

S4

Lesson Starters

National 5

Task 1

1. Factorise fully

(a) $3x^2 - 9x$ (b) $2m - 4m^2$ (c) $u^2 - 16$ (d) $2p^2 - 50$

Task 2

1 Solve

(a) $2x^2 - 14x = 0$ (b) $t^2 = 6t$ (c) $m^2 - 16 = 0$

Task 3

1. Calculate

(a) $(2.13 \times 10^5) \times (4 \times 10^{-2})$ (b) $6.15 \times 10^{-2} \times 4.3 \times 10^8$ (c) $(7.5 \times 10^4) \div (5 \times 10^{-2})$

Task 4

1. Find the value of

(a) 3.12×60 (b) 0.456×200 (c) 1.25×400 (d) 0.0078×6000
(e) $12.6 \div 40$ (f) $345 \div 500$ (g) $2.1 - 0.63 \times 3$ (h) $41.2 + 61.5 \div 50$

NON-CALCULATOR

Task 5

1. A bus leaves Aytoun at 1045 and travels to Beeville, 135 km away, where he arrives at

1315. Calculate the average speed of the bus.

2. $f(x) = 4x - x^3$. Calculate $f(-3)$.

3. $f(x) = 2x^2 - 5x$.

- (a) Evaluate $f(-2)$.
(b) Given $f(x) = 7$ find two possible values for x .

Task 6

1. Factorise fully

(a) $x^2 - 7x + 12$ (b) $n^2 - 2n - 8$ (c) $3x^2 - x - 10$ (d) $5c^2 + 4c - 12$

Task 7

1. Express with a rational denominator

(a) $\frac{10}{\sqrt{5}}$

(b) $\frac{2\sqrt{3}}{\sqrt{30}}$

2. Simplify

(a) $\frac{3a^8 \times 6a^{-3}}{2a}$

(b) $2x^{\frac{1}{2}}(4x^{\frac{7}{2}} - x^{-\frac{1}{2}})$

3. Evaluate

(a) $27^{\frac{2}{3}}$

(b) $16^{-\frac{3}{4}} + (\frac{1}{2})^0$

Task 8

1. There are 1260 pupils in a school. $\frac{5}{9}$ of the pupils are boys.

How many boys are in the school?

2. Michael earns £480 per week. He puts 35% of the money in the bank, gives his mother $\frac{1}{10}$

in rent and spends the rest.

(a) How much does he put in the bank?

(b) How much does he spend?

Task 9

1. Calculate the mean:

(a) 14 15 18 20 23 18 (b) 41 45 34 45 46 47 50

Task 10

1. Express as a single fraction

(a) $\frac{3}{2x} + \frac{1}{3x}$ (b) $\frac{2}{x^2} + \frac{3}{x}$ (c) $\frac{3}{6x-1} - \frac{1}{2x}$

2. Simplify

(a) $\sqrt{18} + 2\sqrt{27} - \sqrt{200}$ (b) $2\sqrt{2}(5\sqrt{2} + \sqrt{6})$

Task 11

1. Calculate the following percentages

(a) 30% of £340 (b) 20% of \$4200 (c) 70% of £12 (d) 80% of £5250

(e) 45% of £160 (f) 65% of £6000 (g) 33½% of £630 (h) 66⅔% of £4200

NON-CALCULATOR

Task 12

1. Expand the brackets and simplify

(a) $(2x - 1)(x^2 - 2x - 1)$

(b) $(2m - 5n)^2 - 25n^2$

(c) $4p - (3p - 2)(p - 2)$

(d) $6ac - (a - 3c)^2$

Task 13

1. Evaluate

(a) $2.16 - 31.5 \div 50$

(b) $0.0037 \times 400 + 32.77$

(c) $2.2 - 3.12 \times 6 + 21.5$

Task 14

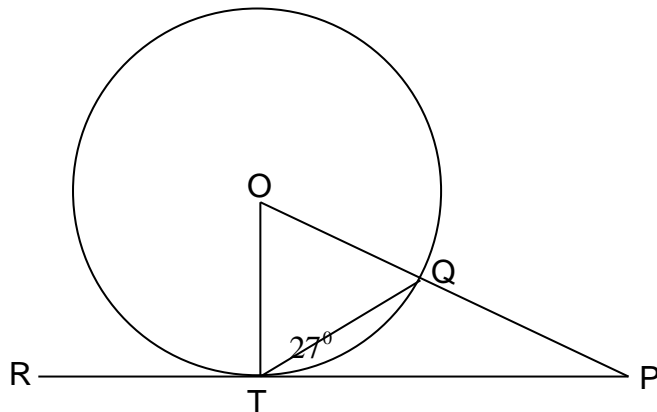
1. Solve (a) $x^2 + 7x - 1 = 0$ (b) $3x^2 - 2x - 7 = 0$ giving your answers correct to 1 d.p.

