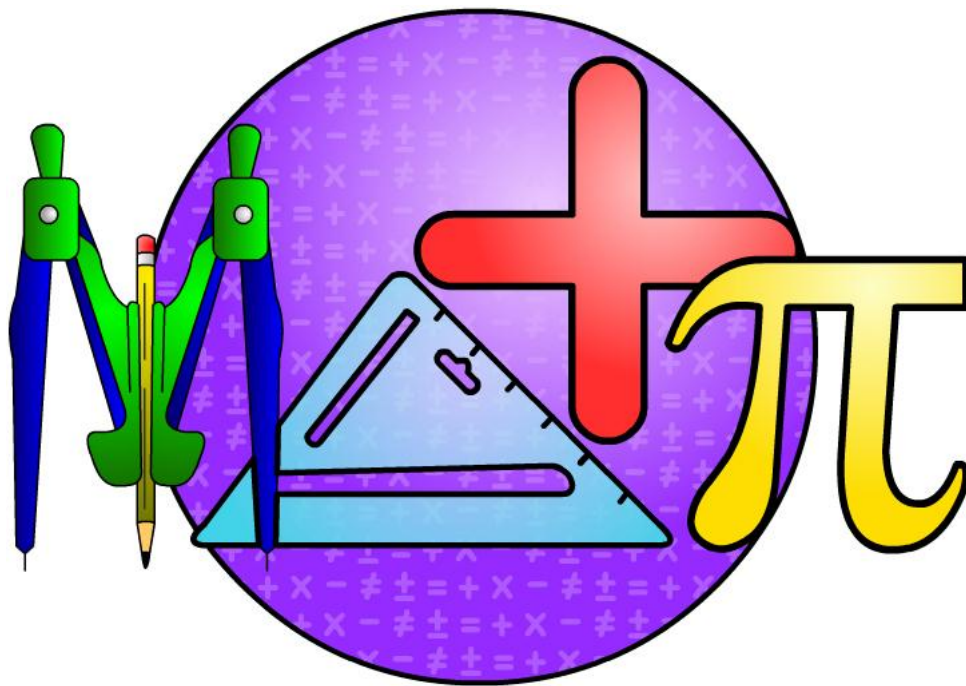




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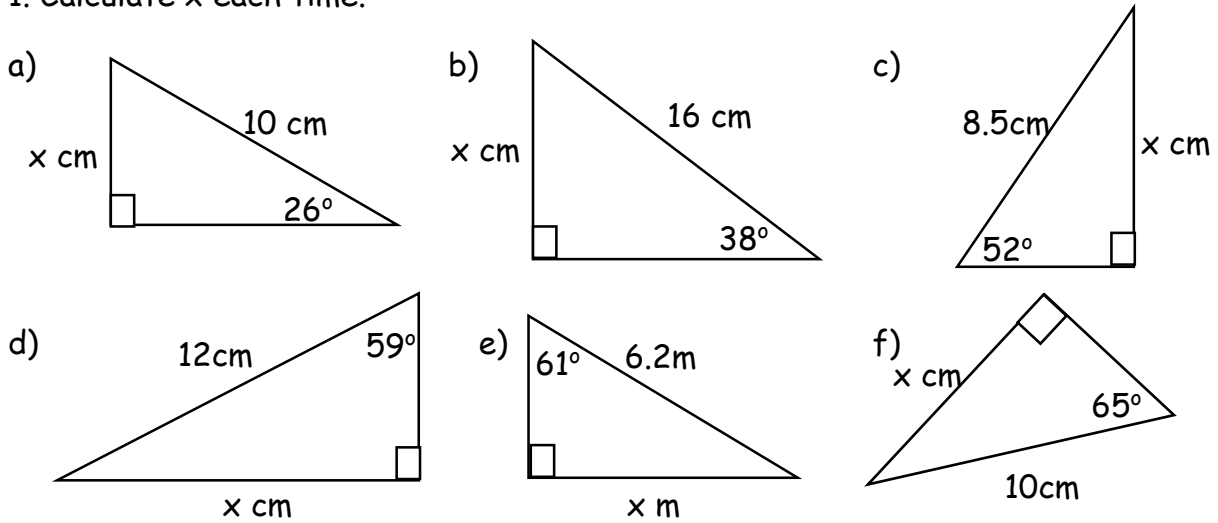


Homework Booklet
National 5 Maths

Trigonometry 1

Exercise 1 - Using Sine to calculate missing sides

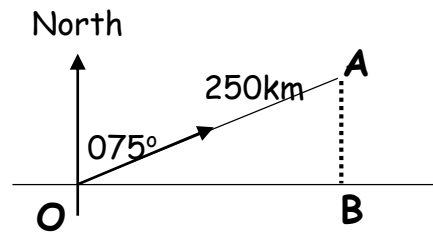
1. Calculate x each time.



3. A boat sails from O for 250 kilometres to A on a bearing of 075° .

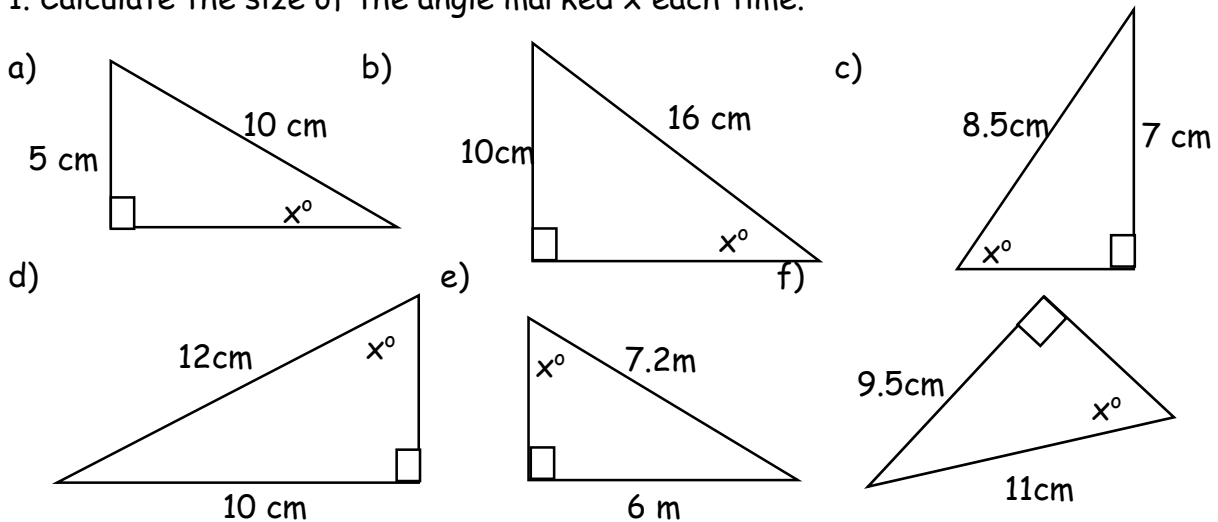
(a) Calculate the size of $\angle AOB$.

(b) Calculate how far north the plane now is from O . (i.e. find AB)



Exercise 2 - Using Sine to calculate missing angles

1. Calculate the size of the angle marked x each time.



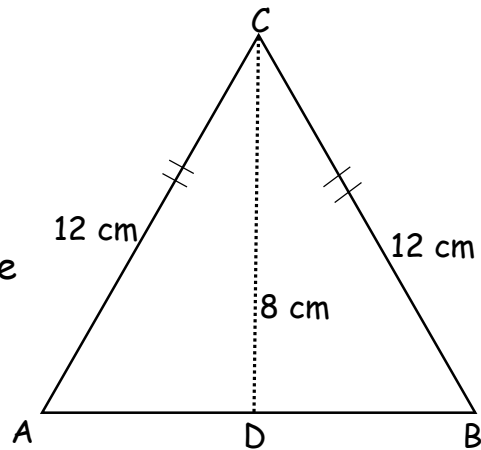
2. This isosceles triangle can be split into 2 identical right angled triangles.

$AC = BC = 12 \text{ cm}$

Height $CD = 8 \text{ cm}$

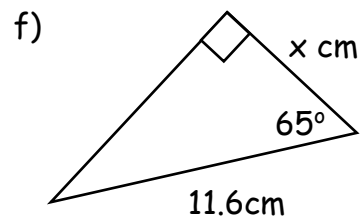
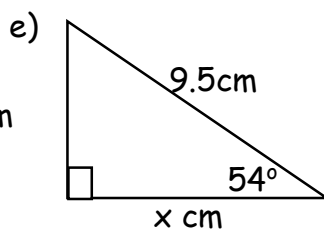
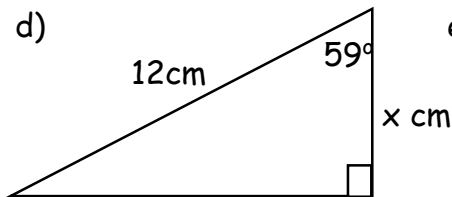
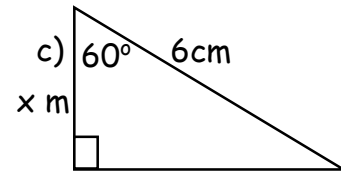
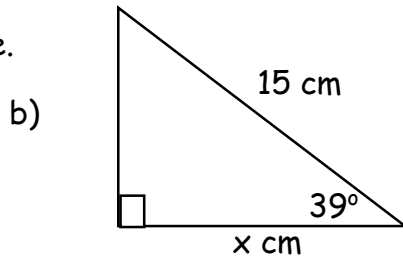
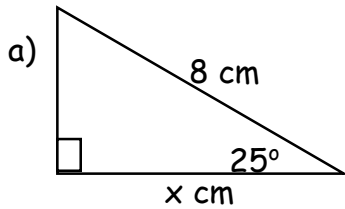
(a) Calculate the size of $\angle CAD$

(b) Now calculate the sizes of the other 2 angles in $\triangle ABC$



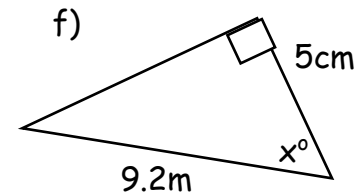
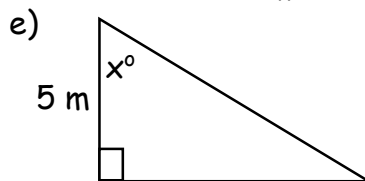
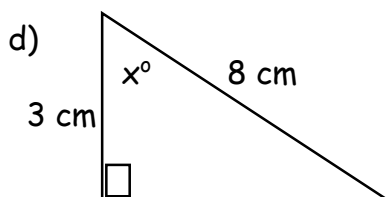
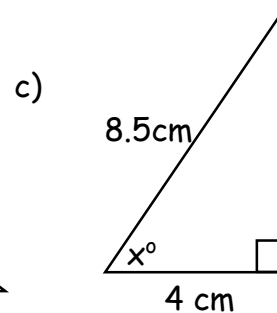
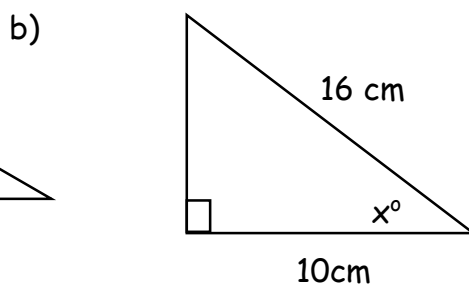
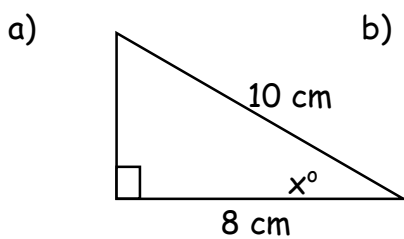
Exercise 3 - Using Cosine to calculate missing sides

1. Calculate x each time.



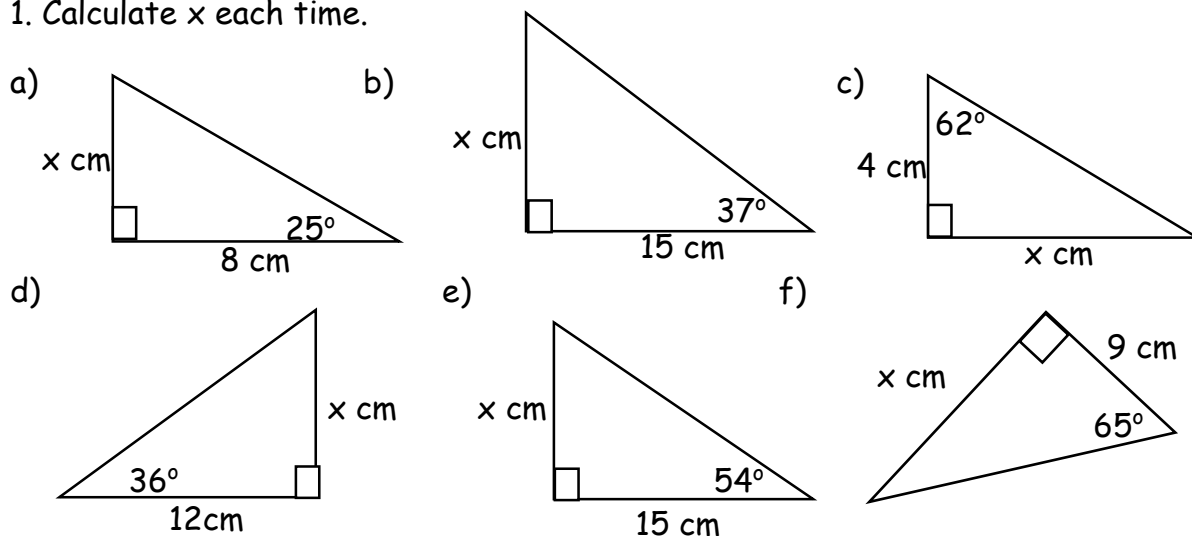
Exercise 4 - Using Cosine to calculate missing angles

