Show that $\frac{5x}{x+5}+\frac{25}{x-7}-\frac{300}{(x+5)(x-7)}$ simplifies to an integer.

A ball, dropped vertically, falls d metres in t seconds.

d is directly proportional to the square of t.

The ball drops 45 metres in the first 3 seconds.

How far does the ball drop in the **next** 7 seconds?

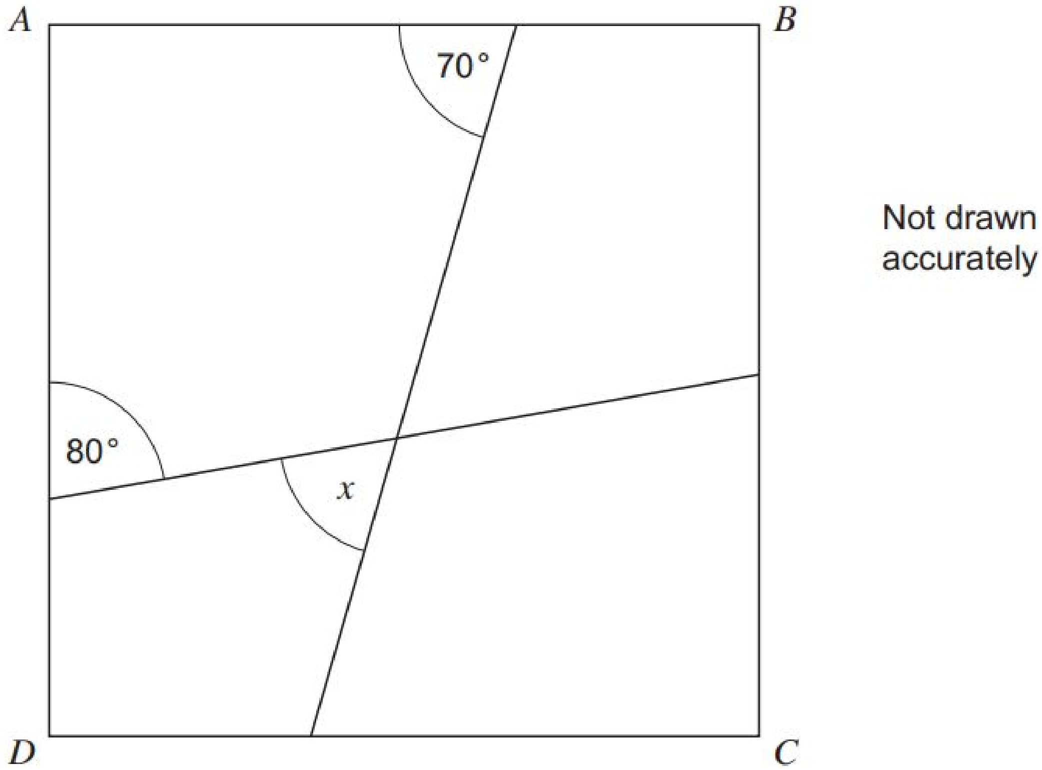
(a) Prove that $(2x+1)(3x+2)+x(3x+5)+2$ is a perfect square.