Task 15

1. RP is a tangent to the circle, centre O, with a point of contact T.

Angle PTQ = 27° .

Calculate the size of angle OPT.



Task 16

1. Find

- (a) $\frac{1}{5}$ of £240 (b) $\frac{2}{3}$ of £4260 (c) $\frac{5}{8}$ of 3600 kg (d) $\frac{7}{10}$ of 24.5 cm

2. (a) $f(x) = x^2 - \frac{15}{x}$. Calculate $f(-5)$.

(b) . Evaluate $P = xy - x(x + y)$ when $x = -2$ and $y = -3$

Task 17

1. Calculate

- (a) $(2.16 \times 10^9) \div (4 \times 10^{-3})$ (b) $5.13 \times 10^7 \times 42\,000\,000$ (c) $2.16 \times 10^7 \div 0.0012$

Task 18

1. A line has equation $y = 2x + 3$

(a) Copy and complete the table below for this line.

x	3	0	-2
y			

(b) Draw this line on a graph

(c) Write down the gradient of the line $y = 2x + 3$

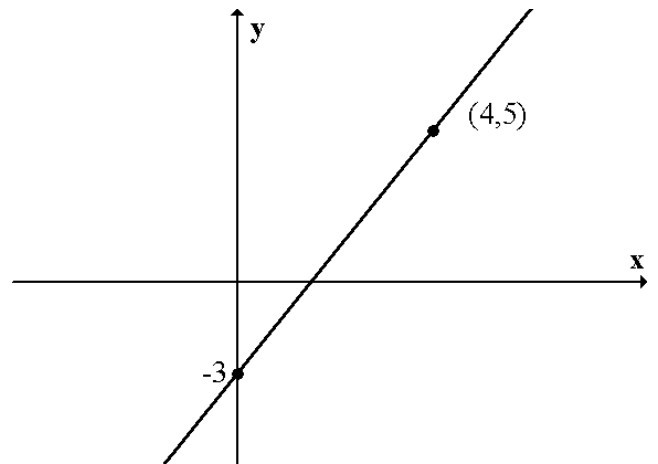
2. (a) Express $P = 2(x^2 - 4y)$ in terms of x .

(b) Express $w = u + \frac{v}{y}$ in terms of y .

Task 19

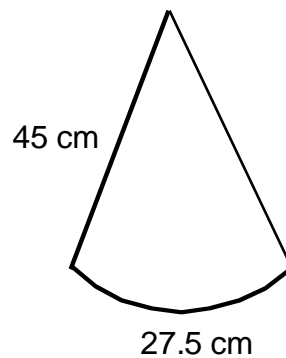
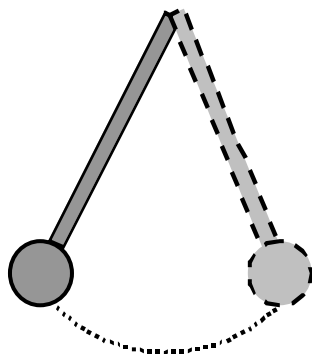
2. (a) Find the equation of the line shown opposite.

(b) The point $(-8,p)$ lies on this line. Find the value of p .



Task 20

1. A pendulum is 45 centimetres long. When the pendulum swings it travels along the arc of a circle and covers a distance of 27.5 centimetres.



Calculate the size of the angle through which the pendulum travels.

2. 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

Task 21

1. $f(x) = x^2 - 5x$.

- (a) Find the value of $f(-6)$.
- (b) Given $f(x) = 36$, find **two** values for x .

2. $g(x) = 3x^2 - 2x$.

- (a) Evaluate $g(-2)$
- (b) Given $g(x) = 1$, find **two** values for x .