1. Calculate the size of the angle marked x each time.

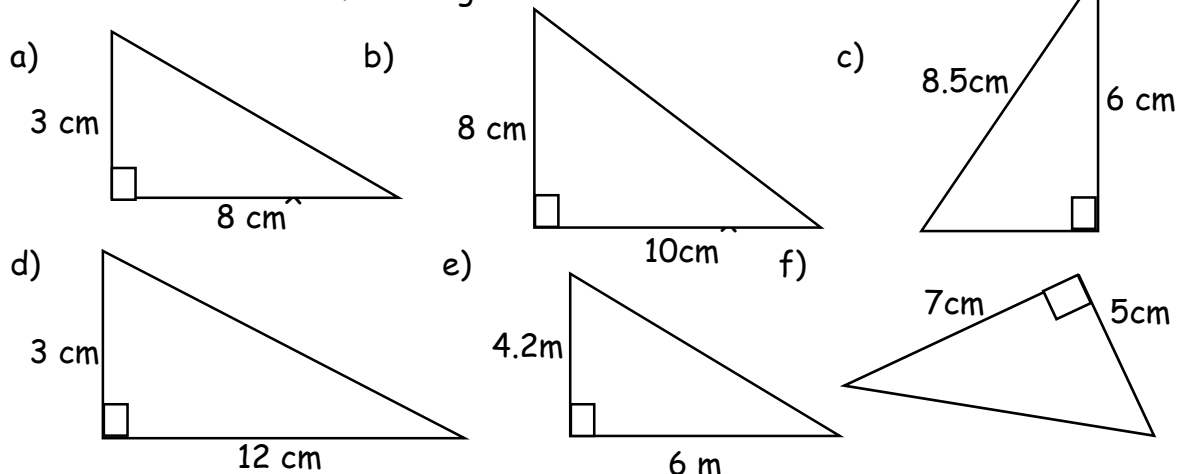


Exercise 5 - Using Tan

1. Calculate x each time.

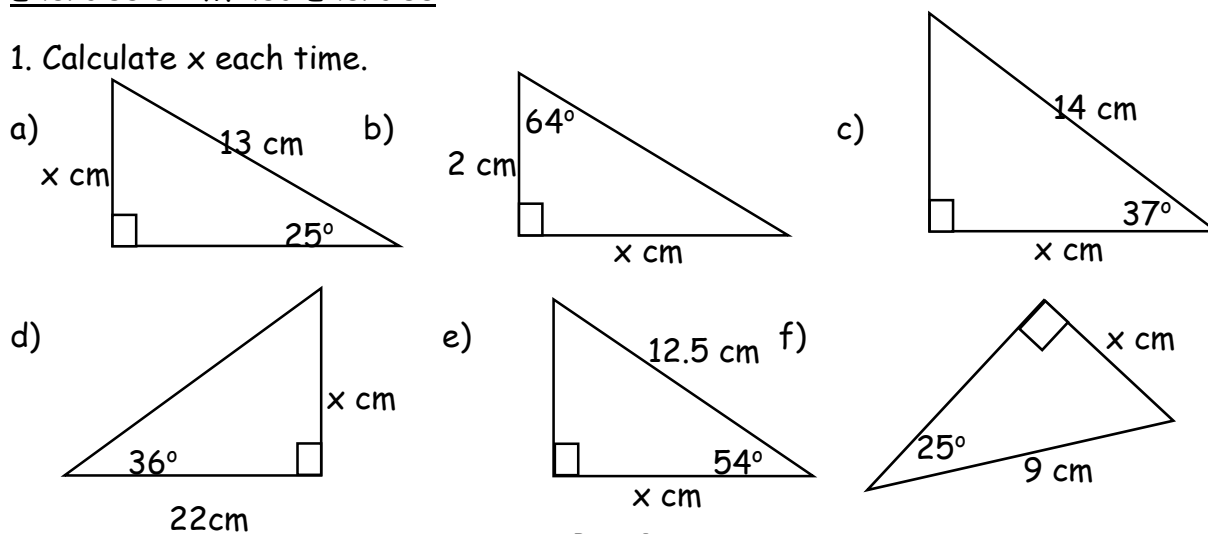


2. Calculate the size of the angle marked x each time.

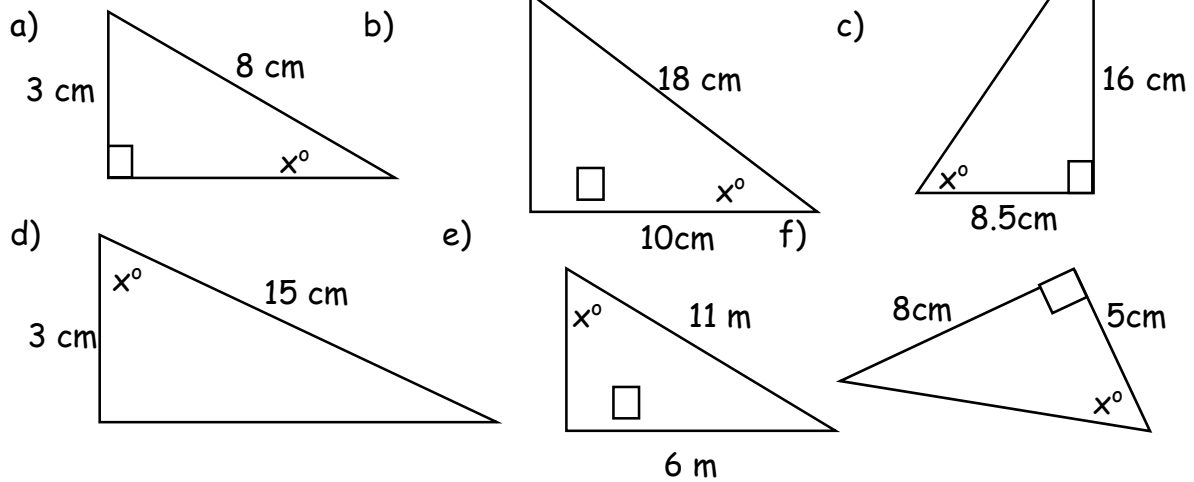


Exercise 6 - Mixed Exercise

1. Calculate x each time.

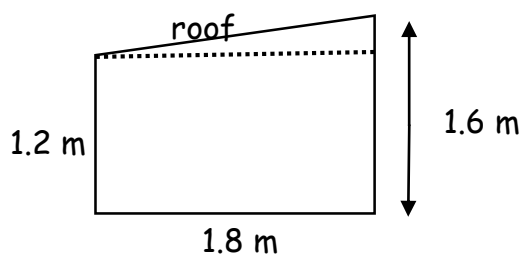


2. Calculate the size of the angle marked x each time.



3. The picture shows the side view of a storage box.

Calculate the size of the angle the roof makes with the horizontal.



Money 1

Exercise 1 - Wages basic

1. Michaela is paid £19200 per annum. How much does she earn each month?
2. Umair is paid an annual salary of £27200. Calculate his monthly wage.
3. Nadia earns £45000 per annum. Calculate how much she is paid per month.
4. A joiner earns £38400 per annum. Calculate his weekly wage.
5. A salesman is paid £650 per week. He is paid for 50 weeks a year. Calculate his annual wage.
6. Michael works in a supermarket. He is paid £6.80 per hour. How much will he earn if he works a 35 hour week?
7. Michelle earns £9.80 per hour. How much will she earn in a year if she works 40 hours per week?

Exercise 2 - Overtime

1. Daniel is paid at a rate of £7.80 per hour. If he works overtime he is paid at double time. How much will Daniel be paid for working 6 hours overtime?
2. Nina is paid £8.20 per hour. If Nina works on a Sunday she is paid double time. How much would she get paid for working 7 hours one Sunday?
3. Stuart gets paid £15.60 per hour. He is paid double time for overtime hours. How much will he get paid for working 4 hours overtime?
4. If Sasha works nightshift she gets paid at time and a half. Her normal hourly rate is £8.80. Sasha works 14 hours nightshift. How much will she be paid for this?
5. Cynthia is paid £7.20 per hour but gets time and a half for any overtime she works. One week she works 10 hours overtime. How much will she be paid for this?
6. Amanda is a mechanic. She gets paid £9.80 per hour and works a 35 hour week. She also gets paid double time if she works overtime. How much would Amanda earn in total, in a week where she works 6 hours overtime?
7. James is paid £11.80 per hour and he works for 30 hours per week. If James works overtime he is paid double time for those hours. One week James earned a total of £519.20. Calculate how many hours overtime James worked that week.

Exercise 3 - Income tax basic

Use the following information for the questions below:

Personal allowance £10600 Income tax rate 20%.

For each person calculate:

(i) Their taxable income (ii) The amount of income tax they pay each year

(a) Jim - £34500 per annum (b) Samia - £39000 per annum

2. Andrew works as a manager in an office. He earns £29000 per annum.

(a) Calculate his taxable income (b) Work out his annual income tax.

(c) Calculate how much tax he pays per month.

3. The table below shows annual gross pay and deductions. Calculate the net pay.

Gross Pay	Deductions	Net Pay
£38600	Income Tax	£5600
	National Insurance	£3366
	Superannuation	£2866
	Union Dues	£188
	Total Deductions	

5. Nargas earns £39950 per annum.

- Calculate how much she will pay in income tax each year.
- Copy and complete the table below to find her net annual pay.
- How much will Nargas take home each month?

Gross Pay	Deductions	Net Pay
£39950	Income Tax	?
	National Insurance	£3514.50
	Superannuation	£3196
	Total Deductions	

Exercise 4 - Income tax bands

Use the following information for the calculations in this exercise.

Personal allowance: £10600

Tax bands:

Taxable income	Tax rate
£0 - £31785	20%
£31786 - £150000	40%
>£150000	45%

Note: For someone earning over £100 000 there is no personal allowance.

- Mark earns £96 000 per annum.
 - Calculate his taxable income.
 - Calculate how much tax Mark pays at 20%
 - Calculate how much tax he pays at 40%
 - Find the total amount of tax Mark pays in a year.
- Sinead is a lawyer. She earns £74 400 per annum.
 - Calculate her taxable income.
 - Calculate how much tax Sinead pays at 20%
 - Calculate how much tax she pays at 40%
 - Find the total amount of tax Sinead pays in a year.
 - What does she pay in tax each month?
- Gideon is a merchant banker. He earns £176 000 per annum.
 - Calculate how much tax Gideon pays at 20%, 40% and 45%.
 - Calculate Gideon's total **monthly** tax bill.

Exercise 5 - Hire Purchase/Interest

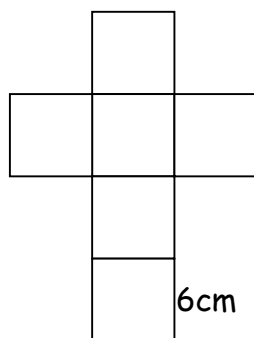
- Colin builds a new garage. He borrows £3200 from the bank. He will pay back 12 monthly loan payments of £290.
(i) What is the total cost of the loan? (ii) How much has he paid in interest?
- A fridge costs £299 if paid in cash or, if using hire purchase, for a deposit of £50 and 6 monthly payments of £45.
(i) What is the HP price?
(ii) What is the difference between the HP price and the cash price?
- Anne wants to borrow £2000. Banka wants the loan repaid in 12 installments of £195. Bloan will take 18 instalments of £120. Based on the total repayment, which option should she choose?
- A laptop with a cash price of £469 can be purchased for a deposit of 15% + 12 payments of £35. What is the HP price?
- Ian can buy his new racing bike that has a cash price of £420, with no deposit, in 6 equal instalments. If the total HP price will be 10% more than the cash price how much is each monthly instalment?
- If the cash price of a mobile phone is £600 or it can be purchased as part of a 2 year mobile phone plan for £30 per month, what is the percentage increase in cost if you choose the mobile phone plan?

Surface Area/Nets

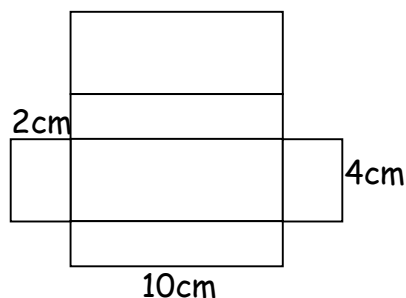
Exercise 1 - Cuboids

- Calculate the surface area of the cube and cuboid shown below.