(b) Gemma says

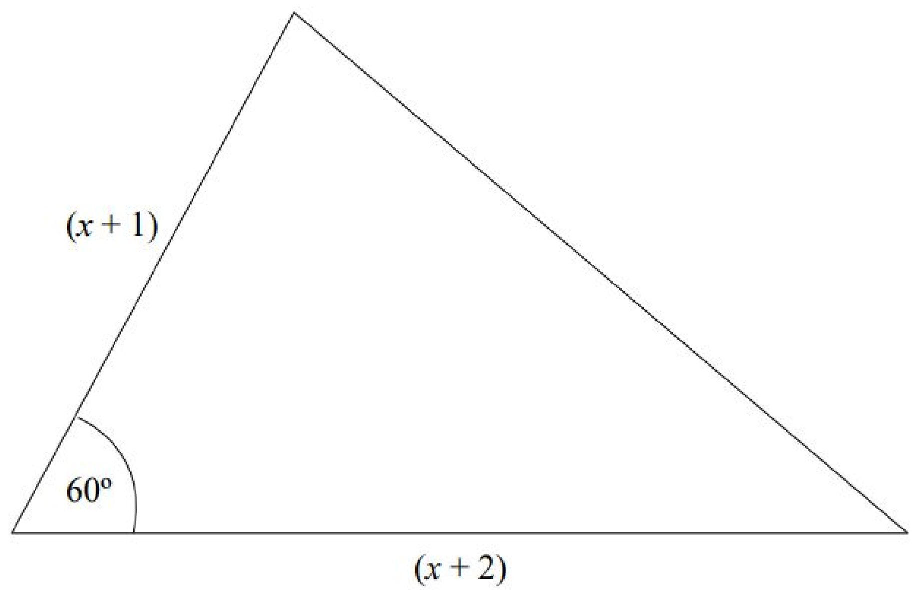
The equation $(2x + 1)(3x + 2) + x(3x + 5) + 2 = {}^{-}12$ has no solutions.

Explain Gemma's reasoning.

ABCD is a square.



Work out the size of angle x.
You **must** show your working, which may be on the diagram.

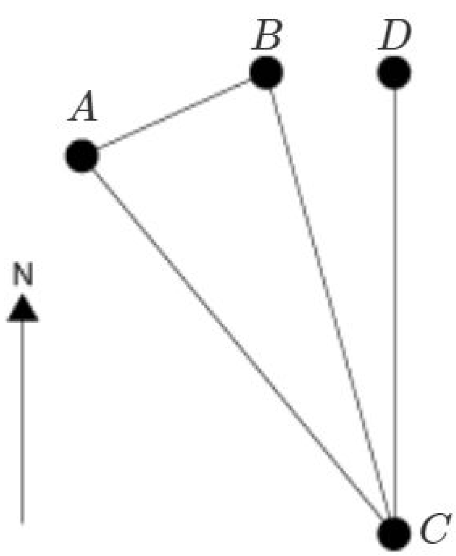


The area of the triangle is 25 cm^2.
Work out the value of x.
Give your answer to 3 significant figures.

$AB = 16cm$, $AC = 13cm$, angle $BCD = 5^\circ$ and angle $ABC = 23^\circ$.

Find the bearing of A from C.

Hint: Use the sine rule.



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The Headteacher of Ysgol Castell Gwyn wants to display pictures, drawn by pupils, along one side of a corridor.
The pictures are to be in one row with no gaps between them, as shown in the diagram below.

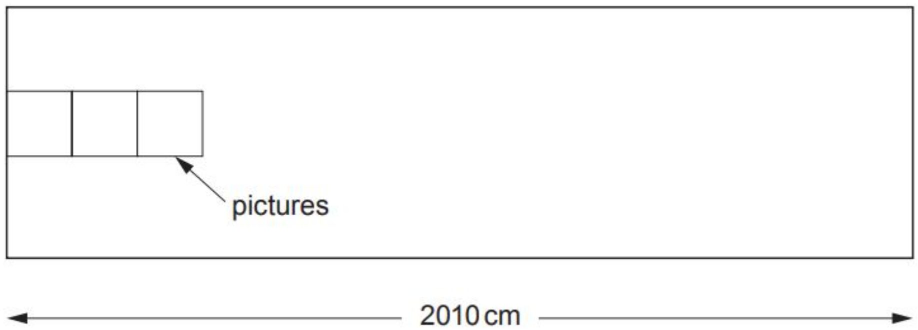
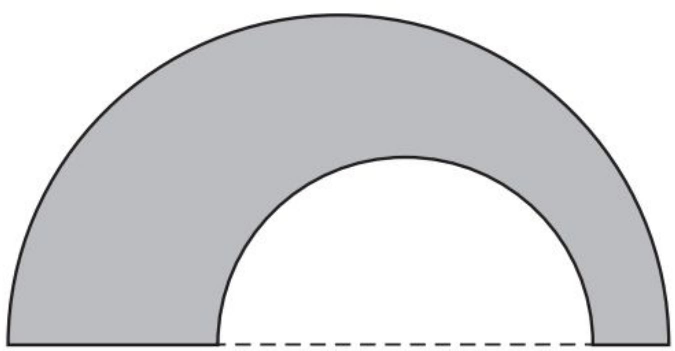