Task 22

1. Evaluate

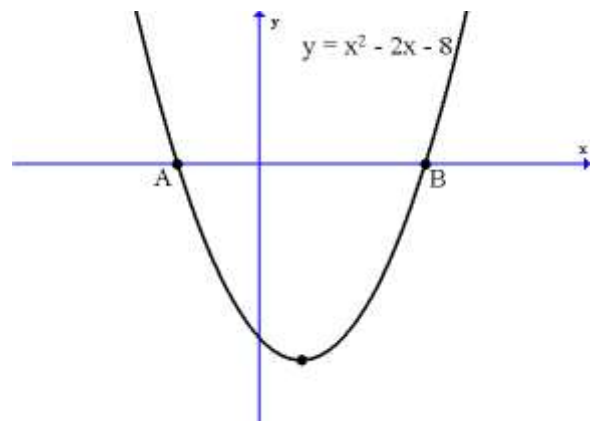
(a) $\frac{1}{2} + \frac{2}{3} \div 1\frac{1}{5}$ (b) $\frac{5}{6} + \left(1\frac{1}{2}\right)^2$ (c) $\frac{5}{6} \div \left(1\frac{1}{2} + 1\frac{1}{3}\right)$ (d) $\frac{3}{4}$ of $\left(1\frac{1}{3} - \frac{5}{6}\right)$

Task 23

1. The parabola opposite has equation

$$y = x^2 - 2x - 8.$$

- (a) Find the coordinates of A and B.
- (b) Find the minimum value of the parabola.
- (c) The point C(7,m) lies on the parabola. Find m.



Task 24

1. (a) Solve the inequation $3 - (x - 2) > 5 - 3x$

(b) Solve $2 - 3(x - 1) > 2x$

2. Expand the brackets and simplify

(a) $(2x - 1)(3x + 4)$ (b) $(3m - 2n)^2$ (c) $(2a - 3)(a^2 - a - 2)$

Task 25

1. Solve $x + 5y = 16$

$$5x - 2y = -1$$

2. 2 pears and 3 apples cost 85 pence.

3 pears and 4 apples cost £1.20.



Find the cost of 6 apples and a pear.

Task 26

1. The total number of visitors to an exhibition was 3.456×10^5 . The exhibition was open from from 1st May to the last day of August. Calculate the average number of visitors per day.

Give your answer in Scientific Notation.

2. It is estimated that 1m^3 of pond water contains 5.33×10^6 bacteria. Calculate the expected number of bacteria in a pond with volume 2500m^3 .

Task 27

1. $f(x) = 3x^2 - x + 1$ and $g(x) = x + 9$.

Find x given $f(x) = g(x)$.

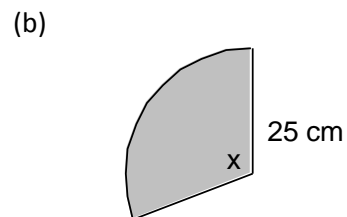
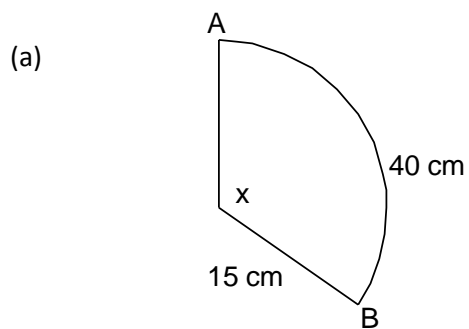
2. $f(x) = 5x^2 - 3x$ and $g(x) = 2x + 3$.

Find x given $f(x) = 4g(x)$.

3. $P = \frac{x^2 + 8x}{4}$. Find x when $P = 5$.

Task 28

1. Calculate angle x in each of the following.



Task 29

1. Jess has 12 pets, some cats and some dogs.

She insures her pets against illness.

The cost of insurance is £5 for each cat and £7 for each dog.

The total insurance bill is £68.

Let x represent the number of cats Jess has and y the number of dogs.

Form two equations involving x and y and use your equations to find

how many dogs Jess has.

2. A school party is going on an overnight theatre trip to London.

They go to a hotel and book a number of single rooms and a number of twin rooms. In total they book 17 rooms.

