 4\text{ cm} \times 2\text{ cm}$	$= 8\text{ cm}^2$
Area of back		= same	$= 8\text{ cm}^2$
Area of top	$= l \times b$	$= 4\text{ cm} \times 3\text{ cm}$	$= 12\text{ cm}^2$
Area of bottom		= same	$= \ldots\text{ cm}^2$
Area right side	$= l \times b$	$= \ldots\text{ cm} \times \ldots\text{ cm}$	$= \ldots\text{ cm}^2$
Area left side		= same	$= \ldots\text{ cm}^2$
	Total Surface Area		$= \ldots\text{cm}^2$

2. Find the total surface area of these cuboids. (*Show your working*).

(a)

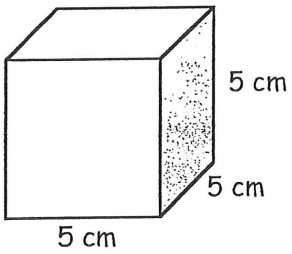


(b)

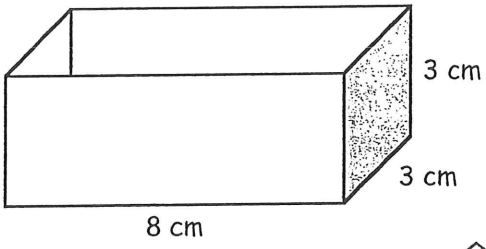


3. A cube has side 5 centimetres.

Find the total surface area of the cube.

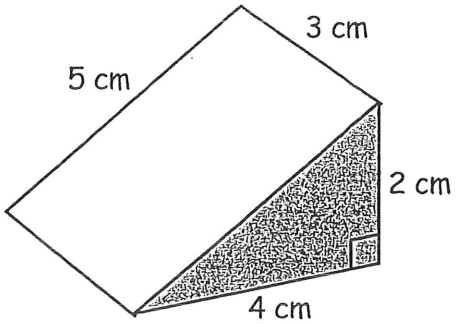


4. This carton has no lid.
Find the surface area of the outside of the carton.



5. Calculate the total surface area of this triangular prism.

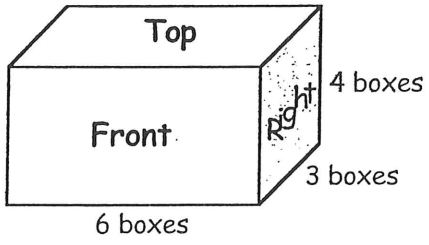
(*Show all working clearly*).

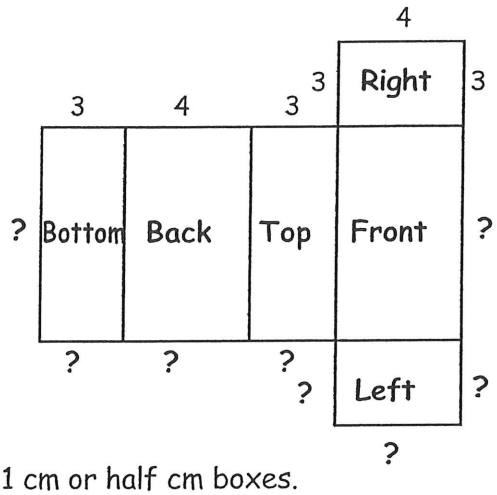


Exercise 2

1. Shown is a net of a cuboid.

   Copy the net and complete the unknown lengths.

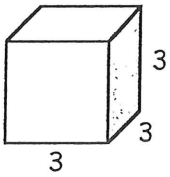




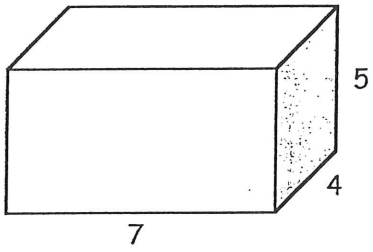
2. For each of the following : (i) draw a net using 1 cm or half cm boxes.

   (ii) calculate the surface area using the net to help you.

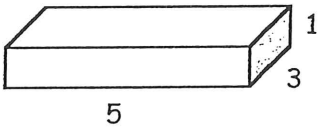
(a)



(b)



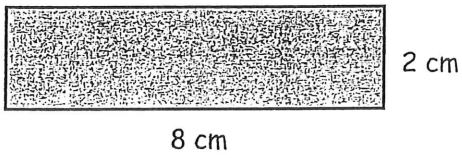
(c)



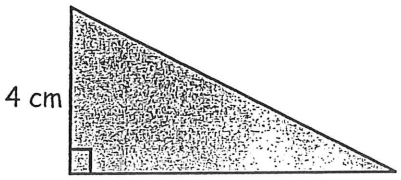
Exercise 3 Revision exercise

1. Calculate the area of each shape : -

(a)

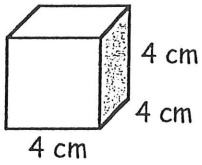


(b)

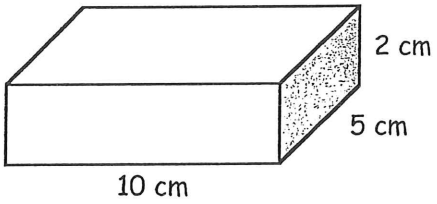


2. Calculate the surface area of each box :-

(a)



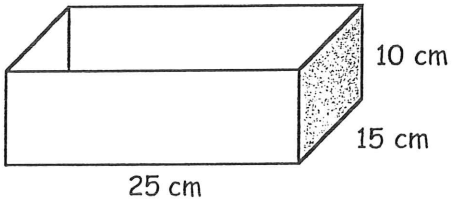
(b)



3. Draw a net of each of the boxes shown above. *(Use 1 box to represent 1 cm)*

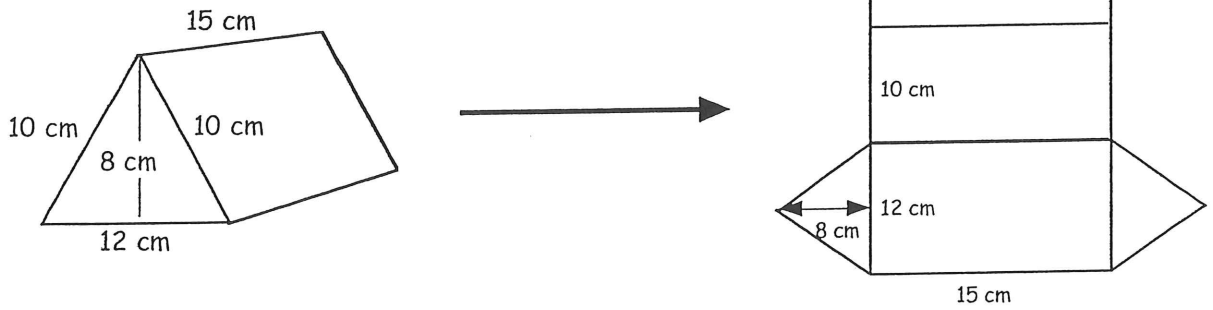
4. A cardboard box which has no lid has dimensions 25 cm by 15 cm by 10 cm.

   Find the area of card needed to make this box.



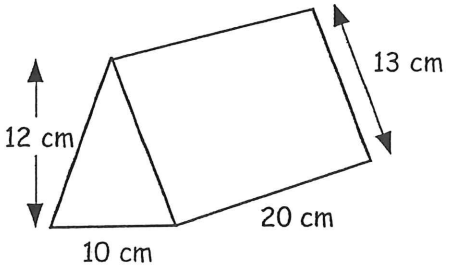
Exercise 4E

1. Calculate the total surface area of the triangular prism. (Show all your working).



2. A giant chocolate bar in the shape of a triangular prism is shown.

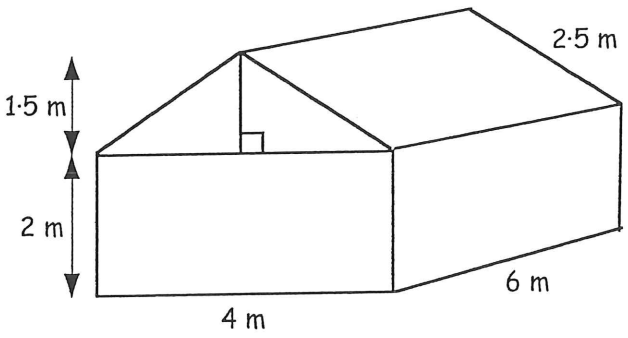
   Find the area of cardboard wrapping required to cover the bar.



3. A greenhouse is made from plastic sheeting.

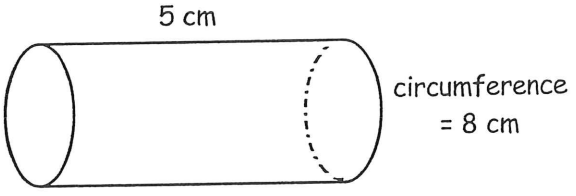
   Calculate the area of plastic sheeting needed to completely cover the greenhouse frame.