Diagram not drawn to scale

The pictures are all square, with sides of length 15 cm, correct to the **nearest 0·5 cm**.
The length of the corridor wall is 2010 cm, correct to the **nearest 10 cm**.

Calculate the smallest number of pictures and the greatest number of pictures that can be fitted in the row. [5]

The shape below is formed from two semicircles and a straight line.

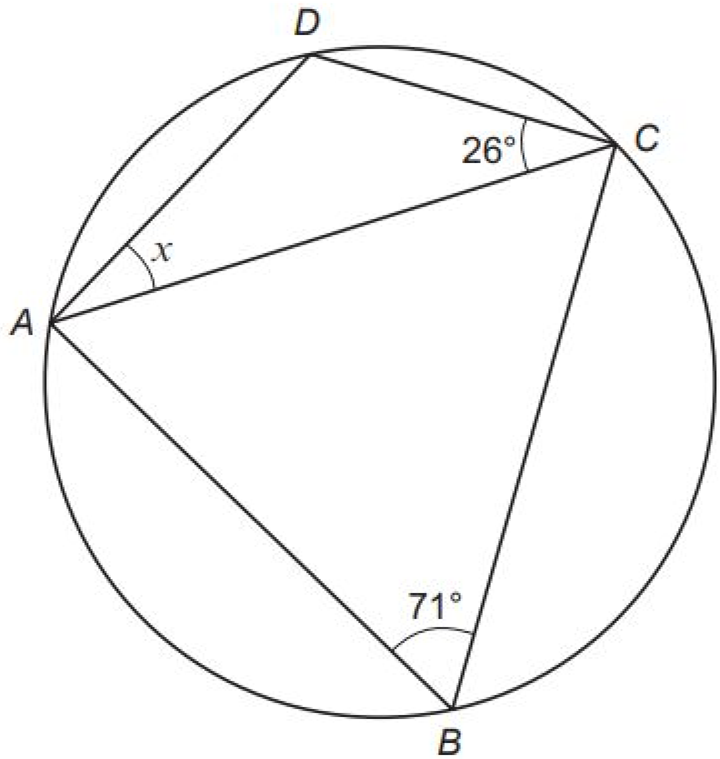


Not to scale

The radius of the large semicircle is 8 cm.
The radius of the small semicircle is t cm.

Find an expression, in terms of t, for the **exact perimeter** of the shaded shape.

Calculate the size of angle x in the diagram below.



A menu has

- 6 starters
- 10 main dishes
- 7 desserts.

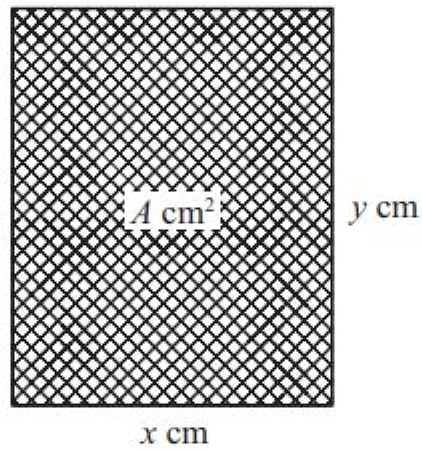
(a) A three-course meal consists of a starter, a main dish and a dessert.

How many different three-course meals are possible?

(b) A two-course meal consists either of a starter with a main dish, a starter with a dessert or a main dish with a dessert.

Show that there are 172 possible different two-course meals. **[3]**

14



The diagram shows a rectangular photo frame of area A cm².
The width of the photo frame is x cm.
The height of the photo frame is y cm.
The perimeter of the photo frame is 72 cm.