Let x represent the number of single rooms booked and y the number of twin rooms booked.

(a) Write down an equation involving x and y .

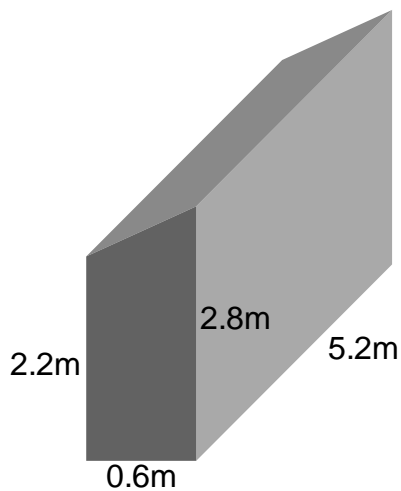
Single rooms cost £35 per night and twin rooms cost £50 per night. The total cost of booking the rooms is £775.

(b) Write down another equation involving x and y .

(c) How many single rooms and how many twin rooms were booked?

Task 30

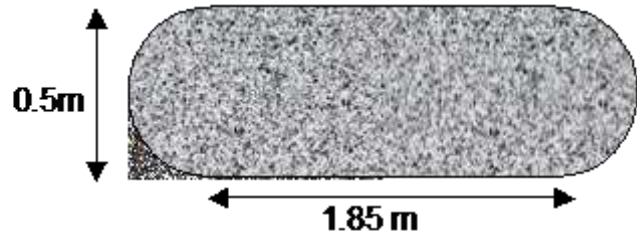
1. Calculate the volume of the prism opposite.



Task 31

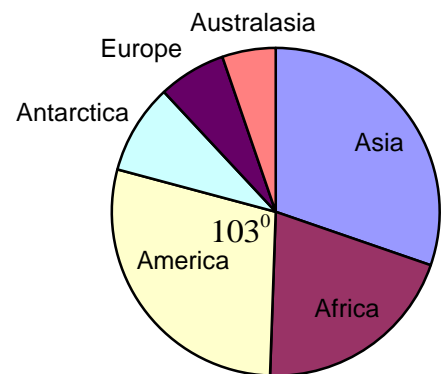
1. The diagram opposite shows a worktop.

The worktop is rectangular in shape with semi-circular ends.



Calculate the perimeter of the worktop.

2. The pie chart shows the relative sizes of the continents of the world. The total land mass of the world is 1.47×10^8 square kilometres.



- Write this land mass as an ordinary number.
- Calculate the land mass of the continent of America. **Give your answer to the nearest whole number.**

Task 32

1. Factorise

- (a) $3x^2 - 12x$ (b) $x^2 - 25$ (c) $2c^2 - 8$ (d) $u^2 - 4u - 12$ (e) $2m^2 - 3m - 9$

Task 33

1. Two different firms charge the following for car hire:

Reliability cars: £13.50 per day plus a deposit of £30

Trustmotors : £100 for the first 5 days and then £10 per day after
the first five days.

- (a) Write down a formula for hiring a car from Reliability cars for **d** days.
(b) Write down a formula for hiring a car from Trustmotors for **d** days where $d > 5$.
(c) Which firm is cheaper?

2. $f(x) = 2^x$. Given $f(x) = \sqrt{32}$ find x .

3. Given $16^{\frac{3}{4}} = 2^x$, find x .

Task 34

1. Amanda, Nadia and Laura are sisters.

Amanda is 4 years younger than Nadia and Laura is 5 years older than Nadia.

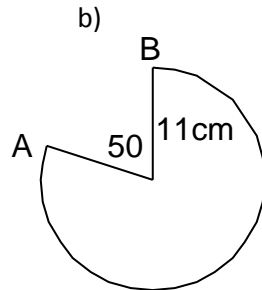
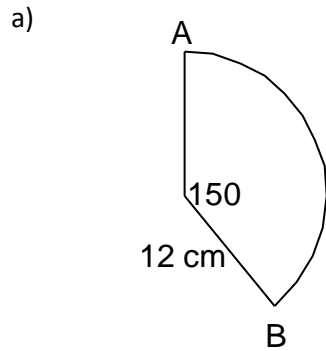
- (a) Using x to represent Nadia's age, write down expressions for Amanda's and Laura's ages.
(b) The sum of their ages is 43. How old is Amanda?