   (Note - *you do not need the base*)



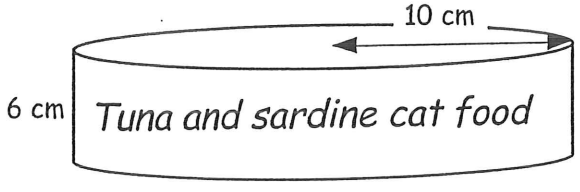
Exercise 5E

1. Calculate the **curved** surface area of the hollow pipe :-

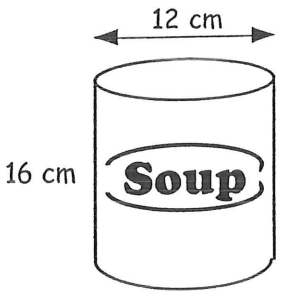


2. Calculate the curved surface area of each cylinder :-

(a)



(b)



Exercise 2

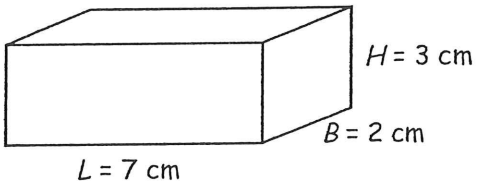
Remember : Volume = $L \times B \times H$

1. Copy and complete for this cuboid :-

$V = L \times B \times H$

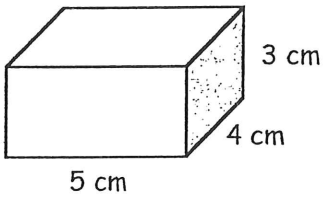
$V = 7 \times 2 \times 3$

$V =$ ..... cm^3

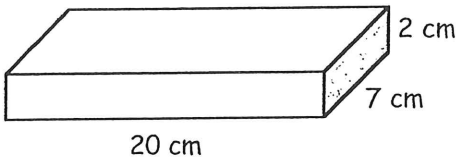


2. Calculate the volumes of each of the cuboids (show all your working) :-

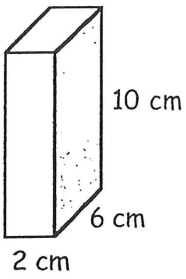
(a)



(b)

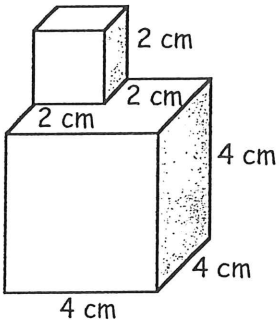


(c)

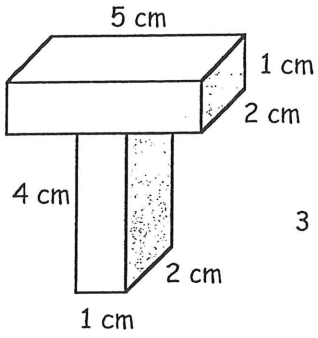


3. Find the total volume of each shape :-

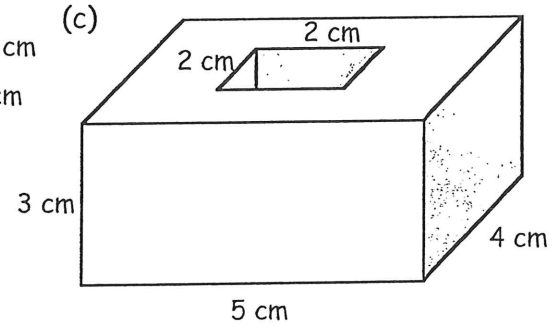
(a)



(b)

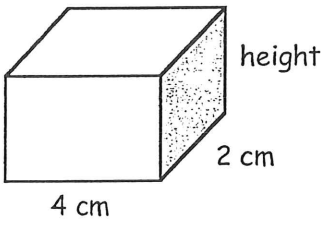


(c)

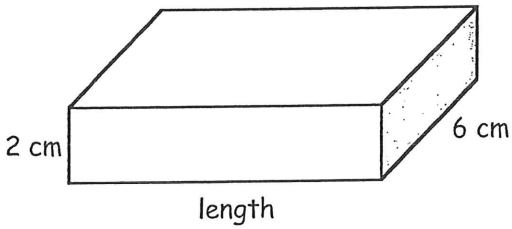


4. Calculate the missing edge in each of the cuboids :-

(a) Volume is 24 cm^3



(b) Volume is 96 cm^3



Exercise 3

Remember : $1\ cm^3 = 1\ ml$

$1000\ cm^3 = 1000\ ml = 1\ litre$

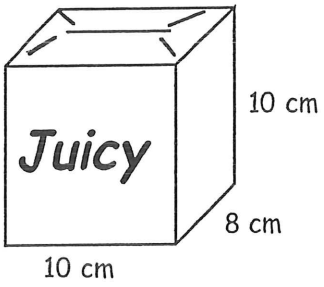
1. A carton of Juicy measures

10 cm by 8 cm by 10 cm

(a) Calculate its volume in cm^3. (Show your working).

(b) Write the volume in millilitres.

(c) How many litres is this ?



2. Change each of the following to litres :-

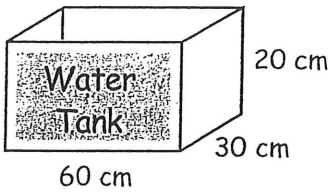
(a) 4000 ml (b) 8000 ml (c) 20000 ml (d) 500 ml (e) 150 ml

3. Change each of the following to millilitres :-

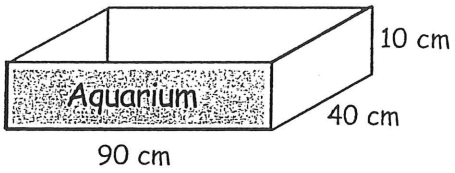
(a) 4 litres (b) 80 litres (c) 200 litres (d) 0·4 litres (e) 1·8 litres

4. Calculate the volume of each container in **litres**.
(Hint : first find the volume in cm^3, then change to millilitres, then change to litres).

(a)

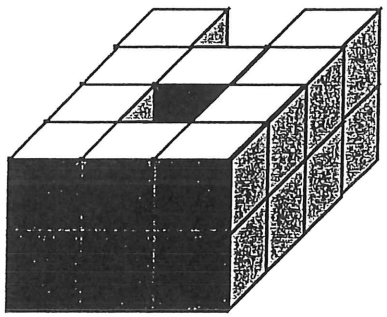


(b)



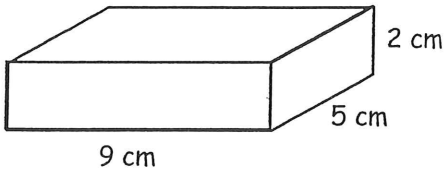
Exercise 4 Revision exercise

1. Write the volume of this shape in cubic centimetres.

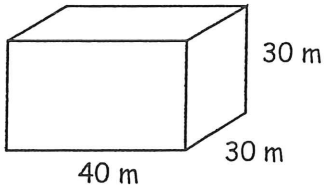


2. Use the formula to calculate the volume of these cuboids :-

(a)



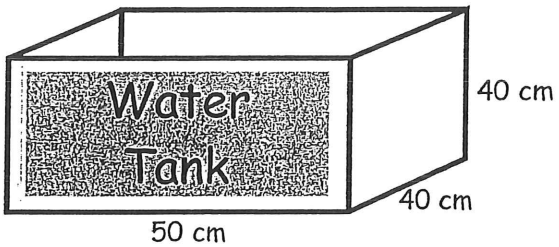
(b)



3. A cuboid has length 5 cm and breadth 4 cm. Its volume is 40 cm^3. Find its height.

4. Change to litres :- (a) 5000 ml (b) 8500 ml (c) 250 ml (d) 20 ml

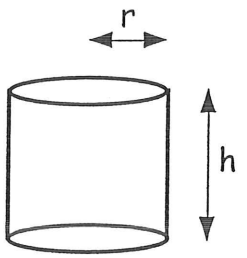
5. Calculate the volume of the tank in **litres**.



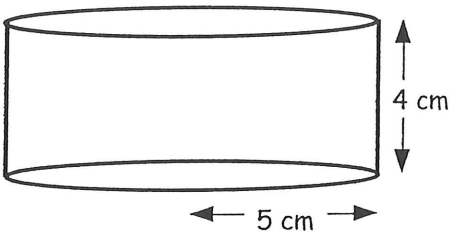
Exercise 5E

1. Copy and complete :-

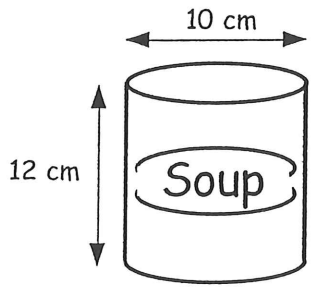
"The volume of a cylinder is $V = \pi$ ..... "



2. Find the volume of the cylinder shown.



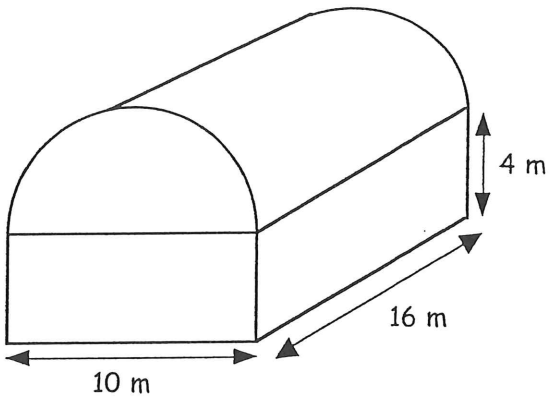
3.



Find the volume of the tin of soup.