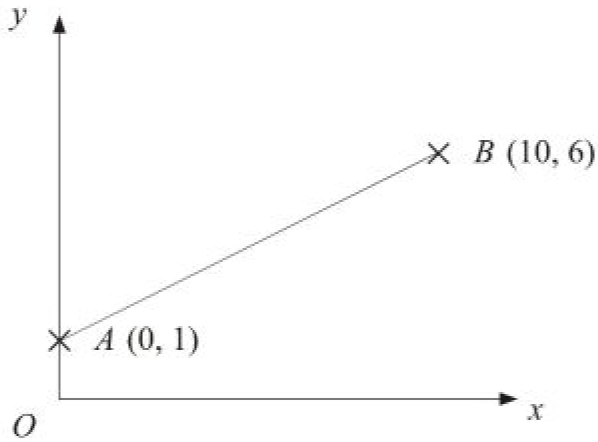
(a) Show that $A = 36x - x^2$

(b) Find $\frac{dA}{dx}$

(c) Find the maximum value of A.

y is directly proportional to the square of *x*.

Find the percentage increase in *y* when *x* is increased by 15%



A is the point (0, 1)
B is the point (10, 6)

The equation of the straight line through A and B is $y = \frac{1}{2}x + 1$

a) Write down the equation of another straight line parallel to $y = \frac{1}{2}x + 1$

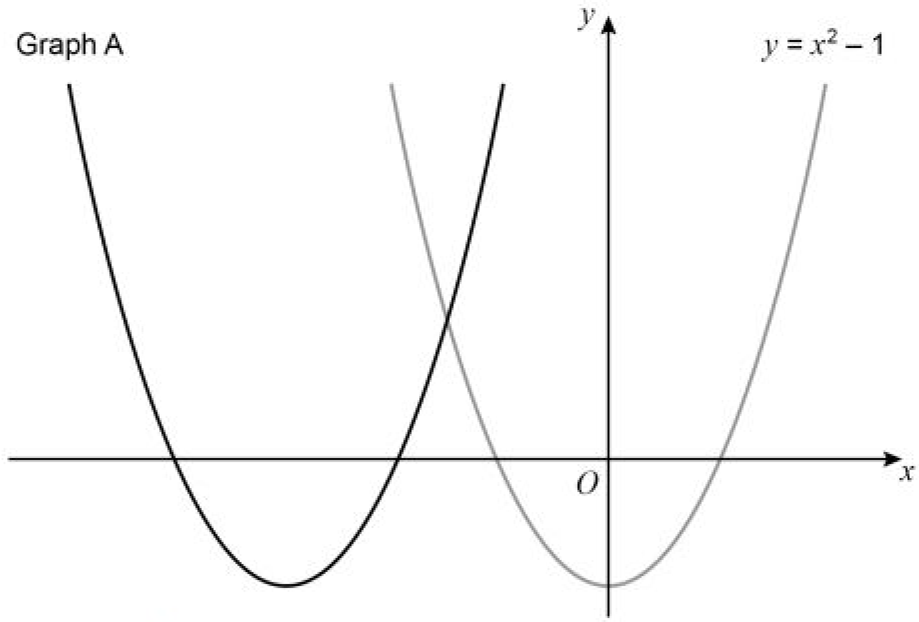
b) Write down the equation of another straight line that passes through the point (0, 1)

c) Find the equation of the line perpendicular to AB passing through B.

You are given that $g(x) = ax + b$.
You are also given that $g(0) = 4$ and that $g(1) = -6$.

Find the value of a and the value of b.

Here are sketches of two graphs.



The graph of $y = x^2 - 1$ is translated 3 units to the left to give graph A.

(a) The equation of graph A can be written in the form $y = x^2 + bx + c$

Work out the values of b and c.

(b) The graph of $y = x^2 - 1$ is reflected in the x-axis to give graph B.

Work out the equation of graph B.

(ii) The lowest common multiple (LCM) of x and 120 is 360.