2. A is the point (2,0) and B is (6,8).

- (a) Find the gradient of the line joining A and B.
(b) If this line is extended it passes through the point (0,-4). Write down the equation of this line.
(c) Does the point (-5,-12) lie on this line?
(d) The point (m,3m) lies on this line. Find m .

Task 35

19. Calculate the length of arc AB.



Task 36

1. Solve

(a) $2(4x - 3) - 4 = 3x - 5$

(b) $4 - 3(2a - 4) > 4(2a + 3)$

(c) $6 - (x - 3) = 2x - 15$

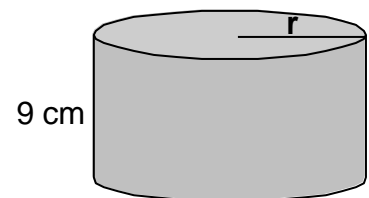
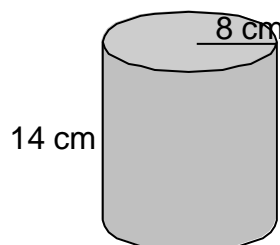
(d) $4p - 3(1 - p) < 2p + 7$

Task 37

1. The cylinders opposite have the

same volume.

Calculate the radius of the second cylinder.



Task 38

1. Evaluate

- (a) 3.15×600 (b) $42.3 \div 90$ (c) 35% of £6400 (d) $\frac{3}{4}$ of £480
(e) $\frac{5}{8}$ of £38 (f) $213 - 43 \times 4$ (g) $51.3 + 655 \div 50$ (h) $7(86.4 - 7.18 \times 8)$

2. $f(x) = 2x^2 - x^3$. Evaluate $f(-3)$.

Task 39

1. Michael invests £15 000 in a high interest investment account. It is expected he will get an interest rate of 7.2% per annum. How much money will Michael have in 5 years time

2. An oil painting is valued at £26 000. The value of the painting is expected to increase at a rate of 11% per annum. How much will the painting be worth in 10 years time?



Task 40

1. A delivery company promises next day delivery on all packages. The cost of delivery is £4.80 for packages weighing up to 10kg plus 40p for each extra kilogram above 10kg.

- (a) Find the cost of delivery for a package weighing 16kg.
(b) Write down a formula for the cost, £C, of delivering a package weighing D kilograms, where $D > 10$.

2. Asma hired a mobile phone at a fixed charge of £17 per month. She is also charged for her total call time each month.

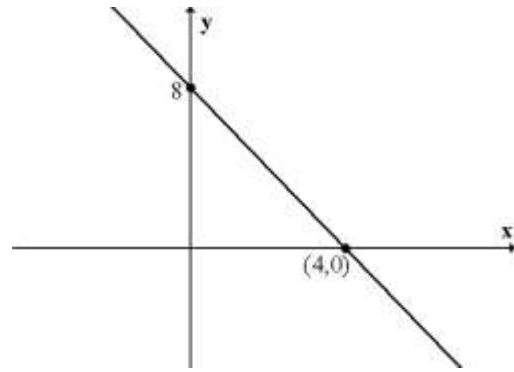
The first 25 minutes of her call time is free. The rest is charged at 30p per minute.

- (a) Calculate Asma's total cost in a month where she makes 62 minutes of calls.
(b) Write down a formula for the total cost, £C, for Asma's phone in a month where her total call time is t minutes, where $t > 25$.

Task 41

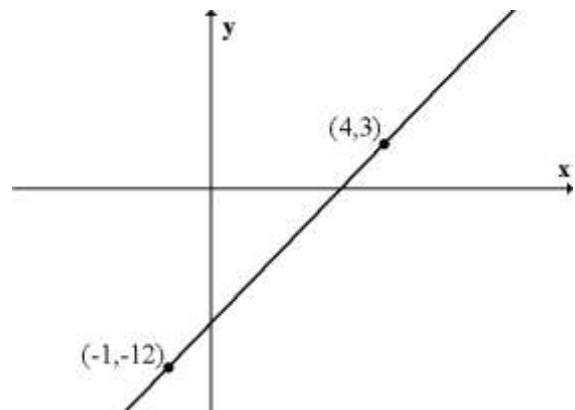
1. (a) Find the equation of the line shown opposite.