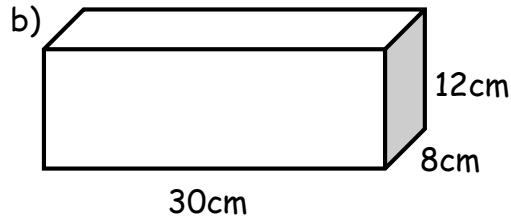
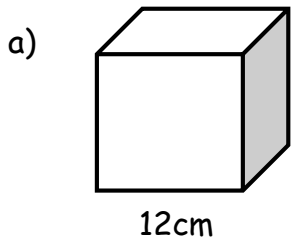
a)



b)

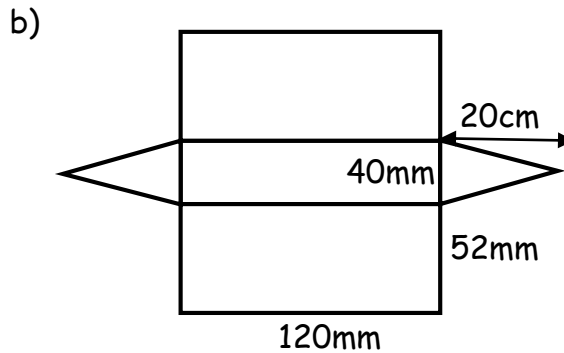
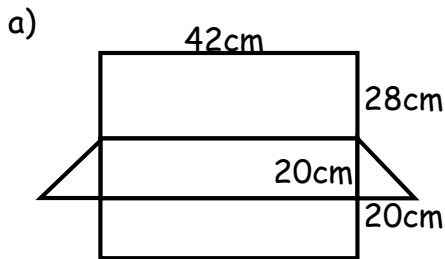


2. Calculate the surface area of the cube and cuboid shown below.

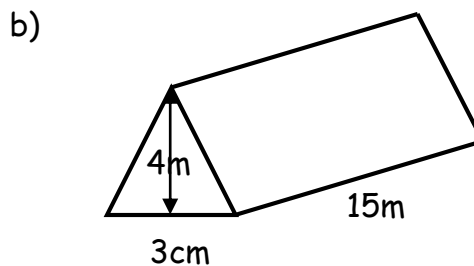
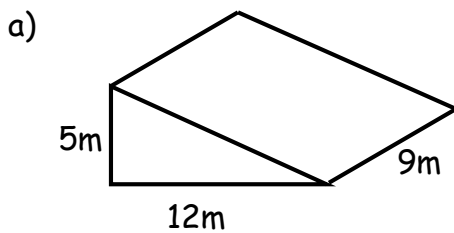


Exercise 2 - Triangular prisms

1. Find the surface area of each triangular prism below.

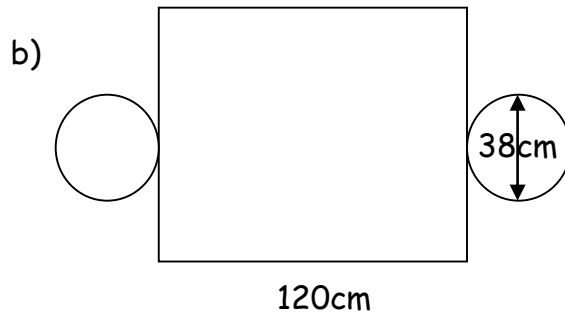
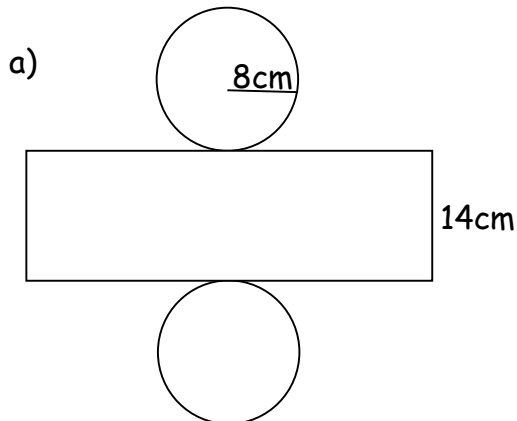


2. Find the surface area of each solid below.



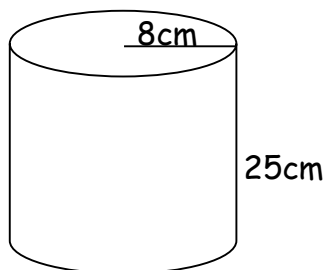
Exercise 3 - Cylinders

1. Below are the nets of two cylinders. Calculate the surface area of each one.

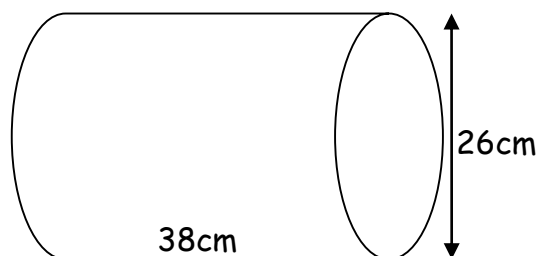


2. Calculate the surface area of each cylinder below.

a)



b)



Relative Frequency

1. a) Copy and complete the table below. The table shows pupils scores in a spelling test.

Score	Frequency	Relative Frequency
5	2	
6	4	
7	6	
8	10	
9	2	
10	1	
Total	25	

b) Estimate the probability that someone picked at random scores 6.

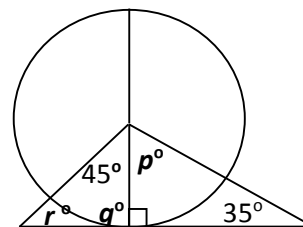
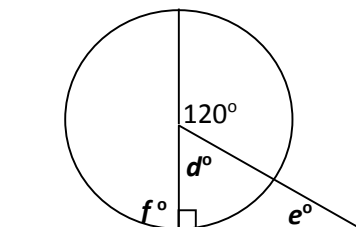
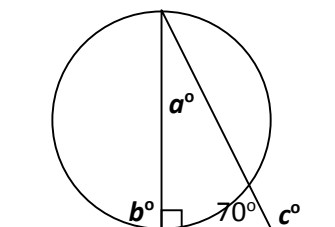
c) Estimate the probability that someone picked at random scores < 8 .

d) Estimate $P(7 < \text{score} < 10)$.

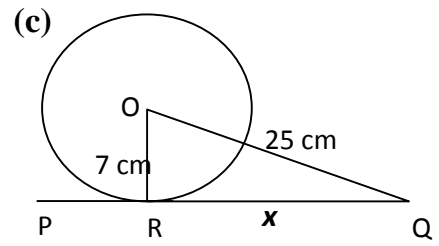
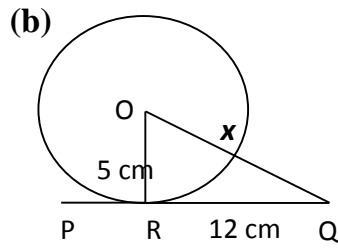
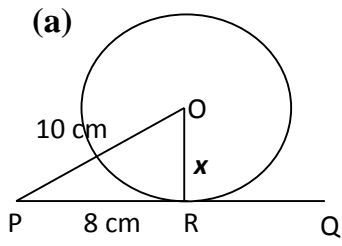
Circle Properties

Exercise 1 - Tangents to circles.

1. Calculate each missing angle.

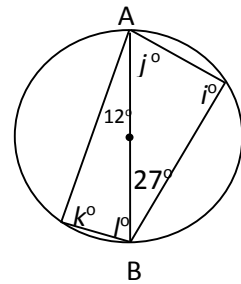
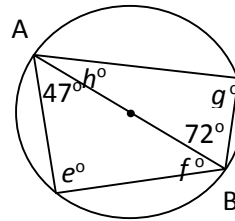
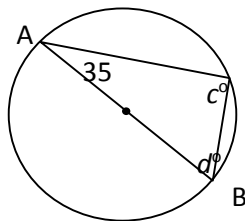
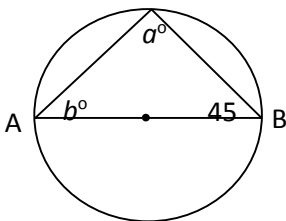


2. Calculate x .

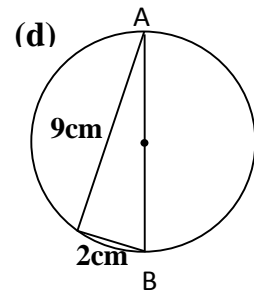
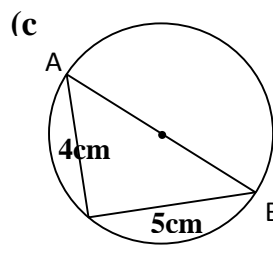
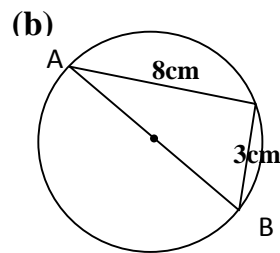
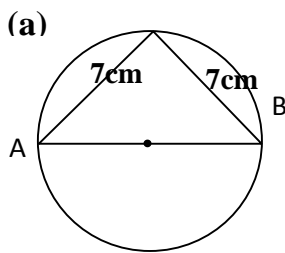


Exercise 2 - Semi-circles

1. Calculate each missing angle.

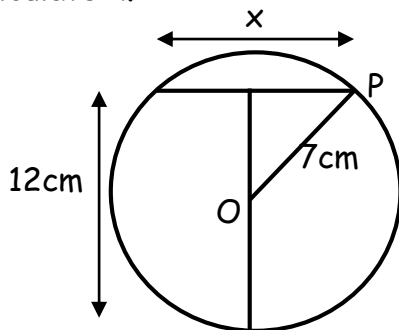


2. Calculate AB

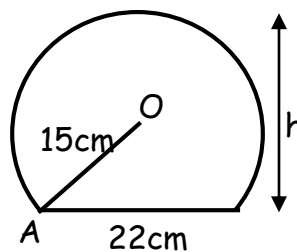


Exercise 3 - Mixed Circle questions

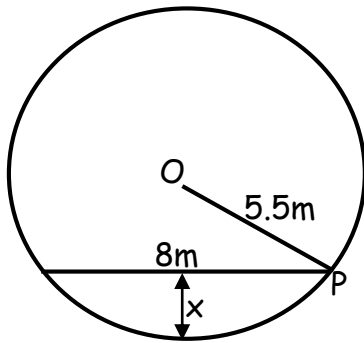
1. Calculate x .



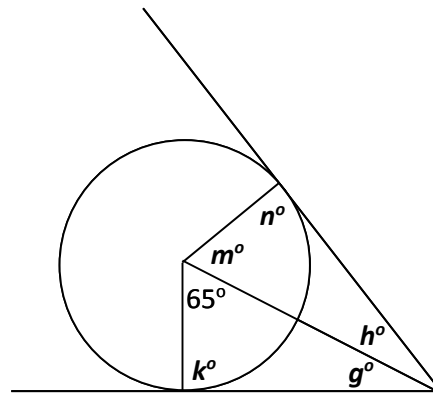
2. Calculate h .



3. Calculate x .



4. Calculate each missing angle.

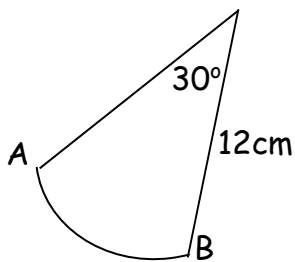


Arcs and Sectors

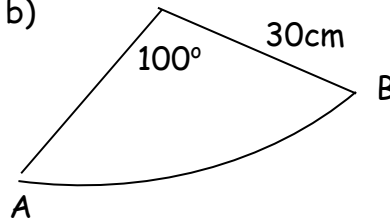
Exercise 1 - Arc lengths

1. Calculate the length of arc AB in each diagram below.

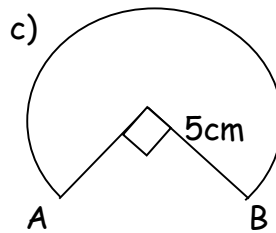
a)



b)

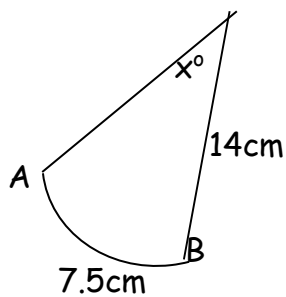


c)

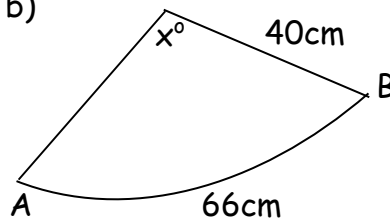


2. In each diagram below the length of arc AB is given. Calculate the size of the angle x° .

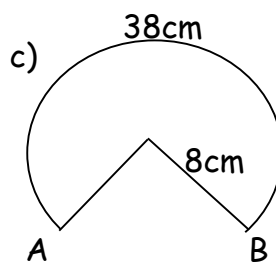
a)



b)

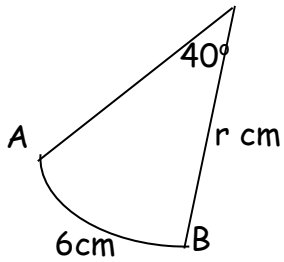


c)