Find the smallest possible value of x.

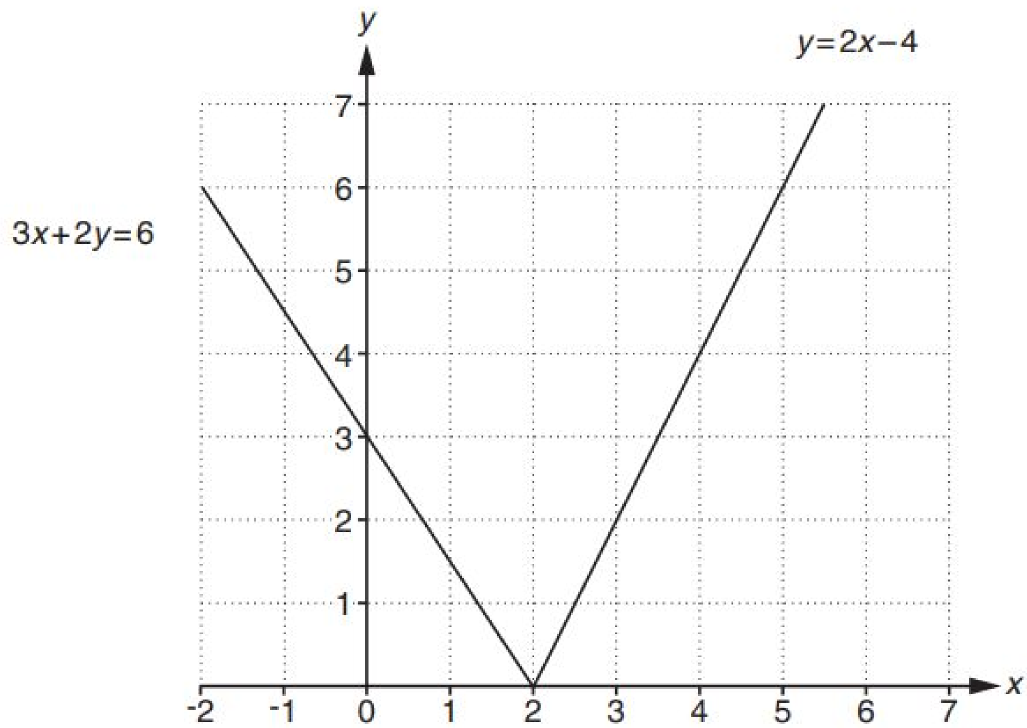
(b) Two numbers, A and B, are written as a product of prime factors.

$$A = 2^4 \times 3^2 \times 7^2 \qquad B = 2^3 \times 3 \times 5 \times 7$$

Find the highest common factor (HCF) of A and B.

4×2^{28} can be written as 2^n.
What is the value of n?

The diagram shows part of the graphs of $y = 2x - 4$ and $3x + 2y = 6$.



(a) On the grid, draw the graph of $y = 3$.

(b) Indicate the area where the following are all true.
Shade the areas **not** required.

$$3x + 2y \geqslant 6$$
$$y \geqslant 2x - 4$$
$$y \geqslant 3$$

Use the formula $x_{n+1} = \dfrac{(x_n)^3}{30} + 2$ with $x_1 = 2$ to calculate x_2 and x_3.
Round your answers correct to 4 decimal places.

Ratna invests £1200 for 2 years in a bank account paying *r* % per year compound interest.
At the end of 2 years, the amount in the bank account is £1379.02.

Calculate *r*.

Zahra mixes 150 g of metal A and 150 g of metal B to make 300 g of an alloy.

Metal A has a density of 19.3 g/cm^3.
Metal B has a density of 8.9 g/cm^3.

Work out the density of the alloy.

At a children's party, the children play a number of games.
The winner of each game chooses a ticket for a prize, at random, from a box.
The ticket is not returned to the box.
At the start of the party, there are 12 prizes available: 1 book, 3 key-rings and 8 pencils.