(b) The point $(p,2p)$ lies on this line. Find the value of p .



2. (a) Find the equation of the line shown.

(b) Find where this line cuts the x and y axes.



Task 42

1. Simplify $\frac{2x^2 - 10x}{2x^2 - 11x + 5}$

2. Solve

(a) $3x^2 - 6x = 0$ (b) $2w^2 - 18 = 0$ (c) $d^2 - 6d = 16$ (d) $3n^2 - 2n - 8 = 0$

Task 43

1. A bag contains 30 coloured counters – 8 red, 14 blue, 5 green and 3 yellow.

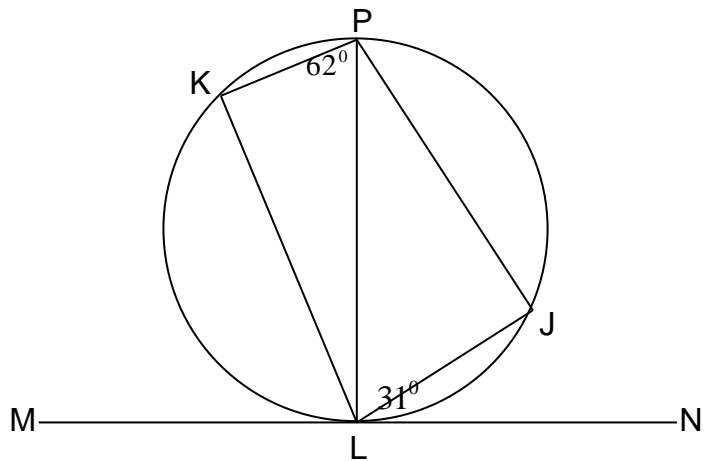
(a) A counter is chosen from the bag at random, what is the probability it is red? Simplify your answer.

(b) A counter is chosen from the bag and replaced. This is done 150 times.

How many times would you expect a green counter to be chosen?

2. In the diagram MN is a tangent and PL is a diameter of the circle.

Angle JLN = 31° and angle KPL = 62° .



Find the size of angle KLJ.

Task 44

1. $H = \frac{x^2 + y^2}{x - y}$. Find h when $x = -4$ and $y = -2$.

2. $P = \frac{a(a - b^2)}{a - b}$. Find P when $a = -3$ and $b = -5$.

Task 45

8. A water storage tank contains 5250 litres of water. A hole in the tank is causing the water to leak from the tank at a rate of 6.25% every 3 hours. Calculate how much water will be left in the tank after a day.

9. A coach costing £55 000 new depreciates in value by 12% in its first year and the by 8.5% in each of its next 3 years.

Find the value of the coach after 4 years.

Give your answer correct to 2 significant figures.



Task 46

1. Solve (a) $3x - 2y = 13$ (b) $6a - 3b = 3$

$2x + y = 11$ $4a - 2b = 2$

2. (a) Mr. Paterson and his two children go to the theatre to see a play.

The cost of their tickets is £20.50.

Let x represent the cost of an adult ticket and y the cost of a child ticket.

Write down an equation involving x and y .

(b) Mr. And Mrs. Kaur and their three children go to see the same play.

Their tickets cost £37.

Write down another equation involving x and y .

(a) Find the cost of an adult ticket and the cost of a child ticket.

Task 47

1. (a) Niruz goes to France on holiday. She changes £650 into euros at a rate of

£1 = 1.42 Euros. How many Euros will she receive?

(b) While in France Niruz spends 700 Euros before changing the rest back to

to pounds at a rate of £1 = 1.46 Euros. How much will she have, to the

nearest penny?

2. Calculate the simple interest on a sum of £2400 at 6.2% per annum for a

period of 8 months.

3. An antique cello is valued at £6500. If the value of the cello rises

at a rate of 12% per annum, how much will it be worth in 4 years

time?



Task 48

1. A piece of machinery costing £32 000 depreciates at a rate of 4.5% per annum.

Find the value of the piece of machinery after 5 years.

2. In a survey of 1250 people, 135 were self-employed. What percentage of the

people surveyed were self-employed?