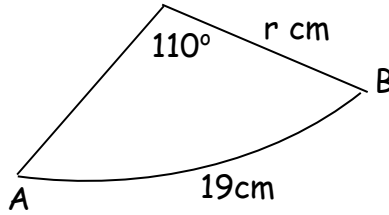


3. In each diagram below, calculate the radius r .

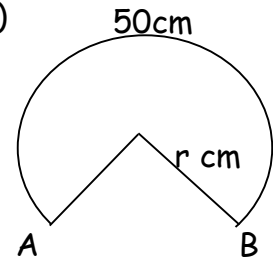
a)



b)



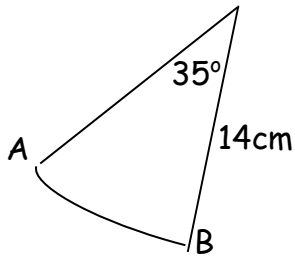
c)



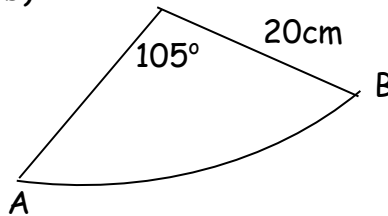
Exercise 2 - Sector area

1. Calculate the area of each sector below.

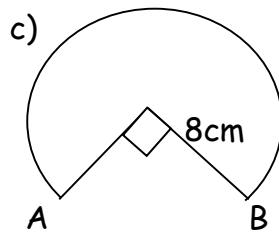
a)



b)

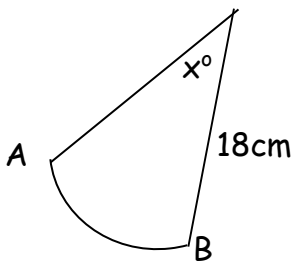


c)

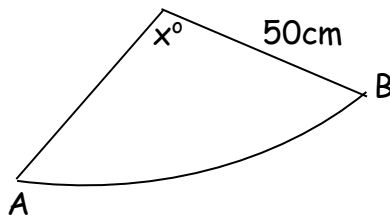


2. Calculate the angle at the centre of each sector.

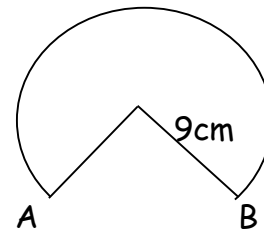
a) Area = 106 cm^2



b) Area = 2500 cm^2

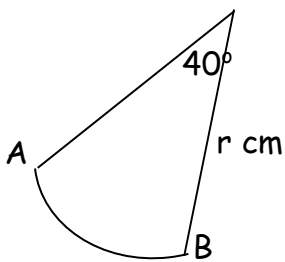


c) Area = 190 cm^2

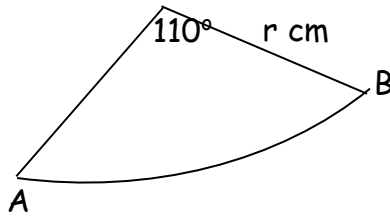


3. Calculate r in each diagram.

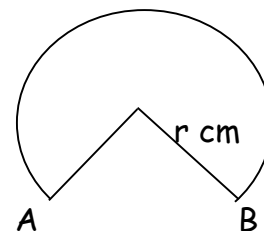
a) Area = 22 cm^2



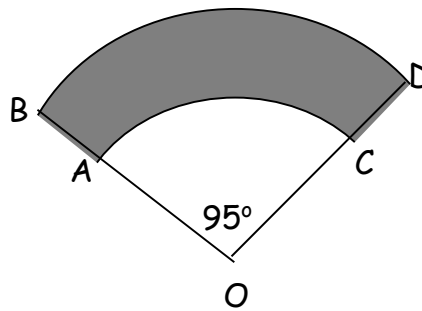
b) Area = 215 cm^2



c) Area = 190 cm^2



4. In the diagram below AC and BD are arcs of circles with centres at O. The radius, OA, is 10 centimetres and the radius, OB, is 16 centimetres. Find the shaded area.



Brackets/Factorising

Exercise 1 - Expanding brackets

1. Expand the brackets

- | | | | |
|-----------------|------------------|-------------------|------------------|
| (a) $5(x + 1)$ | (b) $7(x + 3)$ | (c) $6(x - 12)$ | (d) $x(x + 2)$ |
| (e) $3(4 - y)$ | (f) $a(7 - a)$ | (g) $a(b + 6)$ | (h) $c(d + c)$ |
| (i) $5(2x + 1)$ | (j) $6(4 - 7x)$ | (k) $8(5a - 4)$ | (l) $x(2x + 6)$ |
| (m) $2x(x + 7)$ | (n) $3x(5x - 8)$ | (o) $2x(5x + 6y)$ | (p) $4a(9 + 7a)$ |

2. Expand the brackets

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

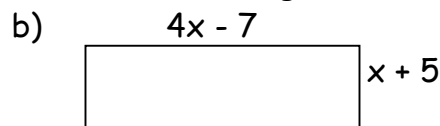
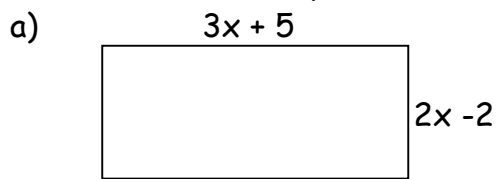
3. Expand the brackets

- | | | |
|------------------------------|------------------------------|-------------------------------|
| (a) $(x + 2)(x^2 + 3x - 1)$ | (b) $(p - 3)(p^2 - 3p + 2)$ | (c) $(u - 4)(u^2 - 3u - 1)$ |
| (d) $(3a - 4)(a^2 - 3a - 5)$ | (e) $(2n - 3)(4n^2 - n + 5)$ | (f) $(2p - 4)(p^2 + 2p + 4)$ |
| (g) $(x^2 - 5x - 2)(2x - 3)$ | (h) $(4u^2 - 3u + 1)(u - 5)$ | (i) $(3m^2 - 2m + 2)(2m - 5)$ |

4. Expand the brackets

- | | | |
|-----------------------------|---|------------------------------|
| (a) $(x^2 + 3)(x - 2)$ | (b) $(4x - 1)(3x^2 - x)$ | (c) $(x^3 - x^2)(x - 1)$ |
| (d) $(x - 2)(3x - 4) + 10x$ | (f) $(3x - 5y)^2 - 25y^2$ | (g) $6p - (2p - 3)(p - 2)$ |
| (h) $(2m - 5)^2 - 3(m - 1)$ | (i) $(4x - 2)(2x + 3) + (x - 1)^2$ | |
| (j) $(4m - n)^2 - n(n + 3)$ | (k) $4(x - 2) + 3(x - 1)^2$ | (l) $(2a + c)^2 - (a - c)^2$ |
| (m) $(u + 3w)^2 - u(u - w)$ | (n) $(x - 1)(x^2 - 3x - 4) - x(x^2 - 4x)$ | |

5. Write down an expression for the area of each rectangle.



Exercise 2 - Factorising

1. Factorise, using common factor method

- | | | | |
|-------------------|-------------------|------------------------|-----------------|
| (a) $4x + 8$ | (b) $6x + 3$ | (c) $8x - 12$ | (d) $20 - 5x$ |
| (e) $12 - 18y$ | (f) $x^2 + 3x$ | (g) $y^2 - y$ | (h) $4x^2 + 4x$ |
| (i) $10x^2 + 15x$ | (j) $12x - 18x^2$ | (k) $14 + 21x + 49x^2$ | |

2. Factorise, using difference of two squares method.

- | | | | |
|------------------|------------------|-------------------|--------------------|
| (a) $x^2 - 4$ | (b) $x^2 - 9$ | (c) $x^2 - 25$ | (d) $64 - x^2$ |
| (e) $49 - x^2$ | (f) $a^2 - 1$ | (g) $2g^2 - 98$ | (h) $4p^2 - 36$ |
| (i) $2g^2 - 200$ | (j) $12 - 3n^2$ | (k) $8 - 8u^2$ | (l) $x^2 - y^2$ |
| (m) $4p^2 - 49$ | (n) $16 - 25c^2$ | (o) $4x^2 - 9y^2$ | (p) $3c^2 - 27d^2$ |

3. Factorise the following trinomials.

- | | | | |
|---------------------|----------------------|----------------------|----------------------|
| (a) $h^2 + 7h + 6$ | (b) $x^2 + 11x + 30$ | (c) $x^2 + 15x + 50$ | (d) $x^2 + 4x - 12$ |
| (e) $x^2 + 5x - 36$ | (f) $x^2 - 3x - 18$ | (g) $x^2 - 2x - 24$ | (h) $x^2 - 10x + 24$ |
| (i) $a^2 - 8a + 16$ | (j) $x^2 - 4x - 32$ | (k) $d^2 - 3d - 10$ | (l) $g^2 + 5g - 50$ |

4. Factorise the following trinomials.

- | | | | |
|----------------------|----------------------|----------------------|----------------------|
| (a) $2x^2 - 5x - 3$ | (b) $5p^2 - 17p + 6$ | (c) $2x^2 + 9x - 5$ | (d) $7a^2 + 9a + 2$ |
| (e) $5m^2 - 6m + 1$ | (f) $3c^2 + 17c - 6$ | (g) $2x^2 - 5x - 7$ | (h) $3x^2 + 25x + 8$ |
| (i) $6x^2 - 7x + 2$ | (j) $10a^2 + 3a - 4$ | (k) $10 - 3a - a^2$ | (l) $20 + 3x - 2x^2$ |
| (m) $5 + 14x - 3x^2$ | (n) $6n^2 + 23n - 4$ | (o) $8x^2 - 10x + 3$ | (p) $9p^2 - 3p - 6$ |

5. Factorise

- | | | | |
|----------------------|----------------------|---------------------|----------------------|
| (a) $x^2 - 4x$ | (b) $x^2 + 12x + 35$ | (c) $a^2 - 36$ | (d) $x^2 + 5x - 14$ |
| (e) $x^2 - 12x + 32$ | (f) $x^2 - 9x - 36$ | (g) $2d^2 + 9d - 5$ | (h) $3g^2 - 48$ |
| (i) $5p^2 - 2p - 7$ | (j) $2u^2 - 18w^2$ | (k) $6x - 10x^2$ | (l) $d^2 - 9c^2$ |
| (m) $3c + 18c^2$ | (n) $5 - 20h^2$ | (o) $30 - x - x^2$ | (p) $15 + 9x - 6x^2$ |

Speed/Distance/Time

Exercise 1

1. Write the following times as decimal times.

- (a) 30 mins (b) 15 mins (c) 45 mins (d) 2 hours 30 mins
(e) 3 hours 15 mins (f) 7 hours 45 mins (g) 6 minutes
(h) 12 mins (i) 24 minutes (j) 54 mins (l) 2 hours 18 mins
(m) 1 hour 36 minutes (n) 5 hours 48 minutes (o) 2 hours 21 minutes

2. Calculate the speed given the distance and time.

- (a) 86 km in 2 hours (b) 133 miles in 3 hours 30 mins
(c) 54m in 36 minutes (d) 680 km in 3 hours 24 minutes

3. Calculate the distance given the speed and time.

- (a) 45 km/h for 3 hours (b) 220 mph for 1 hour 15 minutes
(c) 84m/s for 8 minutes 12 seconds (d) 62 km/h for 48 minutes

4. Calculate the time given the speed and distance. Give your answer in hours and minutes.

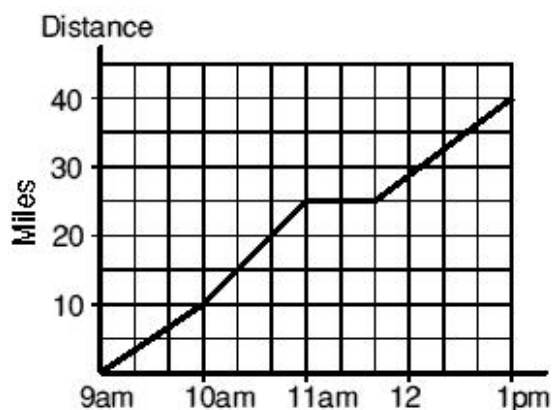
- (a) 186 miles at 62mph (b) 220.5 km at 90km/h (c) 336 km at 80 km/h

Exercise 2

1. The graph shows the journey of a cyclist who travelled between two towns 40 miles apart.

Using the graph, find the following :

- a The time the cyclist began the journey
- b The time at which he stopped
- c For how long he stopped
- d Between which times he was cycling the fastest.
- e His average speed for the whole journey.