4. Farmer Giles has a barn which has a cuboid as its base and a half cylinder on top.

Find the volume of the barn in m^3.



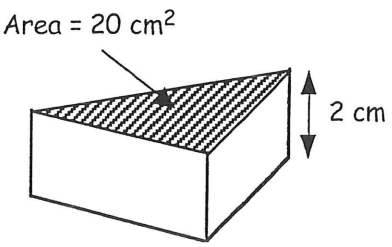
Exercise 6E

1. Copy and complete :- "The volume of a triangular prism is

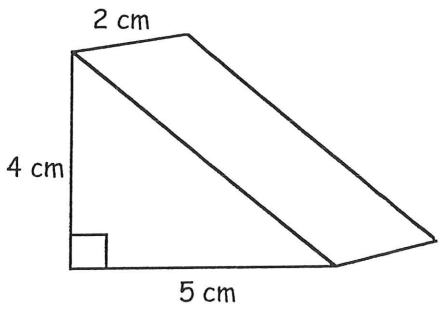
V = area of the base x ..... "

2. Calculate the volume of the following triangular prisms.

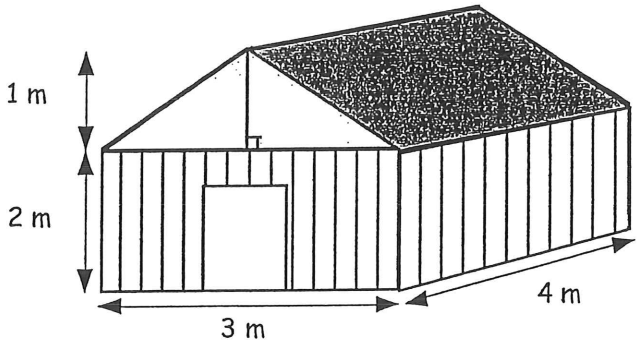
(a)



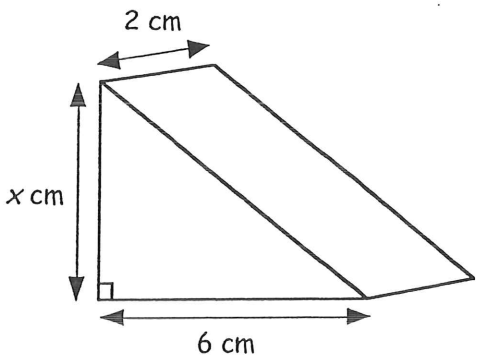
(b)



3. Find the volume of the garden shed.



4.



The volume of this wedge is 30 cm^3.

Calculate x, the height.

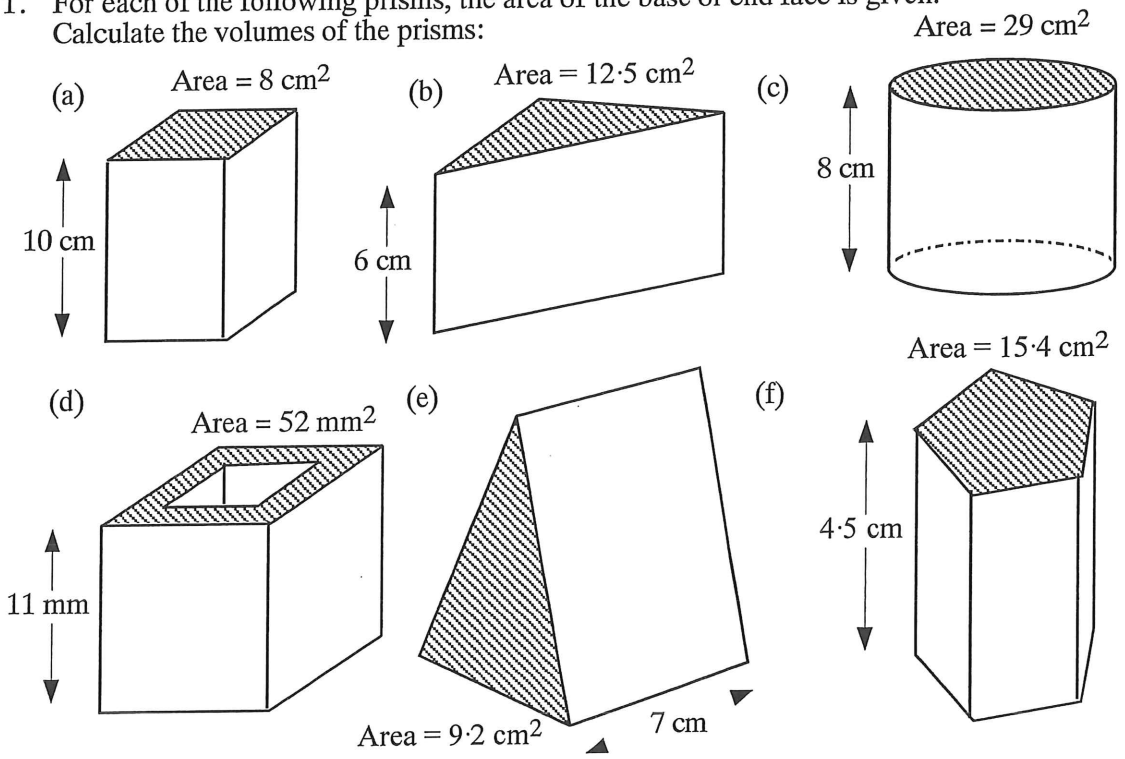
VOLUMES OF SOLIDS

$$\text{Volume}_{\text{prism}} = \text{Area}_{\text{base}} \times \text{height}$$

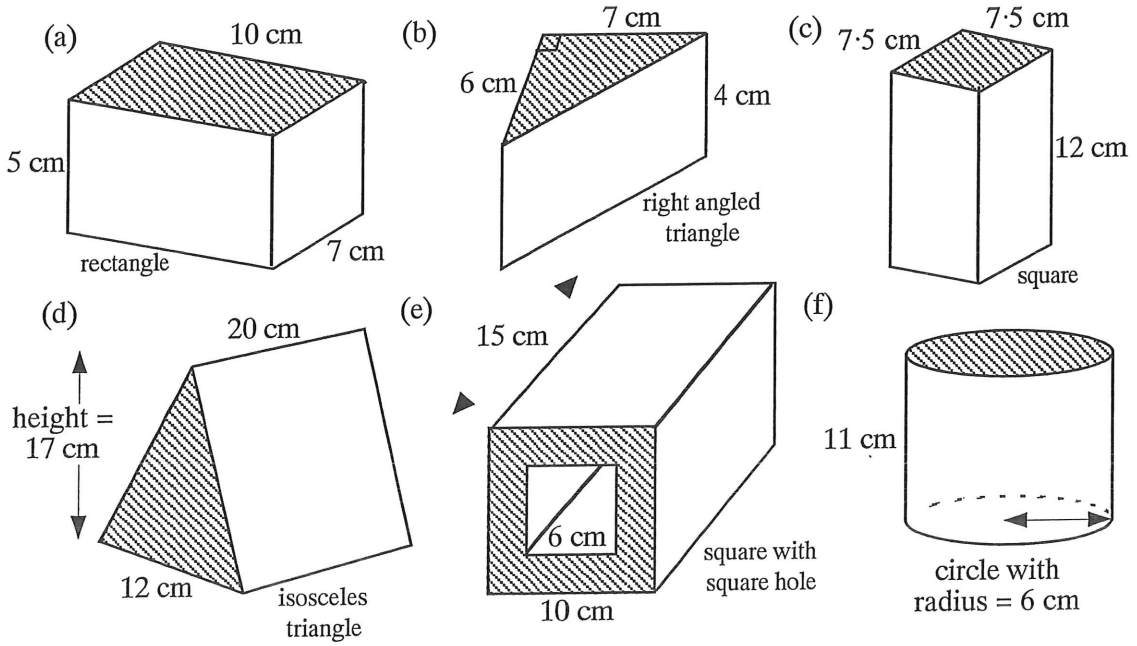
A. Volume of a Prism

Exercise 1

1. For each of the following prisms, the area of the base or end face is given.
Calculate the volumes of the prisms:



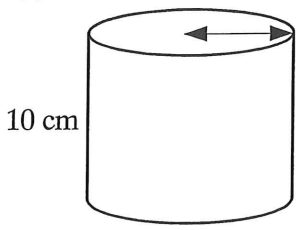
2. This time you must calculate the shaded area first, then find the volumes of the prisms.