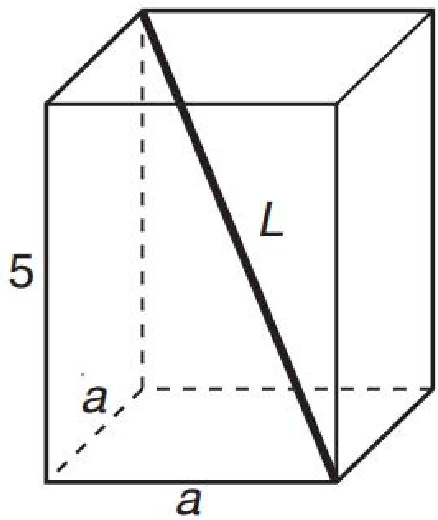
(a) Find the probability that the winners of the first two games choose the same type of prize. [3]

(b) After the winners of the first **three** games have chosen their prizes, find the probability that the ticket for the book is still in the box. [2]

n is a positive integer.

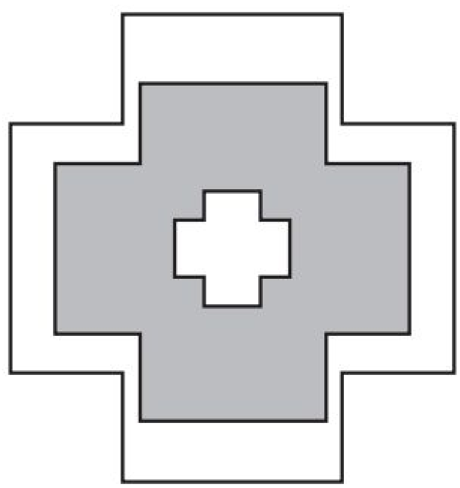
Prove that $13n + 3 + (3n - 5)(2n + 3)$ is a multiple of 6.

A cuboid of height 5 cm has a square base of side a cm.
The longest diagonal of the cuboid is L cm.



Show that $a = \sqrt{\dfrac{L^2 - 25}{2}}$.

The diagram consists of three mathematically similar shapes.
The heights of the shapes are in the ratio 1 : 4 : 5.



Not to scale

Find the ratio

total shaded area : total unshaded area.

Give your answer in its simplest form.

Eirlys works for an accountancy firm.
She receives an annual salary, which is paid in equal instalments.

Eirlys has calculated that, so far this financial year, she has been paid $0{\cdot}41\dot{6}$ of her annual salary.

(a) Express $0{\cdot}41\dot{6}$ as a fraction in its lowest terms. [3]

(b) Use your answer from part *(a)* to find the number of months' pay Eirlys has received. [1]

Here are the first four terms of a quadratic sequence.

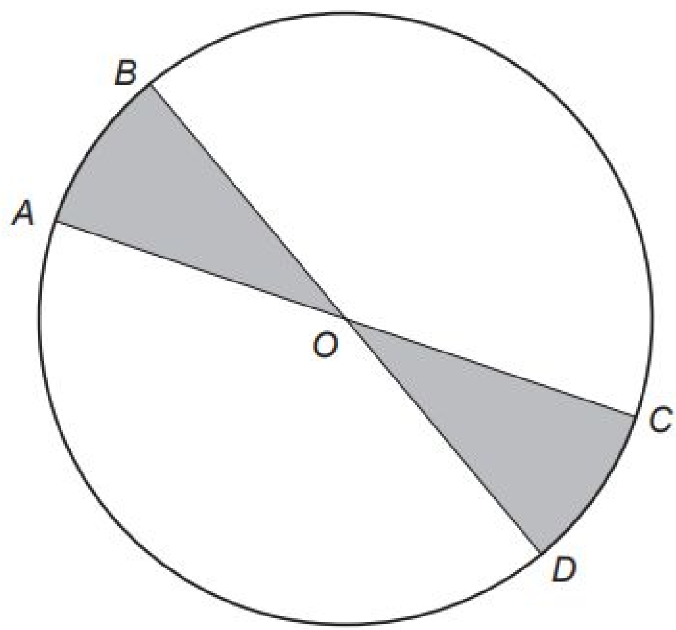
0 9 22 39

The *n*th term can be written as $an^2 + bn + c$.