Task 49

1. Expand the brackets and simplify

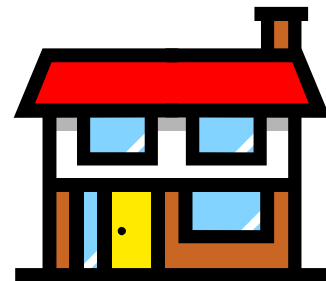
(a) $2(x - 2y) - 3(2x - 3y)$ (b) $(2a - 3)(2a + 3)$ (c) $(6x - 3)^2$

(d) $(3p - 4)(p^2 - 2p - 1)$ (e) $(3x - 2y)^2 + 12xy$ (f) $6n^2 - (2n + 3)(2n - 4)$

Task 50

1. Solve the equation $2x^2 - x - 7 = 0$ **giving your answers correct to 3 significant figures.**

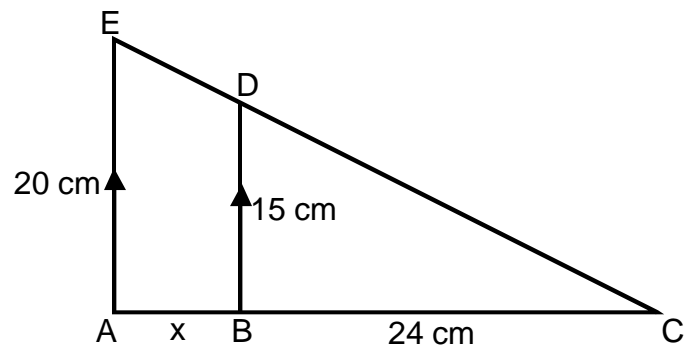
2. Find the annual cost of insuring a house valued at £95500
given an insurance rate of £3.60 per £1000.



Task 51

1. Triangles ACE and BCD are similar.

Calculate, x , the length of AB.



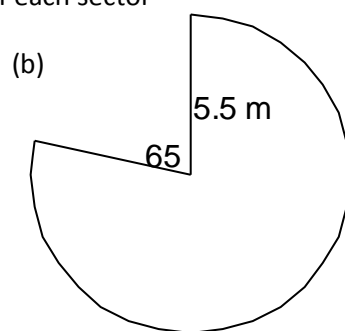
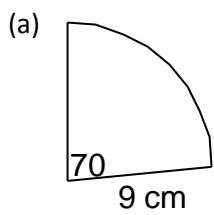
2. A large British company made a profit of $\text{£}3.75 \times 10^9$ in the year 2007.

Calculate the profit the company made per second.

Give your answer in Scientific Notation.

Task 52

1. Calculate the area of each sector



Task 53

1. Simplify

(a) $\frac{2x^2 - 8}{x^2 + x - 6}$

(b) $\frac{4x^2 - 2x}{6x^2 + 5x - 4}$

2. Solve

(a) $5g^2 - 15g = 0$

(b) $x^2 = 7x - 12$

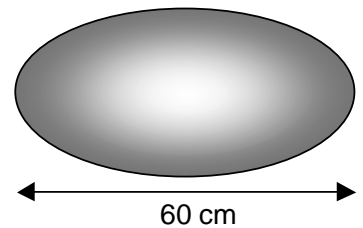
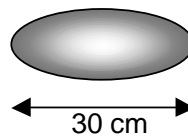
(c) $3x^2 - 5x = 2$

(d) $\frac{x(x - 12)}{4} = -8$

Task 54

The diagram shows two mathematically similar mirrors.

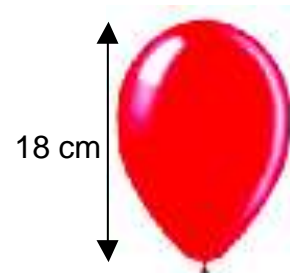
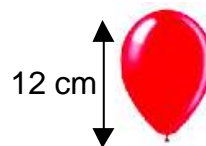
The smaller mirror has area 2600 cm^2 .



Find the area of the larger mirror.

2. The balloons opposite are similar in shape.

The larger balloon has volume 1350 cm^3 .



Find the volume of the smaller balloon.

Task 55

1. $P = \frac{x^2 + xy}{x - y}$. Find P when $x = -4$ and $y = -2$.