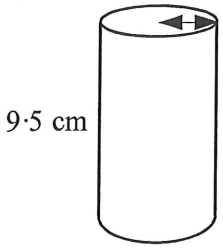
3. The **cylinder** – a special prism.
Calculate the volumes of the following cylinders:

$$\text{Volume}_{(\text{cylinder})} = \pi r^2 h$$

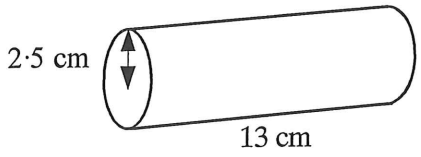
(a)



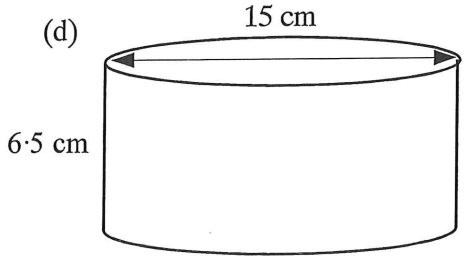
(b)



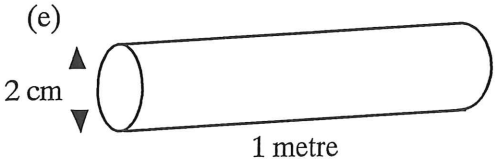
(c)



(d)



(e)

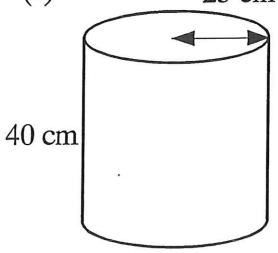


4. **Remember:**

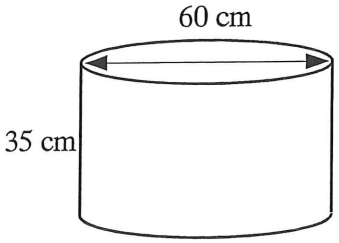
$1\ cm^3 = 1\ ml$; $1000\ cm^3 = 1000\ ml = 1\ litre$

How many litres of water will the following drums hold?

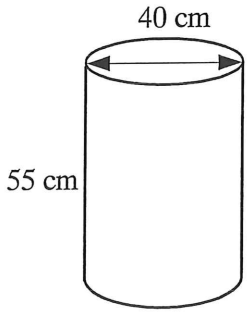
(a)



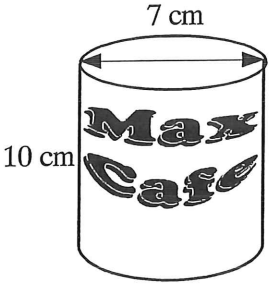
(b)



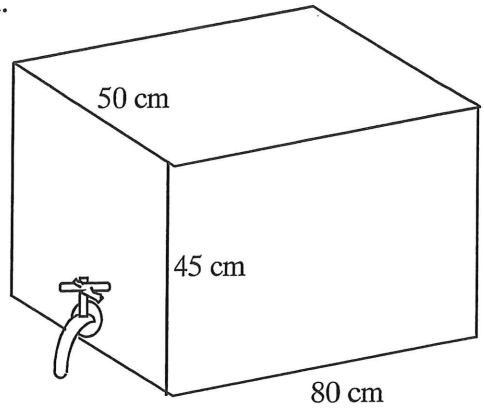
(c)



5. A cylindrical tin of Maxcafe Coffee is 10 centimetres high and has a base diameter of 7 centimetres.
What is the volume of coffee in the tin when it is full?

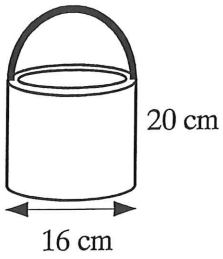


6. This rectangular storage tank is full of white paint.



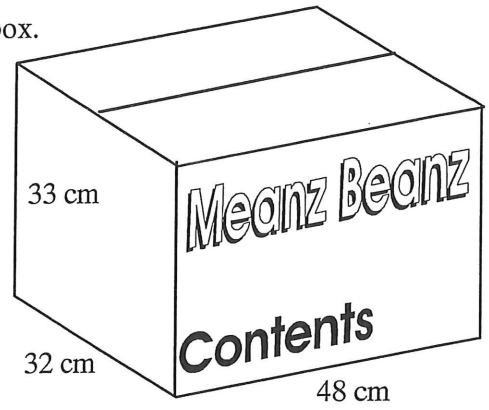
(a) Calculate the volume of paint in the tank in cubic centimetres (cm^3).

(b) Calculate the volume of this cylindrical paint tin.

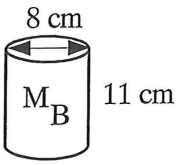


(c) How many times can the paint tin be <u>completely</u> filled from the tank?

7. Meanz Beanz tins are packed into this cardboard box.



(a) How many tins can be placed on the bottom layer?

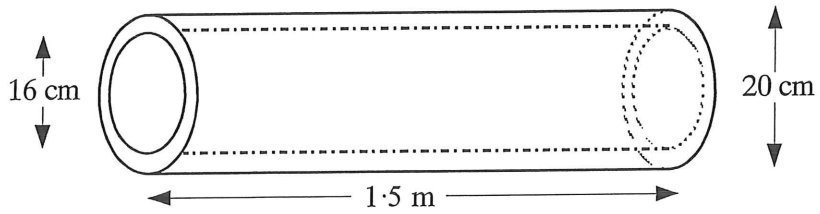


(b) How many layers will there be?

(c) How many tins can be packed in the box altogether?

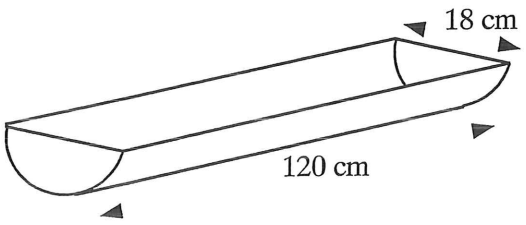
(d) How much air space in the box is there around all the tins?

8. This cast iron pipe has an internal diameter of 16 centimetres and an outside diameter of 20 centimetres. The pipe is 1·5 metres long.



Calculate the volume of iron needed to make the pipe.

9. How much liquid feeding will this semi-cylindrical pig-trough hold?



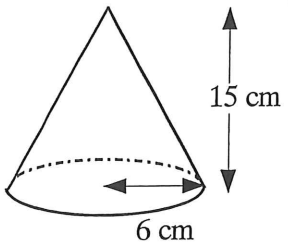
B. Volume of a Cone

$$\text{Volume}_{(\text{cone})} = \tfrac{1}{3}\pi r^2 h$$

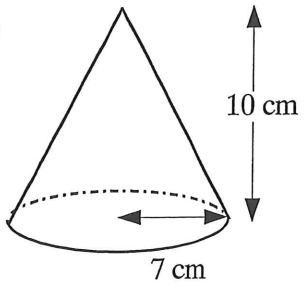
Exercise 2

1. Calculate the volumes of the following conical shapes:

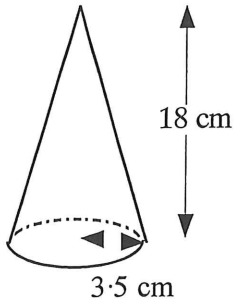
(a)



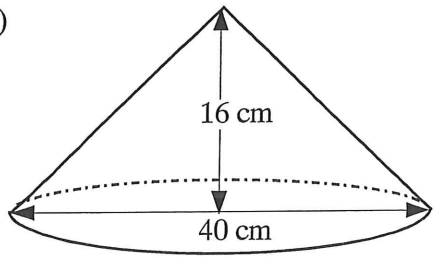
(b)



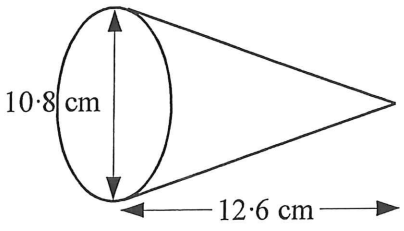
(c)



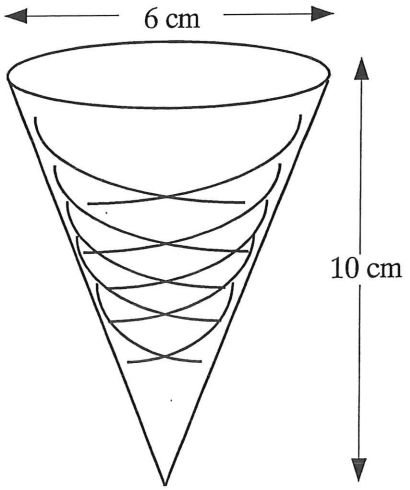
(d)



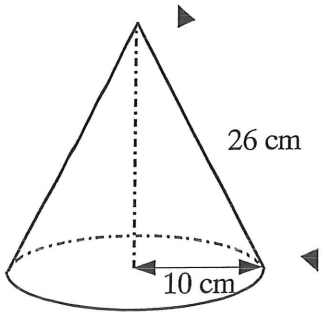
(e)



2. The wafer of an ice-cream cone has a diameter of 6 centimetres.
   The cone is 10 centimetres high.
   Calculate the volume of the cone.



3.



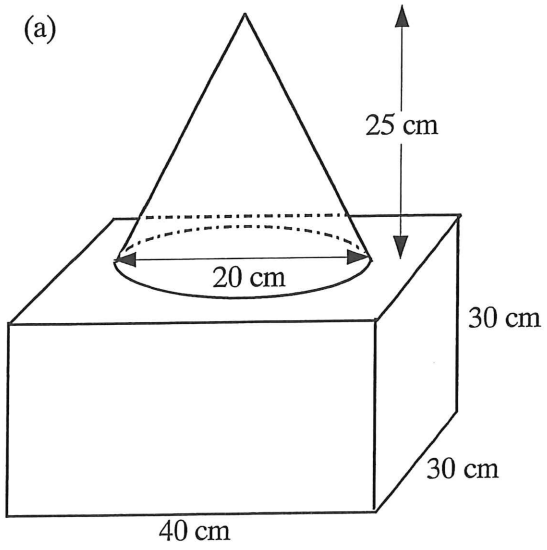
The 'sloping' height of this cone is 26 cm.

The base radius is 10 cm.