Find the values of *a*, *b* and *c*.

In the diagram below, *AC* and *BD* are diameters of a circle, centre *O*.

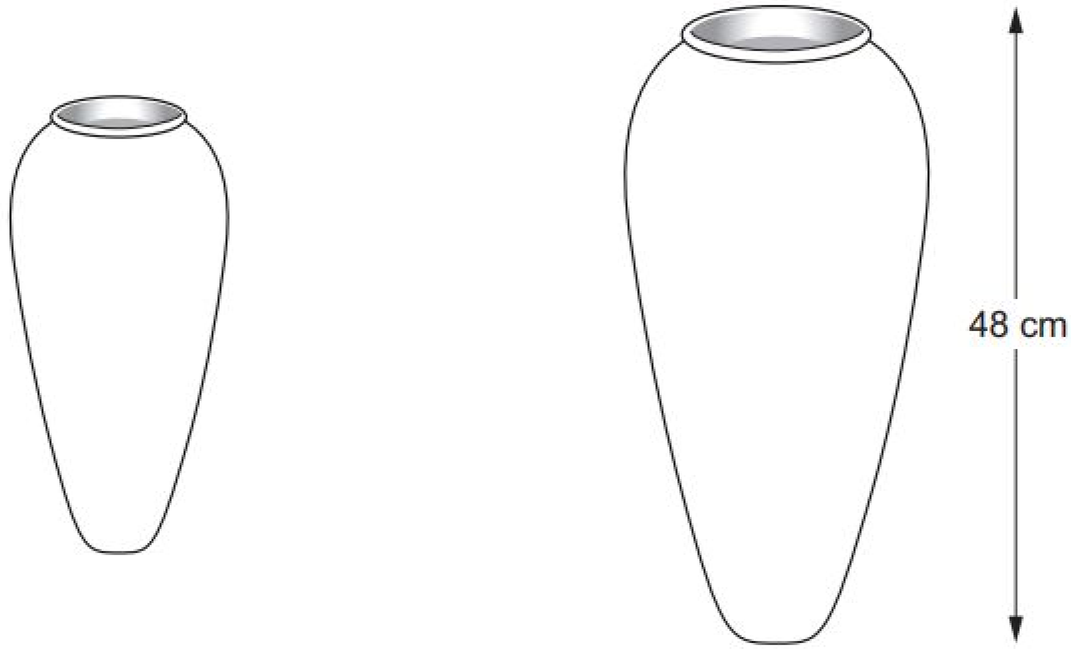
$AO = 30\,\text{cm}$ and $A\hat{O}B = 20°$.



A second circle has an area which equals the total shaded area above.

Calculate the radius of the second circle.

Ffiol-Aur is a company that makes vases.
They make one of their vases in two mathematically similar sizes.



A decorative glaze covers the surfaces of each vase.
The glaze covers an area of:

- $400\,cm^2$ on the smaller vase,
- $3600\,cm^2$ on the larger vase.

The height of the larger vase is 48 cm.
Calculate the height of the smaller vase.

A rectangle of length 12 cm and width $(2x - y)$ cm has an area of 72 cm^2.

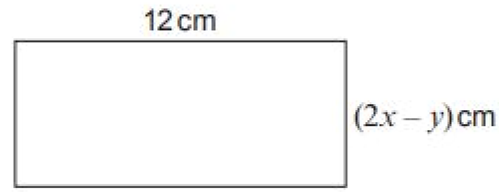


Diagram not drawn to scale

KLMN is a kite where *KL* = $3x$ cm and *LM* = y cm.