Equations/Inequalities

Exercise 1 - revision of basic equations

1. Solve

- | | | | |
|-------------------|-------------------|------------------|-------------------|
| (a) $2x = 18$ | (b) $5x = -15$ | (c) $-7x = 21$ | (d) $2x = 21$ |
| (f) $x + 8 = 17$ | (g) $x - 4 = 11$ | (h) $x + 13 = 2$ | (i) $x - 14 = -5$ |
| (j) $2x + 7 = 15$ | (k) $3x - 5 = 16$ | (l) $4x + 5 = 3$ | (m) $5x - 9 = 12$ |

2. Solve

- | | | |
|-----------------------|------------------------|------------------------|
| (a) $3x - 6 = 2x + 4$ | (b) $5x + 3 = 3x + 9$ | (c) $5x + 15 = 2x + 3$ |
| (d) $x + 3 = 5x + 11$ | (e) $12 - x = 4x + 27$ | (f) $6x = 10 - 4x$ |

Exercise 2 - equations with brackets

1. Solve

- | | | |
|--------------------------|---------------------------|------------------------------|
| (a) $2(x + 3) = 20$ | (b) $3(x - 4) = 18$ | (c) $4(5 - x) = 8$ |
| (d) $2(3x + 1) = 32$ | (e) $5(4x - 6) = 70$ | (f) $7(12 - 2x) = 14$ |
| (g) $5(x + 1) = 2x + 17$ | (h) $3(x - 4) = x - 15$ | (i) $3(2x + 7) = 5x + 4$ |
| (j) $2(4x - 6) = 5x - 3$ | (k) $5(x - 9) = 3(x + 5)$ | (l) $4(12 - 3x) = 2(4x - 1)$ |

2. Solve

- | | |
|---------------------------------------|-----------------------------------|
| (a) $2(x + 3) - 3x = 6 + x$ | (b) $3(x + 2) - 5(x + 1) = x + 4$ |
| (c) $12x - (5 + 7x) = 3(4x - 1) - 4x$ | (d) $15 = 7(5 - x) + 8$ |

3. Solve

- | | |
|---------------------------------------|--|
| (a) $x^2 - 7 = (x - 1)(x - 2)$ | (b) $(2x + 1)(x - 3) = 2x(x + 2)$ |
| (c) $x^2 + (x - 3) = (2x + 3)(x - 2)$ | (d) $3(x - 1)(x + 2) - (x + 3)^2 = 2(x + 3)^2 - 3$ |

Exercise 3 - equations with fractions

1. Solve

- | | | | |
|------------------------------|---------------------------------|----------------------------------|-------------------------------------|
| (a) $\frac{x}{2} = 3$ | (b) $\frac{x}{8} = \frac{1}{2}$ | (c) $\frac{x}{10} = \frac{4}{5}$ | (d) $\frac{5x}{2} = 10$ |
| (e) $\frac{1}{6}(x - 3) = 2$ | (f) $\frac{2}{3}(x + 1) = x$ | (g) $\frac{x + 4}{8} = 2$ | (h) $\frac{x}{4} + \frac{x}{5} = 9$ |

Exercise 4 - Inequalities

- | | |
|------------------------------|-----------------------------------|
| (a) $6a + 3 < 2a - 13$ | (b) $5(2b - 1) > 6b + 2$ |
| (c) $4(2x - 3) < 3(1 - x)$ | (d) $3(4c - 1) - 10 > 6c + 5$ |
| (e) $4 - 2(d - 10) < 3d - 1$ | (f) $5 - (1 - 2f) \leq 4(2f + 1)$ |
| (g) $5g - 3(1 - 2g) \geq 8g$ | (h) $2 - (h - 2) > 3h - (1 - h)$ |

Surds/Indices

Exercise 1 - Simplifying surds

1. Simplify

- (a) $\sqrt{8}$ (b) $\sqrt{12}$ (c) $\sqrt{27}$ (d) $\sqrt{50}$ (e) $\sqrt{20}$ (f) $\sqrt{18}$
(g) $\sqrt{75}$ (h) $\sqrt{300}$ (i) $\sqrt{72}$ (j) $\sqrt{54}$ (k) $\sqrt{147}$ (l) $2\sqrt{98}$

2. Simplify

- (a) $\sqrt{8} + \sqrt{18}$ (b) $\sqrt{12} + \sqrt{27}$ (c) $\sqrt{50} - \sqrt{32}$ (d) $\sqrt{75} + \sqrt{300}$
(e) $\sqrt{72} - \sqrt{50}$ (f) $\sqrt{20} + 3\sqrt{5}$ (h) $\sqrt{300} + \sqrt{147} - 2\sqrt{3}$

3. Simplify

- (a) $\sqrt{2}(\sqrt{6} + \sqrt{2})$ (b) $\sqrt{3}(2\sqrt{3} - 5)$ (c) $(\sqrt{3} + \sqrt{2})^2$ (d) $(\sqrt{7} - 2)(\sqrt{7} + 2)$

4. Express with a rational denominator.

- (a) $\frac{1}{\sqrt{3}}$ (b) $\frac{2}{\sqrt{5}}$ (c) $\frac{6}{\sqrt{2}}$ (d) $\frac{10}{3\sqrt{5}}$
(e) $\frac{\sqrt{2}}{\sqrt{14}}$ (f) $\frac{\sqrt{3}}{\sqrt{24}}$ (g) $\frac{\sqrt{2}}{\sqrt{40}}$ (h) $\frac{\sqrt{5}}{2\sqrt{30}}$

Exercise 2 - Indices

1. Simplify

- (a) $a^4 \times a^5$ (b) $c^6 \times c$ (c) $d^2 \times d^6$ (d) $e^8 \times e^7$ (e) $3f^2 \times f^5$ (f) $4g^2 \times 6g^3$
(g) $a^{-3} \times a^{-4}$ (h) $b^{-7} \times b^{-3}$ (i) $c^{-3} \times c^2$ (j) $d^5 \times d^{-7}$ (k) $e^2 \times e^{-5}$ (l) $f^{12} \times f^{-5}$

2. Simplify

- (a) $a^7 \div a^5$ (b) $c^6 \div c$ (c) $d^{10} \div d^6$ (d) $e^8 \div e^7$ (e) $3f^9 \div f^5$ (f) $4g^5 \div 6g^3$
(g) $a^3 \div a^4$ (h) $b \div b^3$ (i) $c^{-3} \div c^2$ (j) $d^5 \div d^{-7}$ (k) $e^2 \div e^{-5}$ (l) $f^{12} \div f^{-5}$

3. Simplify

- (a) $(a^4)^5$ (b) $(c^6)^2$ (c) $(d^2)^6$ (d) $(e^8)^7$ (e) $(3f^5)^2$ (f) $(4g^2)^3$
(g) $(a^{-3})^{-4}$ (h) $(b^{-7})^{-3}$ (i) $(c^{-3})^2$ (j) $(d^5)^{-7}$ (k) $(e^2)^0$ (l) $(f^0)^{-5}$

4. Write with a positive indice

- (a) a^{-5} (b) c^{-6} (c) $5c^{-3}$ (d) $7e^{-5}$ (e) $\frac{1}{2}f^{-9}$ (f) $\frac{3g^{-4}}{5}$

5. Simplify

- (a) $64^{\frac{1}{2}}$ (b) $27^{\frac{1}{3}}$ (c) $16^{\frac{3}{2}}$ (d) $8^{\frac{2}{3}}$ (e) $4^{\frac{-1}{2}}$

Exercise 3 - Scientific notation

1. Calculate

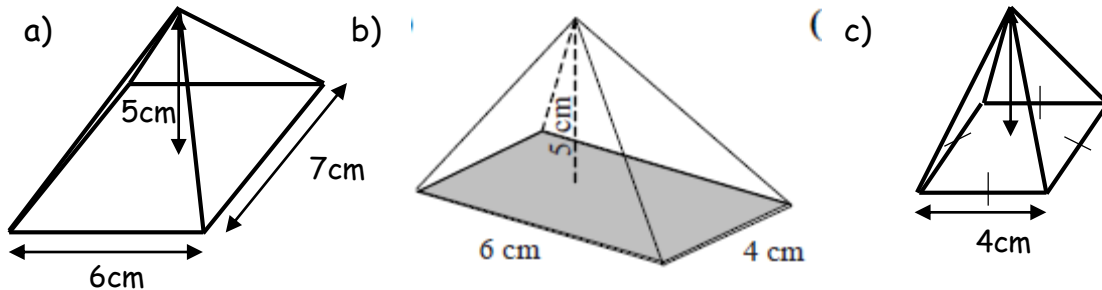
- (a) $4 \times (5 \times 10^7)$ (b) $3 \times (4.1 \times 10^6)$ (c) $3.5 \times (3.82 \times 10^{-3})$
 (d) $(5 \times 10^3) \times (8 \times 10^6)$ (e) $(3.5 \times 10^5) \times (2.1 \times 10^{-2})$ (f) $(3 \times 10^{-4})^2$

2. Light travels at 1.86×10^5 miles per second. How far will it travel in an hour? Give your answer in standard form.

Volume

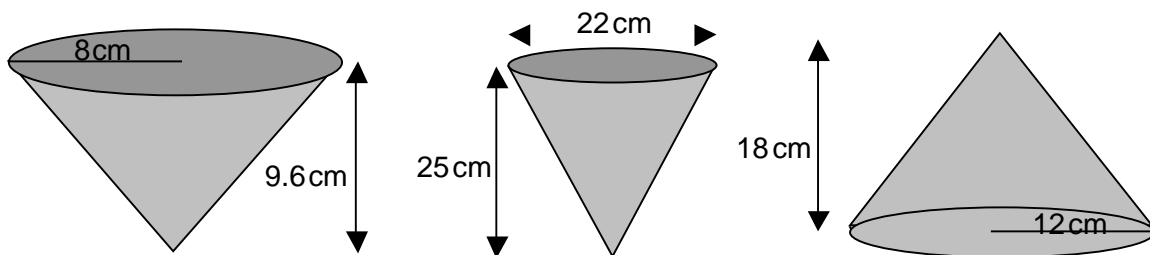
Exercise 1 -Pyramid

1. Calculate the volume of each pyramid.



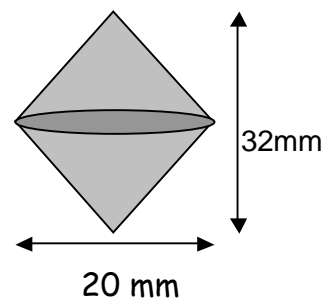
Exercise 2 - Cone

1. Calculate the volume of each cone



2. The diagram opposite shows an anglers metal float.
 The float is made from two identical sized cones.

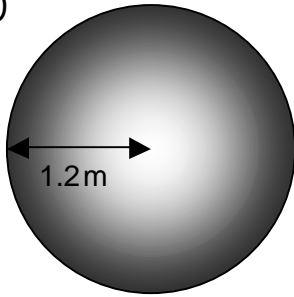
Find the volume of metal in the float.



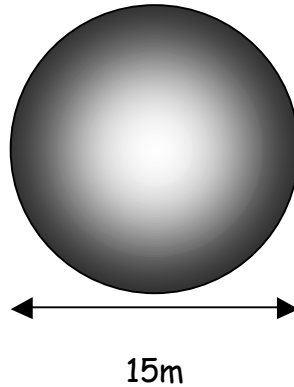
Exercise 3 - Sphere

1. Calculate the volume of each sphere and hemi-sphere.

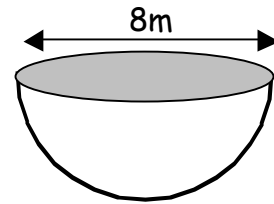
a)



b)



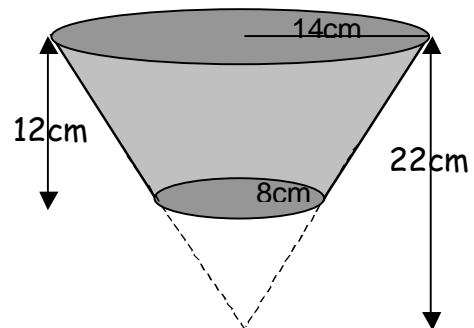
c)



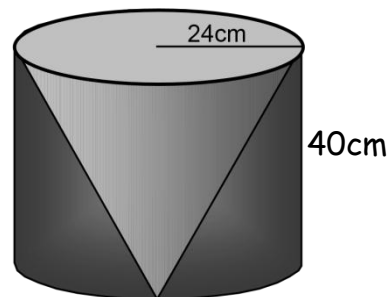
Exercise 4 - compound volume

1. A waste paper bin is in the shape of a large cone with a smaller cone removed.

The large cone has radius 14 cms and height 22 cms. The small cone has radius 8 cms. Calculate the volume of the bin.



2. The diagram shows a cylinder with a cone cut from it. The cone and the cylinder both have radius 24 centimetres and height 40 centimetres. Calculate the volume of the solid once the cone has been removed.

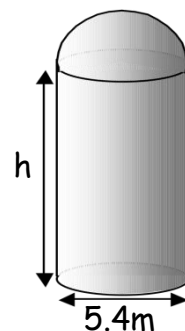


3. A grain silo is in the shape of a cylinder with a hemispherical top. The diameter of the base of the silo is 5.4 metres. The total volume of the silo is 499 m^3 .

(i) Calculate the volume of the hemispherical part of the silo.

(ii) Calculate the height, h , of the cylindrical part of the silo.

(iii) Calculate the total height of the silo.



Straight Line

Exercise 1 - Gradient

1. Find the gradient of the line joining each pair.

- (a) A(2,3) and B(5,9) (b) C(-1,-1) and D(-9,3) (c) E(-4,-2) and F(-9,-9)
(d) G(2,-1) and H(8,-3) (e) I(2,1) and J(10,5) (f) K(-2,-8) and L(1,10)

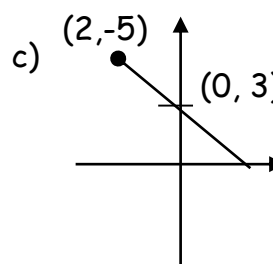
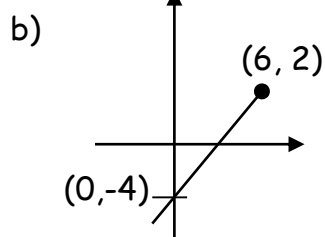
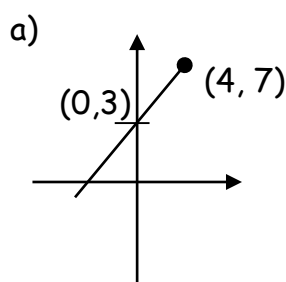
2. (a) Plot the points U(1,3), V(7,6) and W(5,10).