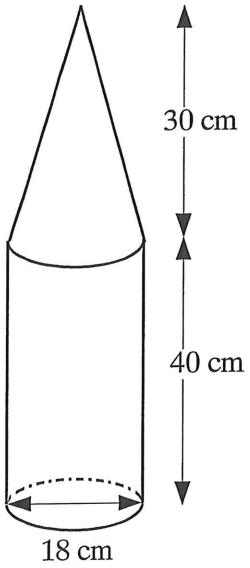
(a) Calculate the height of the cone.
(b) Calculate the volume of the cone.

4. Calculate the total volumes of the following shapes.

(a)



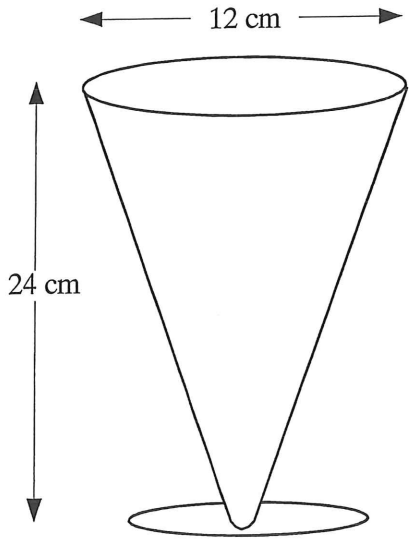
(b)



5. Water is poured into this conical flask at the rate of 50 millilitres per second.

   (a) Calculate the volume of the flask.

   (b) How long will it take, to the nearest second, to fill the flask to the top?



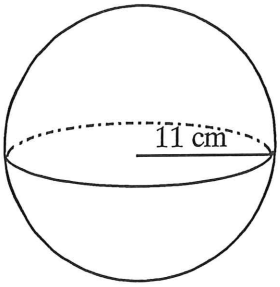
C. Volume of a Sphere

$$\text{Volume}_{(\text{sphere})} = \tfrac{4}{3}\pi r^3$$

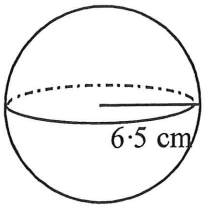
Exercise 3

1. Calculate the volumes of the following spheres:

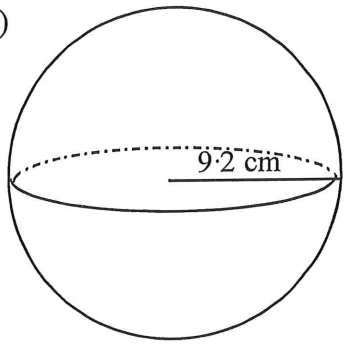
(a)



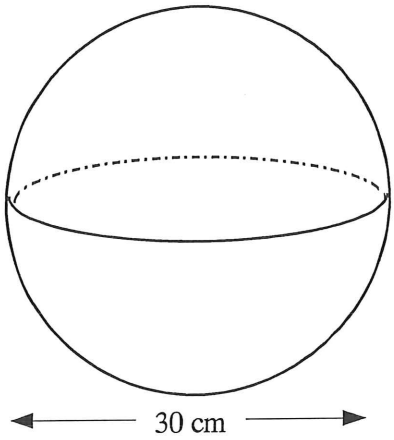
(b)



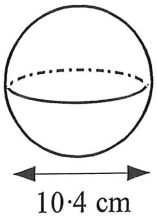
(c)



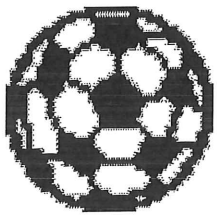
(d)

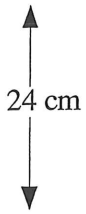


(e)



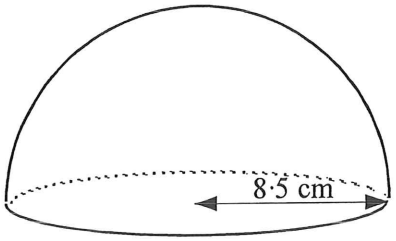
2. This football is fully inflated. Calculate the volume of air inside the football.



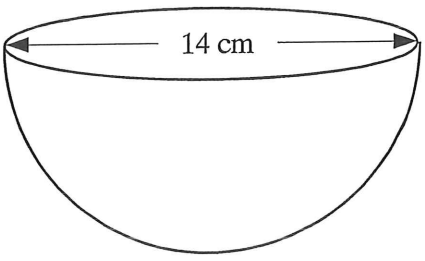


3. Calculate the volumes of these two 'hemispheres':

(a)



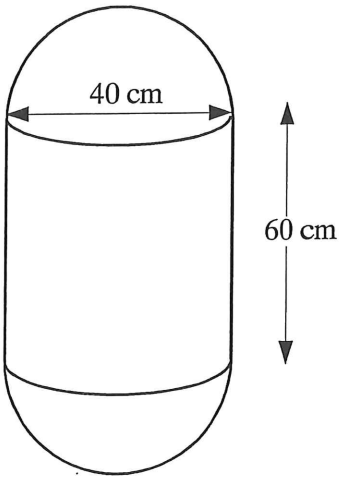
(b)



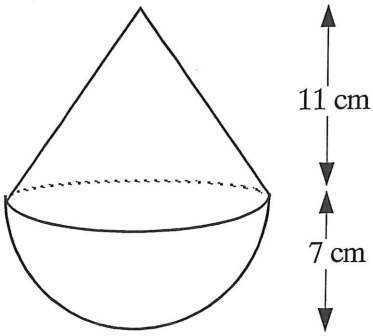
4. (a) Calculate the volume of water which can be stored in this copper hot water tank in cm^3.

The tank consists of a cylinder with two hemispherical ends.

(b) How many litres of water will it hold?
($1cm^3 = 1$ ml; 1000 ml = 1 litre).



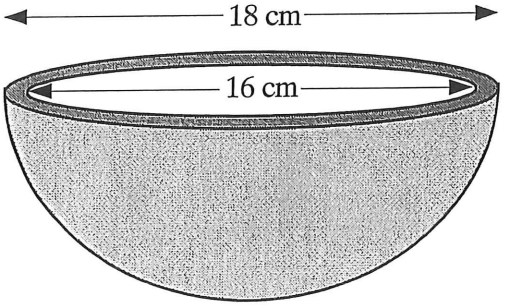
5.



Calculate the volume of this child's rocking toy which consists of a cone on top of a hemisphere.

6. This decorative wooden fruit bowl is in the shape of a hollowed out hemisphere.

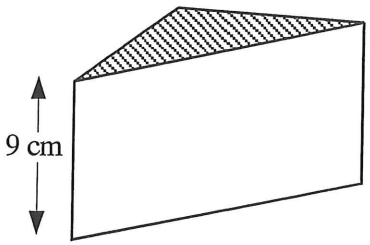
Calculate the volume of wood required to make it.



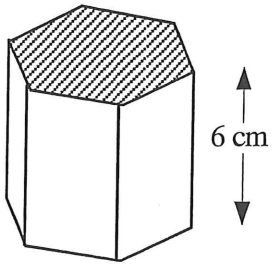
Checkup for Volumes of Solids

1. Calculate the volumes of the following prisms:

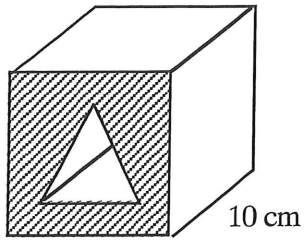
(a) Area = 12·5 cm^2



(b) Area = 28 cm^2



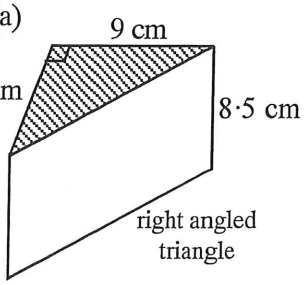
(c)



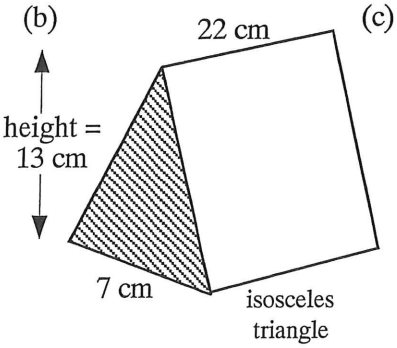
Area = 18·5 cm^2

2. Calculate the shaded areas and use them to find the volume of each shape.

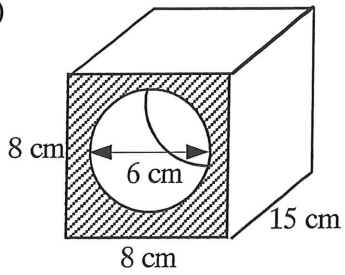
(a)



(b)



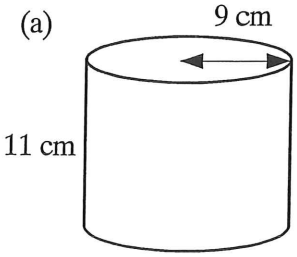
(c)



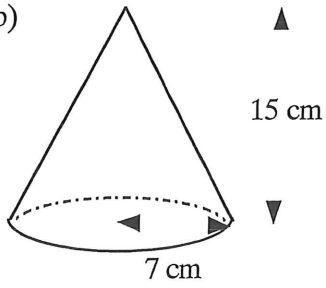
3. Calculate the volumes of the following shapes:

Vol $_{(cylinder)} = \pi r^2 h$
Vol $_{(cone)} = {}^1/_3 \pi r^2 h$
Vol $_{(sphere)} = {}^4/_3 \pi r^3$

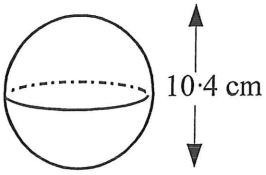
(a)



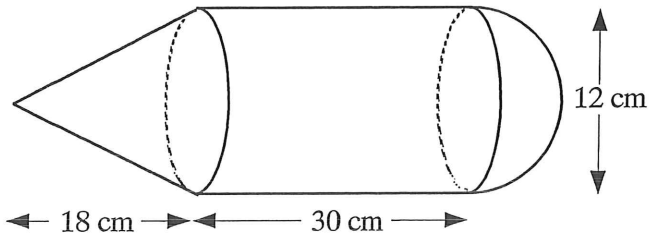
(b)



(c)



4. This shape consists of a cone, a cylinder and a hemisphere. Calculate its total volume.



Chapter 11

Calculators should **not** be used anywhere in this Chapter unless you are otherwise instructed.