2. Simplify

(a) $3(2x - y) - 4(x - y)$

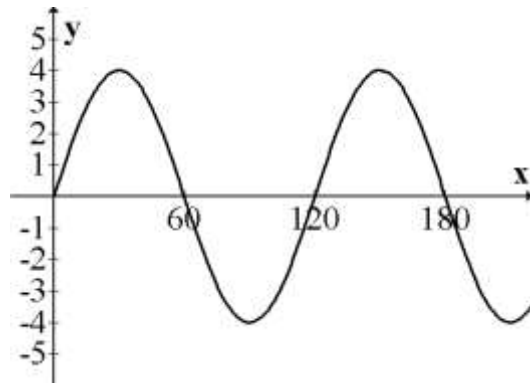
(b) $(3a - 5b)^2$

(c) $(3x - 6)(x^2 + 2x - 1)$

(d) $6x^2 - (2x - 1)(3x - 2)$

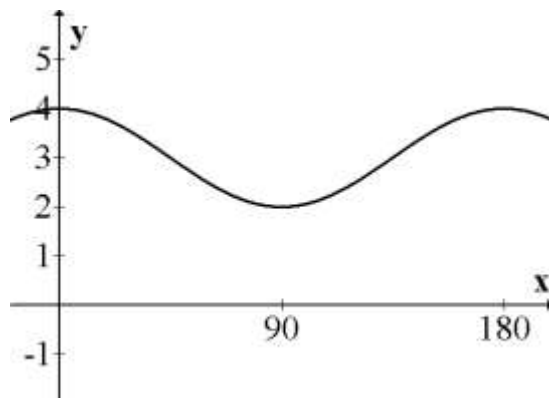
Task 56

1. The diagram below shows the graph of $y = a \sin bx$.



Write down the values of a and b.

2. The diagram shows the graph of $y = \cos bx + c$. Write down the values of b and c.



Task 57

1. Solve

(a) $6 - (x - 3) = 2(2x - 3)$ (b) $\frac{2}{3}x - \frac{1}{2}(3x - 1) > 3$ (c) $\frac{2m - 1}{5} + \frac{m}{2} < 1$

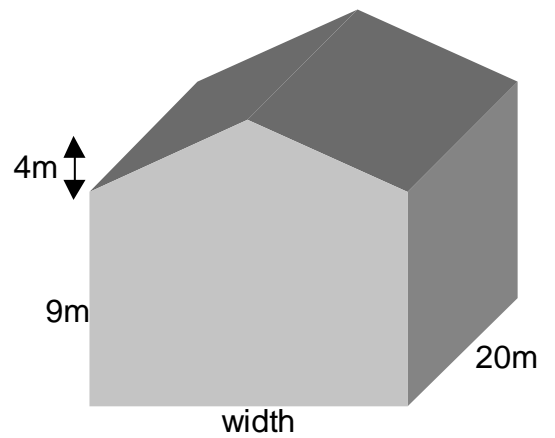
2. Factorise fully

(a) $2xy - 8x$ (b) $3u^2 - 12u$ (c) $2n^2 - 18m^2$ (d) $6p^2 - 7p - 3$

Task 58

1. A factory building has volume 2640 m^3 . The cross-section of the building consists of a rectangle and a triangle.

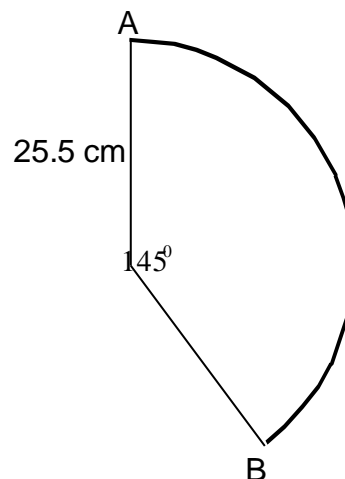
Calculate the width of the building.



2. The diagram shows an arc of a circle AB.

The radius of the circle is 25.5 cm.

Calculate the length of the arc AB.



Task 59

1. Solve the following equations for $0^\circ \leq x^\circ \leq 360^\circ$

(a) $3\sin x^\circ + 1 = 0$

(b) $3\cos 20^\circ + 5\tan x^\circ = 10$

2. In the diagram opposite ABD and BCD
are right-angled triangles.

Calculate the size of angle DCB.