(b) Find the point X such that UVWX is a rectangle.

(c) Find the gradient of each side of the rectangle.

Exercise 2 - $y = mx + c$

1. Find the equation of each line below.



2. Find the equation of the line joining A(0,2) and B(1,8)

3. Find the equation of the line parallel to a line with gradient -3, that intercepts the y-axis at (0,4).

Exercise 3 - $y - b = m(x - a)$

1. Find the equation of the line passing through

- (a) (2,5) and (-1,-4) (b) (-1,2) and (1,6) (c) (1,-1) and (5,1)

2. Find the equation of a line with gradient 8, passing through (2,3)

Exercise 4 - Rearrange equation into the form $y = mx + c$

1. For each question below, find the coordinates of the point where the line cuts the y-axis.

- (a) $y = 2x - 6$ (b) $y = 5x + 3$ (c) $2y = 5x - 8$ (d) $3y = 7x - 4$
(e) $5y = 2x - 11$ (f) $2x + 3y = 12$ (g) $4x + 3y - 5 = 0$ (h) $6x - 3y - 15 = 0$

2. Find the gradient and the coordinates of the y intercept of each line below.

- (a) $y = 4x - 10$ (b) $y = \frac{1}{2}x - 5$ (c) $y = -4x$ (d) $2y = 6x - 8$
(e) $4y = 3x - 12$ (f) $5y = 2x + 1$ (g) $2x + 3y = 6$ (h) $4x + 5y = 2$
(i) $2x + 3y - 15 = 0$ (j) $2x + 7y - 4 = 0$ (k) $x - 2y + 10 = 0$ (l) $3x - 4y - 7 = 0$

Fractions

Exercise 1

1. a) $\frac{1}{2} + \frac{1}{4}$ b) $\frac{1}{2} + \frac{1}{3}$ c) $\frac{1}{2} - \frac{2}{5}$ d) $\frac{3}{16} - \frac{1}{8}$
 e) $\frac{5}{6} + \frac{7}{9}$ f) $\frac{1}{4} - \frac{1}{6}$ g) $1\frac{1}{2} + 4\frac{1}{4}$ h) $5\frac{2}{3} - 2\frac{1}{6}$
 i) $4\frac{1}{4} - 1\frac{2}{3}$ j) $9\frac{2}{5} - 4\frac{3}{4}$ k) $1\frac{5}{6} + \frac{8}{9}$ l) $\frac{21}{10} - 1\frac{2}{7}$

2. Copy and complete

(a) $2\frac{3}{8} + 4\frac{1}{4}$ (b) $5\frac{3}{4} - 1\frac{2}{3}$ (c) $\frac{3}{4} \times \frac{2}{5}$ (d) $\frac{5}{6} \div \frac{2}{3}$
(e) $1\frac{5}{6} + 3\frac{3}{4}$ (f) $6\frac{1}{8} - 2\frac{3}{10}$ (g) $2\frac{7}{10} \times 4\frac{2}{3}$ (h) $6\frac{3}{4} \div 5\frac{5}{8}$

Algebraic Fractions

Exercise 1 - simplify by factorising

1. (a) $\frac{x^2 - 4}{x^2 + 2x}$ (b) $\frac{9x + 27}{10x + 30}$ (c) $\frac{x^2 + 9x + 20}{x^2 + 7x + 10}$ (d) $\frac{4x^2 - 9}{2x^2 - 3x}$
(e) $\frac{6x + 12}{12x + 24}$ (f) $\frac{x^2 + 9x + 20}{x^2 + 7x + 10}$ (g) $\frac{4}{4x + 4}$ (h) $\frac{x^2 - 100}{x^2 + 11x + 10}$

Exercise 2 - Add/Subtract

1. a) $\frac{3}{x} + \frac{1}{5x}$ b) $\frac{4}{3p} + \frac{1}{2p}$ c) $\frac{2}{u^2} + \frac{5}{u}$ d) $\frac{3}{x^2} + \frac{2}{x^3}$
 e) $\frac{3}{x} + \frac{7}{x+5}$ f) $\frac{2}{a-3} - \frac{3}{a}$ g) $\frac{1}{4a-2} - \frac{2}{8a+3}$ h) $\frac{a}{3} - \frac{4}{a+2}$
 i) $\frac{x+2}{3} + \frac{x-5}{4}$ j) $\frac{2x-1}{5} - \frac{x-1}{3}$ k) $\frac{3x-2}{3} + \frac{x}{4}$
 l) $\frac{3x+8}{2} + \frac{3-4x}{3}$ m) $\frac{x+3}{5} + \frac{x-1}{4}$ n) $\frac{x}{5} - \frac{x+2}{6}$

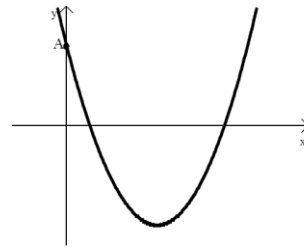
Function Notation

1. $f(x) = 3x + 7$. Find the value of (i) $f(3)$ (ii) $f(-2)$
2. $g(x) = 4x - 5$. Find the value of (i) $g(8)$ (ii) $g(-1)$
3. $h(x) = 3x^2 + 2$. Find the value of (i) $h(4)$ (ii) $h(-5)$
4. $f(x) = 5x - 4$. (a) Find $f(3)$. (b) Given $f(a) = 21$, find the value of a .
5. $f(x) = 4x + 3$. Given $f(c) = 5$, find the value of c .
6. $g(x) = 4x^2$. (a) Find $g(-6)$ (b) Given $g(a) = 64$, find two values for a .
7. $f(x) = 2x^2 - 7$. (a) Find $f(-5)$. (b) Given $f(c) = 193$, find two values for c .
8. $f(x) = 5x + 3$ and $g(x) = 7x - 11$. Given that $f(x) = g(x)$, find x .
9. $h(x) = 5(x - 3)$ and $k(x) = 3x - 5$. Given that $h(x) = k(x)$, find x .

Quadratic Graphs

Exercise 1 - $y = (x + a)^2 + b$

1. The equation of the parabola is $y = (x - 3)^2 - 5$
 - (a) State the coordinates of the minimum turning point of the parabola.
 - (b) State the equation of the axis of symmetry of the parabola.
 - (c) Find the coordinates of A .



2. For each equation below, state
 - (i) the co-ordinates of the turning point
 - (ii) the equation of the axis of symmetry
 - (iii) where the parabola crosses the y-axis(a) $y = (x + 1)^2 - 5$ (b) $y = (x - 3)^2 + 6$ (c) $y = (x + 4)^2 + 7$ (d) $y = (x - 2)^2 - 3$
3. For each equation below, state
 - (i) the co-ordinates of the turning point
 - (ii) the equation of the axis of symmetry
 - (iii) where the parabola crosses the y-axis(a) $y = 5 - (x - 3)^2$ (b) $y = 7 - (x - 2)^2$ (c) $y = 4 - (x + 1)^2$ (d) $y = 8 - (x - 4)^2$

Exercise 2

1. For each parabola below find

(i) the point of crossing the y-axis

(ii) the roots of the parabola

(iii) the minimum or maximum turning point

(a) $y = x^2 - 6x$ (b) $y = x^2 + 4x$ (c) $y = 8x - x^2$ (d) $y = 2x^2 - 32$

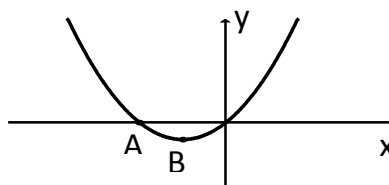
(e) $y = x^2 - 6x + 8$ (f) $y = x^2 + 8x + 15$ (g) $y = x^2 + 2x - 15$ (h) $y = x^2 - 4x - 12$

2. The diagram shows the parabola

$$y = x^2 + 2x.$$

(a) Find the coordinates of the point A.

(b) Find the coordinates of B, the minimum turning point of the parabola.

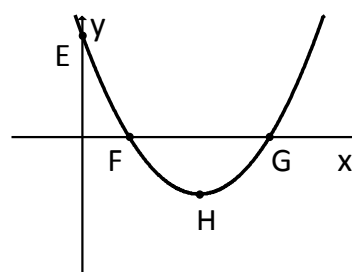


3. The diagram shows the parabola $y = x^2 - 10x + 16$

(a) Write down the coordinates of E

(b) Find the coordinates of F and G

(c) Find the coordinates of H, the minimum turning point.



Completing the square

Exercise 1

Write each of the following in completed square form, $y = (x + a)^2 + b$.

(a) $h^2 + 4h + 12$ (b) $x^2 + 12x + 30$ (c) $x^2 + 6x + 50$ (d) $x^2 + 4x - 12$

(e) $x^2 + 2x - 3$ (f) $x^2 - 8x - 18$ (g) $x^2 - 2x - 4$ (h) $x^2 - 10x + 24$

(i) $a^2 - 8a + 16$ (j) $x^2 - 4x - 32$ (k) $d^2 - 14d$ (l) $g^2 + 5g - 5$

Quadratic equations

Exercise 1 - factorising

Solve:

a) $x^2 - 9x = 0$

b) $x^2 + 13x + 40 = 0$

c) $a^2 - 81 = 0$

d) $x^2 + 3x - 10 = 0$

e) $x^2 - 10x + 21 = 0$

f) $x^2 - 7x - 18 = 0$

g) $5x^2 + 60x = 0$

h) $2d^2 + 9d - 5 = 0$

i) $5n^2 - 2n - 7 = 0$

j) $2p^2 - 32 = 0$

k) $3c + 18c^2 = 0$

l) $3w^2 + 5w = 8$

m) $6 - 24h^2 = 0$

n) $6m^2 = 23m + 4$

o) $2x^2 = 8$

Exercise 2- Quadratic formula

Solve, giving your answer to 1 decimal place.

- a) $x^2 + 4x + 2 = 0$ b) $x^2 + 7x + 5 = 0$ c) $a^2 + 5a + 3 = 0$
d) $x^2 + 3x - 3 = 0$ e) $x^2 + 3x - 2 = 0$ f) $x^2 - 7x + 3 = 0$
g) $x^2 - 8x - 1 = 0$ h) $d^2 - 2d - 2 = 0$ i) $n^2 - 3n - 5 = 0$
j) $2p^2 + 5x + 3 = 0$ k) $2c^2 - x - 7 = 0$ l) $3w^2 - 3w = 5$
m) $4h^2 - 3h - 2 = 0$ n) $3m^2 - 23m + 8 = 0$

Exercise 3 - The discriminant

1. Use the discriminant $b^2 - 4ac$ to find the nature of the roots of the equations below.

- a) $2x^2 - 7x + 1 = 0$ b) $5x^2 + 2x + 2 = 0$ c) $9x^2 - 24x + 16 = 0$
d) $x^2 + x + 7 = 0$ e) $6x^2 - x - 1 = 0$ f) $3x^2 + 2x + 5 = 0$

2. Examine the discriminant to see if the following equations have two real, distinct roots, one equal root or no roots.

- a) $2x^2 - 5x - 1 = 0$ b) $x^2 + x + 7 = 0$
c) $3x^2 - 18x + 27 = 0$ d) $2x^2 + x + 1 = 0$

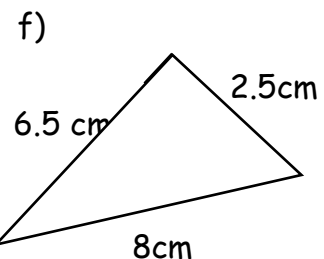
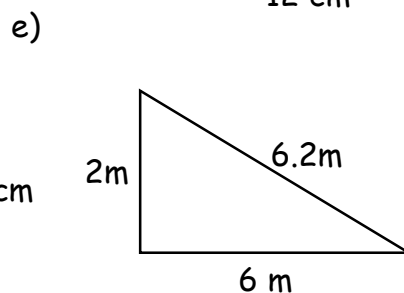
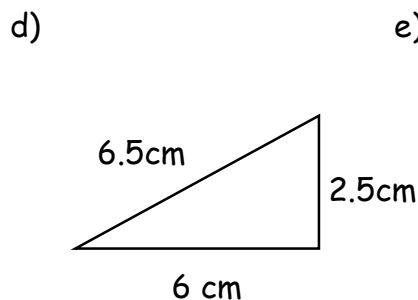
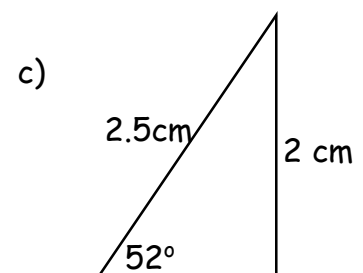
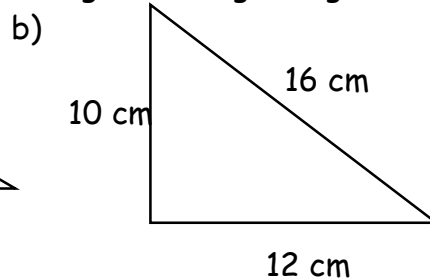
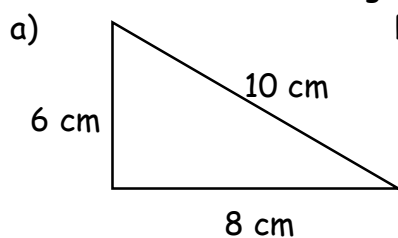
3. Find k given that each of the following equations has equal roots.