Algebra

Exercise 1

1. Simplify each of the following expressions :-

(a) $y + y + y$ (b) $3a + 4a - 5a$ (c) $3e + 3e + 3e + 3e$

(d) $4t + 7t + 5t - 11t$ (e) $9p + 12p + p - 22p$ (f) $9y + 4f + 2y + 5f$

(g) $3r + 8s + 5r - 2s$ (h) $12h + 8u - 9u - 11h$ (i) $w + 4x - 3y + x + 5y$.

2. Simplify by multiplying:-

(a) $5 \times y$ (b) $4 \times e$ (c) $h \times 7$

(d) $g \times g$ (e) $k \times k$ (f) $2a \times 3a$

(g) $5t \times t$ (h) $6k \times 6k$ (i) $2p \times 3p \times 4p$.

3. Find the value of each expression below when $a = 2$, $b = 3$ and $c = 4$:-

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

(d) $a^2 + b^2 + c^2$ (e) $(c - a)^2 - 2b$ (f) $a^3 - (b - c)^3$.

4. Find the value of each expression below when $x = -1$, $y = 5$ and $z = -2$:-

(a) $x + y + z$ (b) $3x + 4y - 3z$ (c) $x^2 + (y - z)^2$.

Exercise 2

1. Multiply out the brackets :-

(a) $3(x + 2)$ (b) $4(t + 4)$ (c) $5(a - 1)$ (d) $10(w - 2)$

(e) $2(2a + 1)$ (f) $3(4e + 5)$ (g) $7(2g - 1)$ (h) $9(5k - 3)$

(i) $3(2a + b)$ (j) $5(x + 2y)$ (k) $8(2h + 4g - 1)$ (l) $15(v - 3w + y - 5)$.

2. Remove these brackets :-

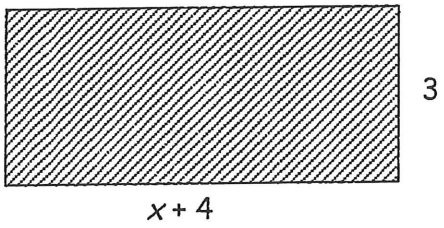
(a) $-2(a + 3)$ (b) $-5(6 + 2c)$ (c) $-3(5 - 4g)$ (d) $-(4a - 6)$

(e) $x(x + 4)$ (f) $t(2t - 5)$ (g) $-p(5p + 2)$ (h) $-k(-3 + 6k - m)$

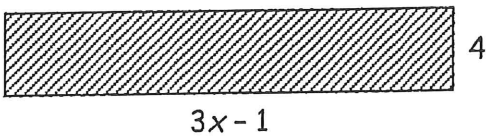
(i) $2y(3y + 1)$ (j) $4x(3x - 7)$ (k) $-2w(7 + 3w)$ (l) $-4p(6p - 2 + k)$.

3. Find the areas of each shape below :-

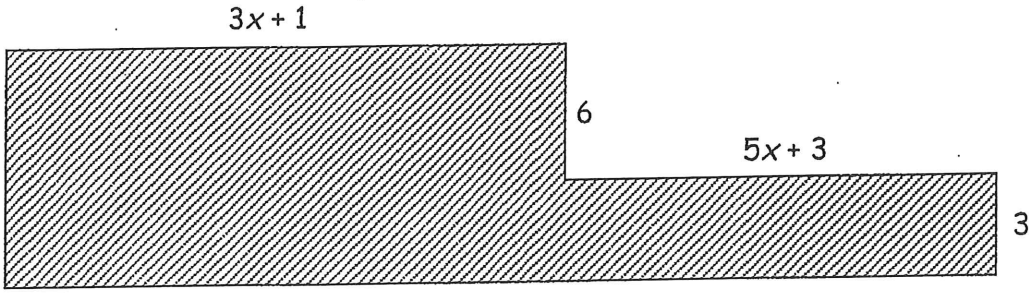
(a)



(b)



(c)



Exercise 3

Multiply out the brackets and simplify :-

1. (a) $2(x+3)+1$ (b) $3(y+4)+5$ (c) $7(k-1)+10$
   (d) $5(t-2)-5$ (e) $3(2g+4)+8$ (f) $6(3x+1)-6$
   (g) $8(3e-2)+5$ (h) $9(4h+7)-60$ (i) $4(w+1)-4w$.

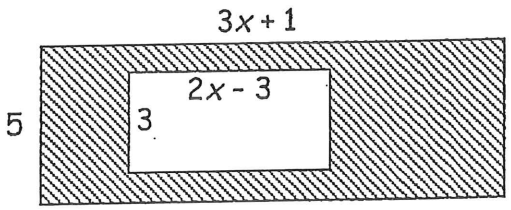
2. (a) $2(f+3)+3(f+1)$ (b) $4(y+2)+7(y+1)$ (c) $6(b+3)+2(b-5)$
   (d) $5(2g+2)+4(g-3)$ (e) $7(p+3)-5(p+1)$ (f) $7(2q+3)-4(3q-5)$
   (g) $5(3m-2)+3(2m-6)$ (h) $4(3p-4)-3(4p-5)$ (i) $5u(2u+3)-2u(u-7)$.

3. (a) $5-4(y+2)$ (b) $12-3(2b+4)$ (c) $6-3(2u-2)$
   (d) $6m-2(4+3m)$ (e) $3h-5(2h-1)+6h$ (f) $r-(r-1)+(-1)$.

4. A rectangular card has length $3x+1$ centimetres and breadth 5 centimetres.

   A smaller rectangle with sides 3 cm by $2x-3$ cm is cut from the card.

   Find in terms of x and y, the area of card left (shaded area) in its simplest form.



Exercise 4

1. Find the value of each of the following when $a = 1$, $b = 2$, $c = 3$ and $d = 4$:-

(a) $2a$ (b) $4c$ (c) $2d + 1$ (d) $a + b + c + d$

(e) $2a + 3c$ (f) $5b - 2d$ (g) $3a + 2b + c - 2d$ (h) $ab + cd$

(i) $4ab + d - 2abc$ (j) $(a + c)^2$ (k) $a^2 + b^2 + c^2$ (l) $(a + b - c)^2$

(m) $(c - d)^3$ (n) $\sqrt{(c^2 + d^2}$ (o) $2abc \div d$ (p) $a + d(bc - ab)$.

2. Find the value of each of the following when $e = -1$, $f = 3$, $g = -2$ and $h = 2$:-

(a) $5e + f$ (b) $3f + 2g - h$ (c) $3e + 2f - 3g$ (d) $ef + gh$

(e) $2fg + e^3$ (f) $(eh - gf)^2$ (g) $e^2 - h^2 - g^2 + f^2$ (h) $3(2e + f) + 2h^2$

(i) $\frac{1}{2}(h + e)^2$ (j) $2efgh$ (k) $e^2(f^2 - h^2)$ (l) $fg(3e - 5g) \div eh$.

Exercise 5

1. Copy and factorise :-

(a) $3a + 6 = 3(... + ...)$ (b) $8g - 20 = 4(... - ...)$ (c) $10y + 25x = 5(... + ...)$

(d) $ab + 4a = a(... + ...)$ (e) $2kg + 2kp = 2k(.. + ..)$ (f) $6b + 9b^2 = 3b(... + ...)$.

2. Factorise :-

(a) $2a + 4$ (b) $3x + 12$ (c) $5k - 40$ (d) $6p + 6q$

(e) $12x + 15$ (f) $16y + 24$ (g) $24k - 15$ (h) $9a + 21b$

(i) $3x + 9y + 6$ (j) $4d + 6e + 10f$ (k) $12w + 30h - 18$ (l) $15q - 45p + 75m$.

3. Factorise fully :-

(a) $3ab + 21b$ (b) $12cd + 15c$ (c) $30pqr - 24pq$

(d) $5x - 15xy + xz$ (e) $x^2 + 4x$ (f) $3y^2 + 6y$

(g) $8x^2 + 4x$ (h) $12y - y^2$ (i) $x^2 + x$

(j) $12x^2 + 4x$ (k) $x^3 + x$ (l) $y^3 + y^2 + y$.

Revision Exercise

1. Simplify :-

(a) $3x + 4x$ (b) $6x + 3x - 8x$ (c) $8 \times k$ (d) $2p \times 5$

(e) $g \times 10$ (f) $3t \times t$ (g) $4p \times 3p$ (h) $2k \times 3k \times 4k$.

2. Multiply out each bracket :-

(a) $3(x + 40)$ (b) $6(y - 3)$ (c) $9(2x + 4)$ (d) $12(3b - 5)$

(e) $a(a + 1)$ (f) $3k(2k - 4)$ (g) $-3g(4 + 2g)$ (h) $-w(4 - 3w)$.

3. Multiply out each bracket and simplify :-

(a) $3(x + 1) + 4$ (b) $4(2y + 5) - 15$ (c) $6 + 2(3e - 3)$

(d) $13 - 4(3 - 2t)$ (e) $3x(x + 1) - 3x$ (f) $12y - 3y(2y - 4) + 3y^2$

(g) $2(b + 3) + 3(2b - 1)$ (h) $5(2a + 6) - 2(4a + 15)$ (i) $5a(a + 3) - 2a(2a + 5)$.

4. Find the value of each expression when $a = -1$, $b = 2$, $c = 3$, $d = 4$ and $e = -2$:-

(a) $b + c + e$ (b) $ab + cd$ (c) $2b + 3c - 4e$ (d) $abcde \div 4$

(e) $a^2 + b^2 + c^2$ (f) $a^2 - b^2$ (g) $(ab + cd)^2 - e^2$ (h) $\sqrt{(ae)^2 - c}$.

5. Factorise fully :-

(a) $3x + 6$ (b) $4y - 10$ (c) $14p - 21$ (d) $ab + ac$

(e) $12xy + 4x$ (f) $15xyz - 3xy$ (g) $5m^2 + m$ (h) $16b^3 + 6b^2 + 28b$.

ALGEBRAIC OPERATIONS

A. Multiplying Algebraic Expressions Involving Brackets

Exercise 1

1. Write these without brackets:

(a) $6(x + 2)$	(b) $3(a + 1)$	(c) $5(y - 4)$	(d) $7(t - 1)$
(e) $10(x - 10)$	(f) $2(2 + x)$	(g) $3(4 + y)$	(h) $6(5 - w)$
(i) $8(1 - c)$	(j) $15(2 - h)$	(k) $3(x + y)$	(l) $9(a - c)$
(m) $4(2 - x)$	(n) $11(e - f)$	(o) $1(1 - y)$	(p) $1(y - 1)$

2. Remove the brackets:

(a) $3(2x + 4)$	(b) $2(4a + 3)$	(c) $5(1 + 2y)$	(d) $6(3 - 3x)$
(e) $7(2w - 4)$	(f) $c(x + 5)$	(g) $d(v + 3)$	(h) $g(h - 1)$
(i) $s(r - 4)$	(j) $m(n + 10)$	(k) $x(v + w)$	(l) $a(x + r)$
(m) $x(a - y)$	(n) $a(a + b)$	(o) $r(r - s)$	(p) $r(r - 1)$
(q) $a(1 - a)$	(r) $x(x - 8)$	(s) $x(x + 3y)$	(t) $w(3w - 1)$
(u) $x(5x - 3)$	(v) $a(7x - 5a)$	(w) $m(4m + 8n)$	(x) $v(27 - 2v)$

3. Multiply out the brackets:

(a) $2(x + y + 4)$	(b) $7(x + y + 1)$	(c) $5(x - y - 6)$
(d) $6(x + 2y + 5)$	(e) $10(4x - y + z)$	(f) $9(6a - 2b + 1)$
(g) $x(3x + 5y + z)$	(h) $2a(3a - 4b + c)$	(i) $s(s^2 + 3)$
(j) $x(x^2 + 1)$	(k) $y(y^2 - 1)$	(l) $c(c^2 - 6)$
(m) $w(w^2 + w)$	(n) $a(a^2 - a)$	(o) $x(x^3 - 2x^2)$

Exercise 2A

1. Multiply out these brackets:

(a) $(x + 1)(x + 5)$	(b) $(x + 2)(x + 3)$	(c) $(x + 5)(x + 6)$
(d) $(x + 3)(x + 7)$	(e) $(x + 4)(x + 4)$	(f) $(x + 1)(x + 1)$
(g) $(a + 1)(a + 8)$	(h) $(s + 11)(s + 10)$	(i) $(w + 4)(w + 100)$

2. Multiply:

(a) $(x - 3)(x - 1)$	(b) $(x - 4)(x - 2)$	(c) $(x - 7)(x - 8)$
(d) $(a - 2)(a - 5)$	(e) $(b - 7)(b - 7)$	(f) $(c - 3)(c - 2)$
(g) $(v - 10)(v - 10)$	(h) $(w - 6)(w - 3)$	(i) $(z - 1)(z - 1)$

3. Multiply:

(a) $(x + 5)(x + 1)$	(b) $(c - 4)(c - 2)$	(c) $(s - 6)(s + 3)$
(d) $(a - 7)(a - 5)$	(e) $(v + 9)(v + 9)$	(f) $(q - 6)(q + 2)$
(g) $(r + 6)(r - 2)$	(h) $(w - 8)(w + 8)$	(i) $(x + 1)(x - 1)$
(j) $(d - 3)(d - 3)$	(k) $(a - 6)(a + 11)$	(l) $(z - 10)(z + 11)$

4. Multiply:

(a) $(2x + 3)(2x - 3)$ (b) $(5c - 1)(5c + 1)$ (c) $(2s - 1)(2s + 3)$

(d) $(2a - 3)(2a - 1)$ (e) $(v + 1)(4v - 3)$ (f) $(3q - 4)(2q + 3)$

(g) $(4r - 2)(5r + 3)$ (h) $(4w - 5)(2w + 5)$ (i) $(10x + 1)(10x - 1)$

(j) $(2 - d)(1 - d)$ (k) $(4 - p)(3 + 2p)$ (l) $(1 - 3p)(1 - 2p)$

5. Multiply out:

(a) $(x + 2)^2$ (b) $(y + 4)^2$ (c) $(z + 3)^2$ (d) $(t + 10)^2$

(e) $(x - 1)^2$ (f) $(y - 6)^2$ (g) $(z - 2)^2$ (h) $(t - 8)^2$

(i) $(a + b)^2$ (j) $(g + h)^2$ (k) $(r - s)^2$ (l) $(e - f)^2$

(m) $(3x + 1)^2$ (n) $(4x - 3)^2$ (o) $(x + 3y)^2$ (p) $(a - 4b)^2$

(q) $(4a + b)^2$ (r) $(5c + d)^2$ (s) $(5p + 2q)^2$ (t) $(2x - 3y)^2$

Exercise 2B

Multiply out the brackets and simplify:

1. $(x + 1)(x^2 + 3x + 1)$
2. $(x + 2)(x^2 - 4x + 1)$
3. $(w - 3)(w^2 + w - 2)$
4. $(z - 1)(z^2 - 5z - 1)$
5. $(v + 2)(2v^2 + v + 5)$
6. $(a - 5)(5a^2 - 10a - 20)$
7. $(m + 2)^3$
8. $(n - 1)^3$
9. $(x + {}^1/_x)^2$
10. $(x - {}^1/_x)^2$

B. Factorising Algebraic Expressions – The Common Factor

Exercise 3

1. Factorise the following by taking out the common factors:

(a) $4a + 4b$ (b) $7v + 7w$ (c) $3x - 3y$ (d) $6c - 6d$

(e) $2r + 4s$ (f) $9m - 12n$ (g) $av + aw$ (h) $pq - pr$

(i) $bx + b$ (j) $ax^2 + a$ (k) $x^2 + dx$ (l) $y^2 - yz$

(m) $a^2 + a$ (n) $t^2 - t$ (o) $h^3 + h^2$ (p) $m^3 - m^2$

(q) $ab + bt$ (r) $mn - nr$ (s) $8x + 12y$ (t) $35p - 21q$

(u) $2a^2 + 8ab$ (v) $12ab - 9ac$ (w) $pqr + pqs$ (x) $8c^2 - 2c$

2. Factorise:

(a) $am - bm$ (b) $20 - 5w$ (c) $d - d^2$ (d) $yz + z$

(e) $pr - pu$ (f) $2mn + mp$ (g) $6cd - 4ce$ (h) $9pq - 12pr$

(i) $8a^2 + 6a$ (j) $15x^2 - 6xy$ (k) ${}^1/_2x + {}^1/_2y$ (l) $pq + {}^1/_2sq^2$

(m) $10a^2b + 8ab^2$ (n) ${}^1/_2 + {}^1/_2x$ (o) ${}^1/_2v - {}^3/_2$ (p) $2\pi rh + 2\pi r^2$

(q) $6a + 3b - 12c$ (r) $mn - mp + m^2$ (s) $3x^2 - 2xy + 6x$ (t) $25x^2 - 5x^2y$

Chapter 43

Equations & Inequations

Exercise 1

1. **Copy** each equation and solve it to find the value of x :-

(a) $x + 9 = 15$ (b) $x + 11 = 11$ (c) $x - 8 = 4$

(d) $x - 18 = 0$ (e) $x - 60 = 20$ (f) $x + 8 = 3$

(g) $x + 19 = 0$ (h) $3 + x = 5$ (i) $22 + x = 1$.

2. **Copy** each equation and solve it to find the value of the letter :-

(a) $2m = 26$ (b) $7k = 0$ (c) $4x = 2$

(d) $8u = 12$ (e) $8v = 18$ (f) $15p = 10$.