- a) $x^2 - 8x + k = 0$ b) $kx^2 - 12x + 9 = 0$ c) $x^2 + kx + 16 = 0$

4. Find m if $x^2 + 2mx + 9 = 0$ has equal roots.

Converse of Pythagoras

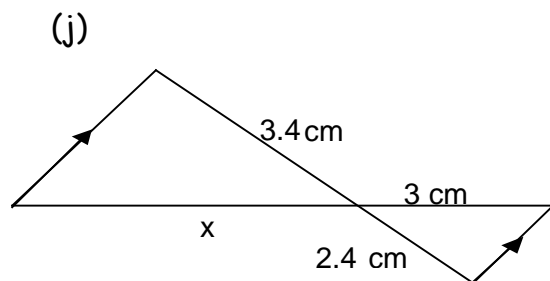
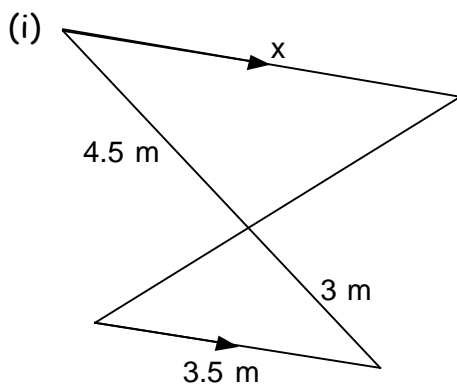
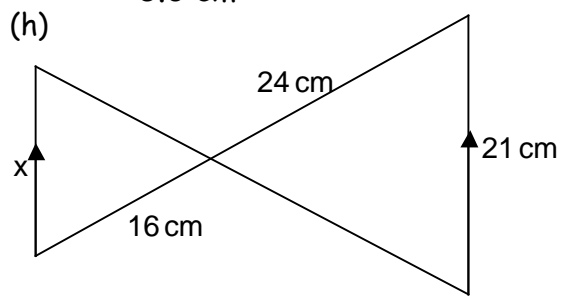
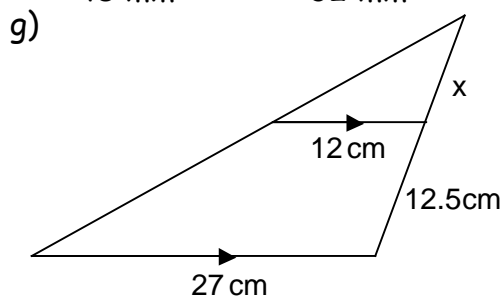
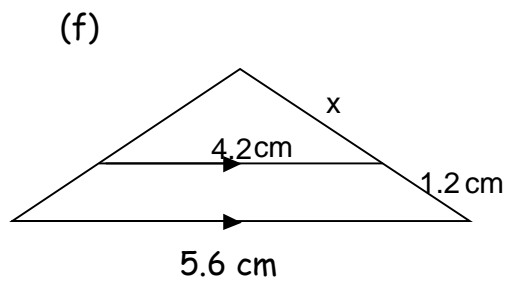
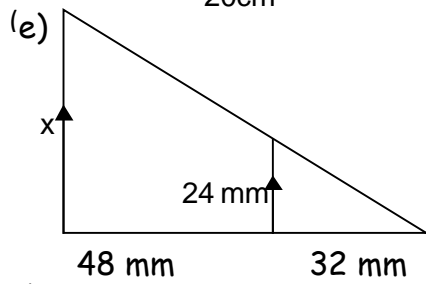
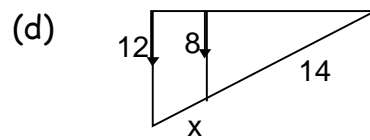
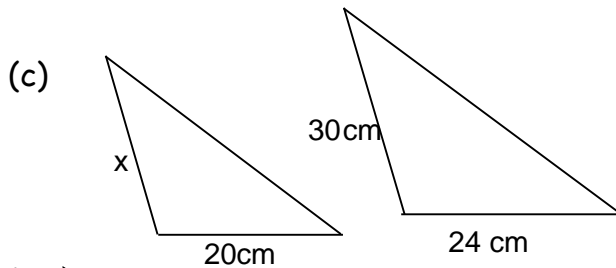
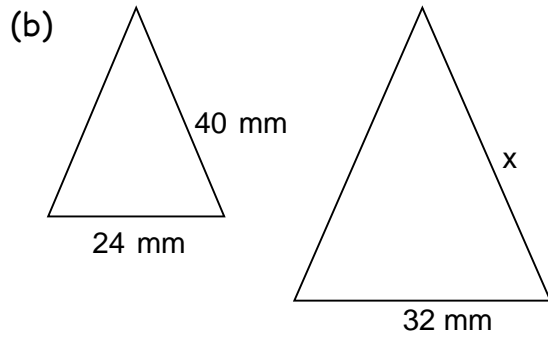
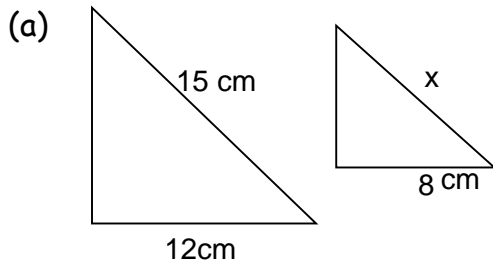
1. Which of the following triangles are right angled?



Similar shapes

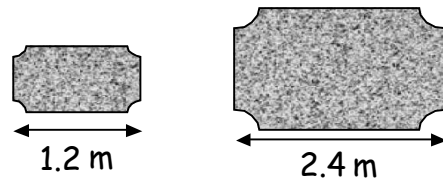
Exercise 1 - similar triangles

1. In each question below the triangles given are similar. Calculate x in each part.



Exercise 2 - Similar Areas

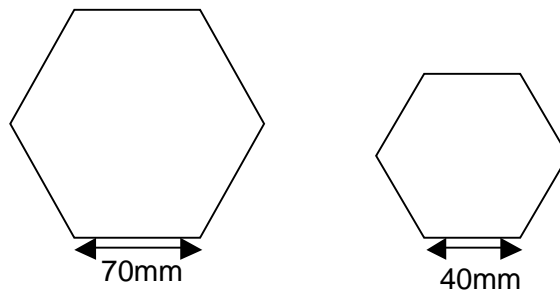
1. Two kitchen worktops are similar in shape. The area of the smaller worktop is 6.8 m^2 . Calculate the area of the larger worktop.



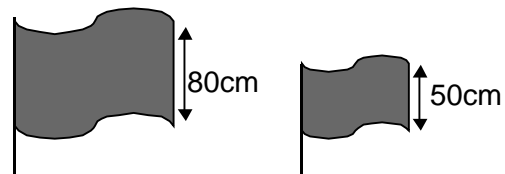
2. A photograph and its enlargement are similar in shape. The smaller photograph has an area of 56 cm^2 . Calculate the area of the larger photograph.



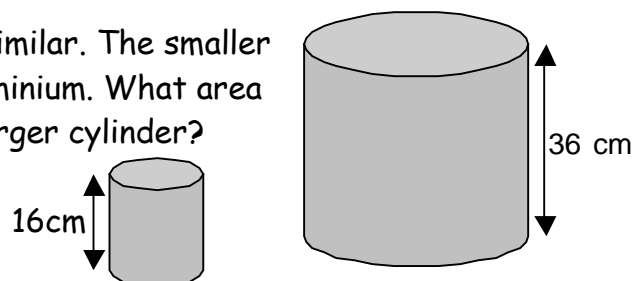
3. Two regular hexagons are mathematically similar in shape. The larger hexagon has an area of 7350 mm^2 . Find the area of the smaller hexagon.



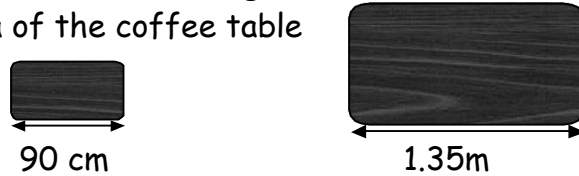
4. Two flags are mathematically similar. The larger flag has an area of 7680 cm^2 . Find the area of the smaller flag.



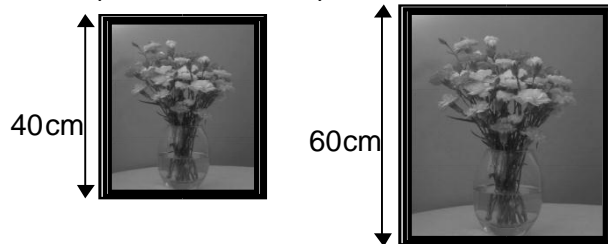
5. Two cylinders are mathematically similar. The smaller cylinder is made from 800 cm^2 of aluminium. What area of aluminium is needed to make the larger cylinder?



6. The top of a coffee table and the top of a dining table are similar in shape. The dining table is 1.35 metres long and has an area of 0.9 m^2 . Calculate the area of the coffee table

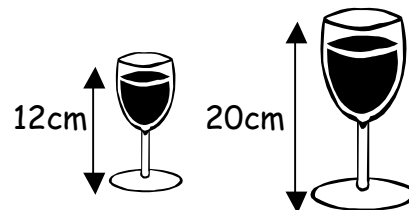


7. Two picture frames are mathematically similar in shape. The cost of the frames depends on their area. The smaller frame costs £4.60. Find the cost of the larger frame

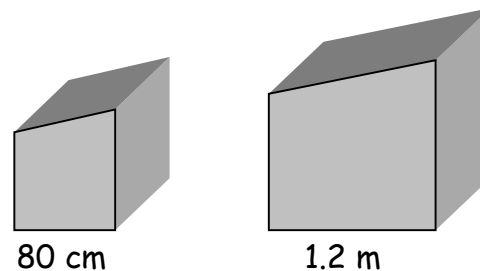


Exercise 3 - Similar Volume

1. The wine glasses shown are similar in shape. The smaller glass can hold 135 ml of wine. How much wine can the larger glass hold?



2. Two storage bins are similar in shape. The larger bin has a volume of 1.8 m^3 . Calculate the volume of the smaller bin.



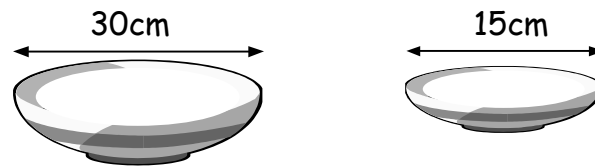
3. Two porcelain vases are similar in shape. The volume of the smaller vase is 1200 cm^3 . Calculate the volume of the larger vase.



4. The pitchers shown opposite are similar. The larger pitcher can hold 864 ml of liquid. How much liquid can the smaller pitcher hold?



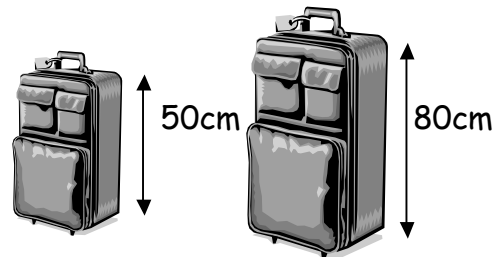
5. The diagram opposite shows a pair of similar fruit bowls. The smaller bowl has a volume of 1400 cm^3 . Find the volume of the larger bowl.



6. The diagram shows two suitcases which are mathematically similar in shape.

The cost of the suitcases depends on the volume of items the suitcase can hold.

The larger suitcase costs £25.60, find the cost of the smaller suitcase.