3. Find the value of x in the following equations (*Show each step of working carefully*).

(a) $4x + 1 = 21$ (b) $3x + 5 = 29$ (c) $9x - 3 = 15$

(d) $7x - 6 = 29$ (e) $6x - 12 = 0$ (f) $5x - 1 = 44$

(g) $9x - 20 = 34$ (h) $3x + 42 = 87$ (i) $2x - 7 = 32$

(j) $9x + 9 = 0$ (k) $2x - 19 = 0$ (l) $3x + 5 = -7$.

Exercise 2

1. Solve the following equations :-

(a) $5x + 3 = 3x + 5$ (b) $8x + 9 = 7x + 17$ (c) $7x - 1 = 3x + 15$

(d) $5x - 3 = 2x + 18$ (e) $12x - 5 = 8x + 7$ (f) $10x - 1 = 8x + 6$

(g) $6x + 4 = 3x + 4$ (h) $9x - 1 = 4x + 34$ (i) $7x - 8 = x + 1$.

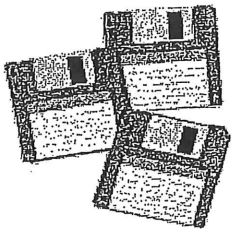
2. Solve for x :-

(a) $4x = 3x + 8$ (b) $4x = x + 18$ (c) $9x = 4x + 45$

(d) $10x = 9x + 41$ (e) $3x = x + 17$ (f) $5x - 26 = 3x$

(g) $7x - 48 = x$ (h) $3x + 17 = x$ (i) $10x - 30 = 6x$.

3. Simon had 6 boxes of disks.
Amy had only 1 box of disks but had 50 loose disks as well.

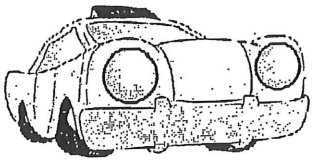


They discovered that they had exactly the same number of disks.

(a) Make up an equation to show this information.
(*let x be the number of disks in 1 box*)

(b) Solve the equation to determine how many disks there are in each box.

4. A large group of friends decide to go to a football match.
They fill 6 taxis and 4 of them also to walk to the match.



Afterwards, they have 4 taxis (full) to take them back.
The remaining 16 friends walk home.

(a) Make up an equation to show this information.
(*let x be the number of people in 1 full taxi*)

(b) Solve the equation to determine how many people a full taxi carried.

Exercise 3

1. Solve these equations by multiplying out the brackets first :-

(a) $2(x+7)=18$	(b) $3(x+4)=30$	(c) $5(x-6)=10$
(d) $4(x+9)=48$	(e) $6(x+3)=66$	(f) $2(x+5)=18$
(g) $9(x-4)=36$	(h) $9(x+1)=9$	(i) $2(x-1)=11$
(j) $5(x-7)=0$	(k) $3(x-8)=9$	(l) $5(x+7)=20$.

2. Solve these equations :-

(a) $2(4x+3)=14$	(b) $5(2x-1)=45$	(c) $3(6x-1)=33$
(d) $2(7x+4)=50$	(e) $3(2x-8)=0$	(f) $4(5x-8)=88$
(g) $2(3x-1)=4x+14$	(h) $5(2x+1)=7x+14$	(i) $3(1+2x)=5x+17$
(j) $6(2x-1)=10x$	(k) $14(2x-1)=26x+4$	(l) $8(x+3)=7x$.

3. Solve the equations :-

(a) $2(x+5)-x-4=7$	(b) $4(x+2)+3x-3=12$
(c) $5(x+2)-3x=18$	(d) $3(x-5)+4x+1=28$
(e) $2x+1+3(x-6)=23$	(f) $8x+2(x-9)=82$
(g) $3(x-3)+2(x+5)=21$	(h) $5(2x+1)+3(1-2x)=20$
(i) $5(2x+1)-2(x-2)=6x+13$	(j) $10(x+3)-6(x+1)=2x+40$.

Exercise 4

Solve each of these equations, by first of all multiplying **every term** by the l.c.m. of all the fractional denominators :-

1. $\frac{1}{2}x - 3 = 1$
2. $\frac{1}{4}x + 7 = 10$
3. $\frac{1}{8}x - 5 = 0$
4. $\frac{2}{3}x - 1 = 9$
5. $1 + \frac{3}{5}x = 13$
6. $\frac{3}{8}x + 4 = 4$
7. $\frac{3}{4}x - \frac{1}{2} = 7$
8. $\frac{1}{2}x + \frac{1}{3} = 4$
9. $\frac{4}{5}x - \frac{1}{4} = 0$
10. $\frac{1}{2}x - 5 = \frac{1}{4}$
11. $\frac{2}{3}x - 1 = \frac{1}{6}$
12. $\frac{3}{4}x - 1 = \frac{1}{5}$
13. $\frac{1}{2}x + 1 = \frac{1}{3}x + 4$
14. $\frac{3}{4}x - 4 = \frac{3}{5}x - 1$
15. $1 + \frac{5}{8}x = \frac{1}{4}x + 10.$

Exercise 5

Multiply each term by the l.c.m. of the denominators to dispose of the fractions and solve :-

1. $\frac{x+1}{4} = 3$
2. $\frac{x+4}{5} = 4$
3. $\frac{x+2}{3} - 2 = 5$
4. $8 - \frac{x-5}{3} = 0$
5. $\frac{2}{3}(6x+3) - 22 = 0$
6. $\frac{3}{4}(5x-1) - 7 = 3\frac{1}{2}$
7. $\frac{5}{8}(x+3) - \frac{1}{2}x = 2$
8. $\frac{2}{5}(6x-1) - \frac{1}{3}x = 12$
9. $2 + \frac{3}{10}(2x+6) = \frac{1}{3}x + 7$
10. $\frac{2}{3}(2x+4) + \frac{1}{2}(x-3) = 14$
11. $\frac{x-1}{5} + \frac{x+2}{3} = 1$
12. $\frac{2x-1}{4} - \frac{x+6}{3} = 0.$

Exercise 6

1. Solve these inequalities, leaving your answers in the form $x < 1$, etc. :-

(a) $x + 4 > 7$ (b) $x + 8 < 14$ (c) $x - 9 \leq 20$

(d) $x + 6 \geq 23$ (e) $x - 15 \leq 15$ (f) $x - 61 \geq 0$

2. Solve each inequality, leaving your answers in the form $x \geq 7$, etc. :-

(a) $5x < 25$ (b) $4x > 28$ (c) $3x < 39$

(d) $9x \geq 54$ (e) $7x \leq 98$ (f) $100x > 1400$

3. Solve the following inequalities :-

(a) $3x + 5 < 23$ (b) $2x + 11 > 27$ (c) $6x - 8 < 4$

(d) $7x + 3 \geq 52$ (e) $10x - 9 \leq 81$ (f) $5x - 23 > 7$

(g) $4x + 4 \leq 4$ (h) $3x - 2 < 25$ (i) $2x + 5 \leq 22$

(j) $2(x + 5) < 16$ (k) $4(x + 8) > 40$ (l) $4(x - 1) \geq 20$

(m) $4(2x + 1) \leq 84$ (n) $2(6x - 4) > 4$ (o) $5(x + 3) < 3x + 21$

(p) $3(2x - 7) \geq 5x + 19$ (q) $2(8x + 1) < 3x + 2$ (r) $7(2x - 1) \leq 12x$

Revision Exercise

1. Find the value of x in the following equations (*Show each step of working carefully*).

(a) $x + 5 = 19$ (b) $x - 40 = 10$ (c) $9x = 54$

(d) $2x = 17$ (e) $10x = 5$ (f) $4x + 1 = 21$

(g) $9x - 6 = 30$ (h) $2x + 7 = 14$ (i) $3x - 2 = -11$

(j) $5x + 1 = 3x + 7$ (k) $7x - 1 = 4x + 14$ (l) $9x = 3x + 42$

2. Don had 9 packets of toffos. He gave 2 packets to Emma, who also had 25 loose toffos.

They discovered that they then had exactly the same number of toffos.

(a) Make up an equation to show this information.

(*let x be the number of toffos in 1 packet*)

(b) Solve the equation to determine how many toffos there are in each packet.

3. Solve these equations :-

(a) $3(x + 5) = 36$ (b) $8(x - 3) = 40$

(c) $2(3x + 1) = 38$ (d) $9(2x - 8) = 0$

(e) $5(3x - 2) = 5x$ (f) $8(2x - 1) = 4x + 16$

(g) $8(x + 2) - 6x = 21$ (h) $5(2x - 1) + 3(1 + x) = 37$

4. Multiply each term by the l.c.m. of the denominators to dispose of the fractions and solve :-

(a) $\frac{1}{2}x - 5 = 4$ (b) $\frac{1}{2}x + \frac{1}{3} = 3$

(c) $\frac{x + 2}{5} - 2 = 0$ (d) $\frac{x - 1}{4} - \frac{x + 1}{10} = 1$

5. Solve the following inequalities :-

(a) $x + 8 > 11$ (b) $x - 12 \leq 12$ (c) $x - 32 \geq 0$

(d) $4x < 64$ (e) $2x + 18 > 24$ (f) $3(2x + 1) \leq 33$

(g) $3(2x - 4) \geq 5x + 17$ (h) $2(3x + 1) < 4x - 2$ (i) $6(2x - 4) \leq 9x$