Simultaneous Equations

Exercise 1 - Solve by plotting

1. Plot each pair of lines on one diagram and state the point of intersection

(a) $y = 2x + 1$
 $y = x - 4$

(b) $y = 3x - 2$
 $y = 6 - x$

(c) $y = x + 3$
 $y = 2x - 1$

(d) $y = 0.5x - 1$
 $y = 5 - x$

(e) $x + y = 3$
 $2x + y = 4$

(f) $x + 2y = 4$
 $x - y = 1$

(g) $x - y = 8$
 $3x + y = 0$

(h) $y + x = 4$
 $y - x = 2$

(i) $2y - x = 3$
 $2y + x = 5$

(j) $3x + y - 3 = 0$
 $x + 2y + 9 = 0$

(k) $2y - 3x - 8 = 0$
 $2y + 5x + 8 = 0$

Exercise 2 - solve by substitution

1. Solve the following pairs of equations

(a) $y = 2x + 1$
 $y = x - 4$

(b) $y = 3x - 2$
 $y = 6 - x$

(c) $y = x + 3$
 $y = 2x - 1$

(d) $y = x - 1$
 $2y + x = 4$

(e) $y = 3 - x$
 $2x + y = 4$

(f) $y = x - 1$
 $x + 2y = 4$

(g) $y = x - 8$
 $3x + y = 0$

(h) $y = 4 - x$
 $y - x = 2$

(i) $y = 5x$
 $y = 3x + 4$

(j) $y = 3 - 3x$
 $x + 2y + 9 = 0$

(k) $y - 4x - 3 = 5$
 $y + 7x - 30 = 0$

Exercise 3 - solve by elimination

1. Solve the following pairs of equations

(a) $5a + 2b = 16$
 $2a + 2b = 10$

(b) $3c - 4d = 14$
 $c + 4d = 10$

(c) $5g + 3h = 14$
 $5g + h = 8$

(d) $2m + n = 22$
 $6m - n = 58$

(e) $3p + 2q = 7$
 $3p + 8q = 1$

(f) $6x - 3y = 12$
 $5x + 3y = -1$

(g) $4u - 6w = -10$
 $2u - 6w = -14$

(h) $5w - 2z = 15$
 $5w + z = 0$

(i) $3a - 7c = 5$
 $2a - 7c = 1$

(j) $5g + 6h = 1$
 $5g - 2h = -7$

(k) $3m - 2n = 16$
 $5m + 2n = 80$

(l) $4x + 3y = 170$
 $4x + y = 110$

(m) $2u + 3w = 18$
 $4u - 3w = -54$

(n) $3p + 7q = 19$
 $5p + 7q = 20$

(o) $5h + 4k = 20$
 $5h + 8k = 34$

(p) $10a + 4b = 24$
 $5a + 4b = 13$

(q) $4m - 8n = -1$
 $8m - 8n = 12$

(r) $10u - 2w = 8$
 $10u + 6w = 20$

2. Solve the following pairs of equations

(a) $2a + 3b = 19$
 $3a - b = 1$

(b) $5c + 2d = 26$
 $c + d = 7$

(c) $5g - 3h = 16$
 $3g + h = 4$

(d) $4x + 9y = 56$
 $2x + 4y = 26$

(e) $3m + 2n = 17$
 $2m - 6n = -40$

(f) $5p - 2q = 23$
 $2p + 8q = -26$

(g) $2u + 3v = 23$
 $7u + v = -5$

(h) $8g - 4h = 20$
 $2g + 3h = -7$

(i) $5a + 2b = 23$
 $2a + 3b = 18$

(j) $5e - 3g = -8$
 $4e + 5g = 38$

(k) $4m - 2n = 16$
 $3m - 5n = 19$

(l) $7u - 3v = -16$
 $5u + 4v = 7$

(m) $3x - 5y = 15$
 $2x - 2y = 10$

(n) $3a + 7c = 97$
 $4a + 3c = 47$

(o) $2p + 2q = 110$
 $7p - 3q = 35$

(p) $4a - 6q = 2.3$
 $3a + 4q = 10.65$

(q) $5m - 2n = -17$
 $2m + 7n = -2.9$

(r) $4x + 4y = -20$
 $5x - 3y = -1$

3. (a) $2a + 3c = 9$ (b) $3m - 2n = 16$ (c) $2p - 4q = -30$ (d) $4x + 2y = -10$
 $3a + c = 10$ $2m + 3n = 15$ $5p - 3q = -5$ $3x - 5y = -1$

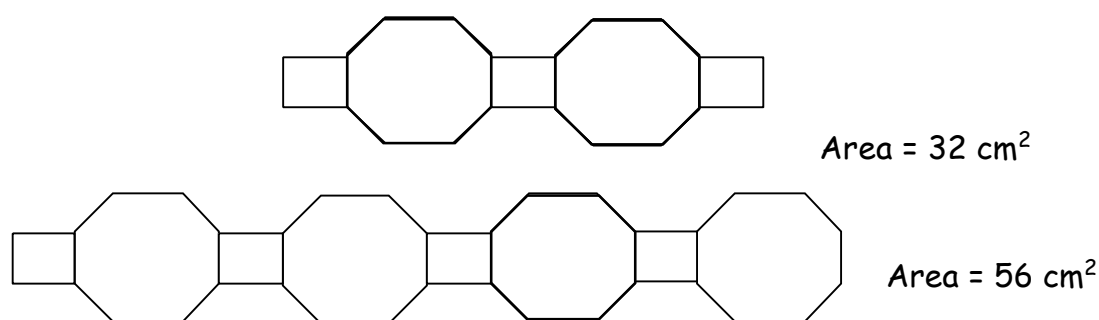
Exercise 4 - Problem solving

1. 2 apples and 3 pears cost 76 pence. 3 apples and a pear cost 58 pence.
Find the cost of an apple and of a pear.

2. 3 pens and 2 pencils cost 78 pence. 5 pens and 3 pencils cost £1.27.
Find the cost of one pencil.

3. 4 knives and 5 forks cost £1.95. 3 knives and 3 forks cost £1.32.
Find the cost of 5 knives.

4. The diagram below shows patterns made with squares and octagons. The total area of each pattern is given. Calculate the area of one octagon.

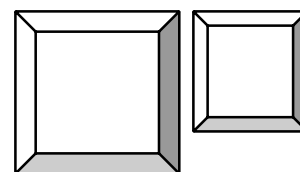


5. The diagram opposite shows the same make of picture frame in two different sizes.

(a) 2 large frames and 5 small frames cost £34.

(b) 3 large frames and 4 small frames cost £37.

Find the cost of a large frame and of a small frame.



6. 3 soup bowls and 2 dinner plates cost £25.

2 soup bowls and 4 dinner plates cost £34.

Find the cost of a dinner plate and of a soup bowl.

8. (a) Mr. and Mrs. Alba take their 3 children to see the film Black Knight. The tickets cost a different amount for adults and children. Altogether they pay £25.50 for their tickets. Using x to represent an adult ticket and y to represent a child ticket, write down an equation involving x and y .

(b) Mr. McMahon and his son also go to see the Black Knight. They pay £10.50 for their tickets. Write down another equation involving x and y .

(c) Mr. and Mrs. Chicklis take their 5 children to see the same film. How much will it cost them for their tickets?

Change the subject of the formula

Exercise 1 - basic

1) Rearrange each equation so that x is the subject

a) $2x + 3 = y$

b) $5x + 7 = y$

c) $4x - 1 = y$

d) $3x - 7 = 2y$

e) $3(2x - 3) = y$

f) $2(4x + 1) = 3y$

g) $a(x + 3) = y$

h) $a(x - b) = 2$

i) $a(x + 1) = b$

2) Rearrange to make x the subject of the formula

a) $\frac{x}{2} = a$

b) $\frac{x}{2} - 3 = a$

c) $\frac{x}{4} + 2 = a$

d) $\frac{3x}{4} = a$

e) $\frac{x+2}{3} = y$

f) $\frac{x-5}{4} = y$

g) $\frac{x+b}{c} = a$

h) $\frac{x}{c} + b = a$

Exercise 2 - Squares and Square Roots

1) Rearrange to make x the subject of the formula

a) $x^2 - 3 = y$

b) $x^2 + 9 = y$

c) $x^2 - a = b$

d) $x^2 + y^2 = z^2$

e) $\frac{x^2}{3} = y$

f) $\frac{x^2}{7} = z + 2$

g) $\frac{x^2}{8} = a + b$

h) $3x^2 = y$

i) $5x^2 = z + 2$

j) $2x^2 + m = n$

k) $5x^2 + 1 = a^2$

2) Rearrange to make the subject m

a) $(m + 3)^2 = y$

b) $(m - 4)^2 = y$

c) $(m + r)^2 = k$

d) $(2m - 5)^2 = y$

e) $(3m + a)^2 = j$

f) $(km - u)^2 = p$

3) Rearrange to make the subject h

a) $\sqrt{h} = j$

b) $\sqrt{h} = y + z$

c) $\sqrt{h} - 2 = y$

d) $\sqrt{h-2} = k$

e) $\sqrt{h+2} = g$

f) $\frac{\sqrt{h}}{p} = q$

g) $\sqrt{\frac{h}{p}} = q$

h) $\sqrt{\frac{h}{g}} = f$

i) $\sqrt{\frac{x^2 - 2}{f}} = c$

Percentages

Exercise 1 - Compound interest

1. Find the compound interest on a sum of £2500 invested at a rate of 6% per annum for 3 years.
2. Find the compound interest on a sum of £1400 at a rate of 7.6% p.a. over a period of 7 years.
3. Calculate the compound interest on
 - (a) a sum of £1500 at a rate of 7% p.a. for 4 years.
 - (b) a sum of £15 000 at a rate of 5.5% p.a. for 5 years.
 - (c) a sum of £120 000 at a rate of 11.2% p.a. for 10 years.

Exercise 2 - Appreciation/Depreciation

1. A people carrier cost £11 000 new in 2005. The value of the car will depreciate at a rate of 15% per annum for each of the next 4 years. Find the value of the car in 4 years time. Give your answer correct to 2 significant figures
2. Wilchester Rovers is a football club whose average attendance in 2008 was 16 450. Since then the average attendance at the club has fallen steadily at a rate of 3.2% each year. Calculate the average attendance at the club in the year 2012. Give your answer correct to three significant figures.
3. A vineyard produced 250 kilograms of grapes in 2005. It is estimated the vineyard will be able to increase production at a rate of 3% p.a. for the next 5 years. Calculate the weight of grapes that will be produced in 5 years time.
4. The number of bacteria in a test tube is 50 000. The bacteria reproduce at a rate of 35% every 4 hours. Calculate the number of bacteria in the test tube after one day.
5. A car costing £18 500 new depreciates by 15% in its first year and then by 9% for each of the next 4 years. Find the value of the car after 5 years.
6. A raincloud contains 2500 litres of water. The cloud is increasing in size at a rate of 4.3% per hour. Calculate the volume of water in the cloud in 8 hours' time.

7. Hillside secondary school had a roll of 1400 in 2001. If the roll falls at a rate of 4% per annum, calculate the roll of the school in 2006.

8. A farmer buys a new tractor for £42 000. The tractor depreciates at a rate of 10% in each of its first 2 years, and then at a rate of 8% in each successive year. How long will it take for the tractor to be worth less than £26 000?

9. A van rental company purchases vans costing £22 000 each. The value of a van depreciates by 30% in its first year and then by 15% in each successive year. A van is replaced at the end of the year in which its value falls below half its original price. After how many years will the company replace a van?

9. In 1999 the city of Venice was visited by 16 million tourists. In 2000 to 2002 the number of tourists fell at a rate of 3.5% per annum and then from 2003 to 2005 the number of tourists rose at a rate of 6.8% per annum. Calculate the number of tourists who visited Venice in 2005.

10. The annual sales in 4 branches of the fashion shop Top Store are given below.

Branch	East Kilbride	Braehead	Argyle St.	Glasgow Fort
Sales	£225 000	£210 000	£294 000	£198 000

The company expect each of their branches to increase sales by 11% per annum over the next 4 years.

Which of the 4 branches will have sales of at least £330 000 in 4 years time?

11. In 2004 a house was valued at £85 000.

Its contents were valued at £32000.

The value of the house appreciates at a rate of 12% each year.

The value of the contents depreciates at a rate of 4% each year.

What will be the total value of the house and its contents in the year 2010?

12. A museum attracted 2.25 million visitors in the year 2012. The museum hope to increase visitor numbers to 3 million by the year 2018. If they can increase the number of visitors to the museum by 5% per annum, will they reach their target in 2018? Explain your answer.

13. An antique sculpture is valued at £14 500 in 2013. It is estimated the value of the sculpture will increase at a steady rate of 9% per annum. How many years will it take for the sculpture to be worth more than £20 000?

Exercise 3 - Finding original amount

1. A student pays an aeroplane fare of £240.

If this represents 60% of the adult fare, find the adult fare.

2. In a maths examination Michael scored 75% of what Brian scored.

If Michael scored 66 marks, what did Brian score?

3. A classical concert is attended by 640 people on a Friday evening. That evening 80% of the tickets had been sold. How many people can the venue hold when full?

4. Amanda and Ian decide to see who can cycle further in an hour. Amanda covers 6.3 kilometres which is 70% of the distance covered by Ian.

How far did Ian cycle?

5. Between the years 2009 and 2010 a stereo system increased in value by 30%.

If the stereo cost £650 in 2010 what was its value in 2009?

6. A can of cola contains 396 millilitres. This is 20% more than a normal sized can. How much does a normal can of cola hold?

7. Vincent buys a painting at auction. He pays £1449 in total for the painting. This price includes auction commission of 15%. How much was the price of the painting before the commission was added?

8. The average cost of a computer has fallen in price by 65% since 1999. If the average cost is now £560, find the average cost in 1999.

9. David takes his family out for a meal. The total bill for the meal is £71.50. This cost includes a service charge of 10%.

What was the cost of the meal before the service charge was added?

10. Renco coffee are selling a jar of coffee with a special offer of an extra 12.5%. The jar now contains 270 grams. How much does the original jar contain?

11. Kestles are selling a box of corn rings containing an extra 40%. The box now contains 1050 grams of corn rings. How much did the box contain before the 40% was added?

12. Laura's wages have increased by 6%. She now earns £19080, find her wage before the increase.