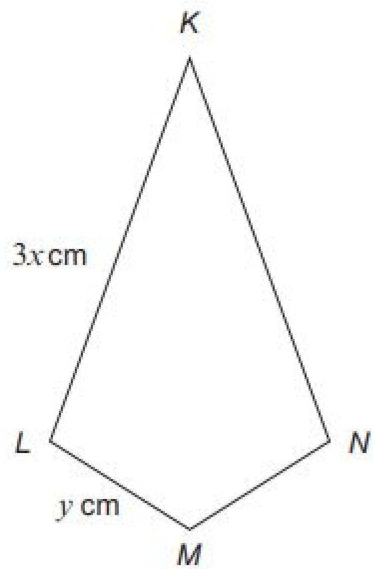


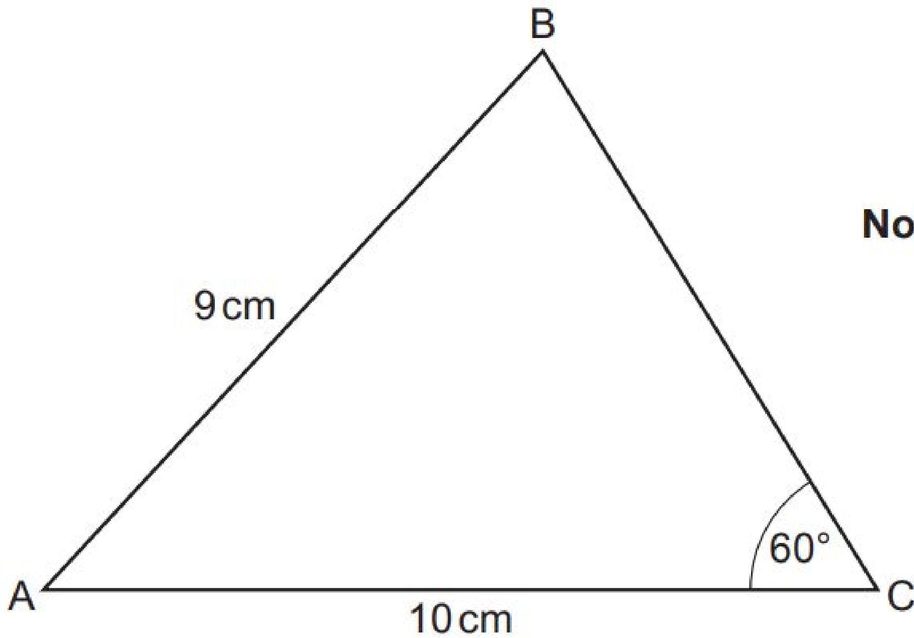
Diagram not drawn to scale

The perimeter of the kite *KLMN* = 33 cm.

Calculate the values of x and y.

In this triangle:

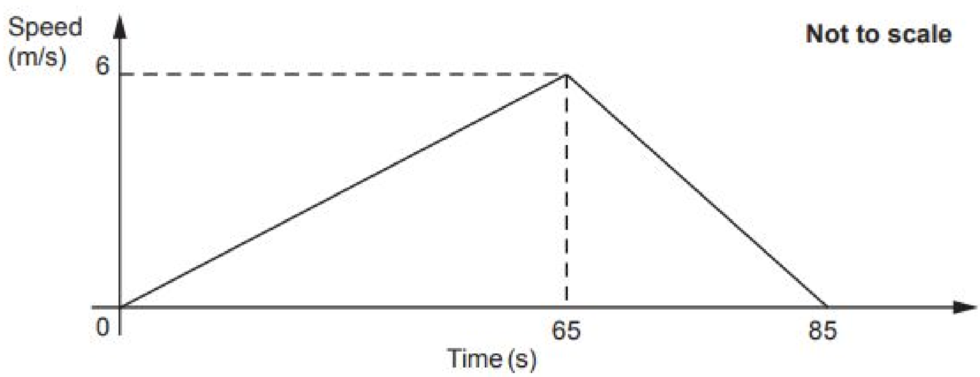
- AB = 9 cm
- AC = 10 cm
- BC > 5 cm
- angle BCA = 60°
- angle ABC < 90°.



Not

Calculate the area of triangle ABC.

The graph shows the speed of a tram as it travels from the library to the town hall.



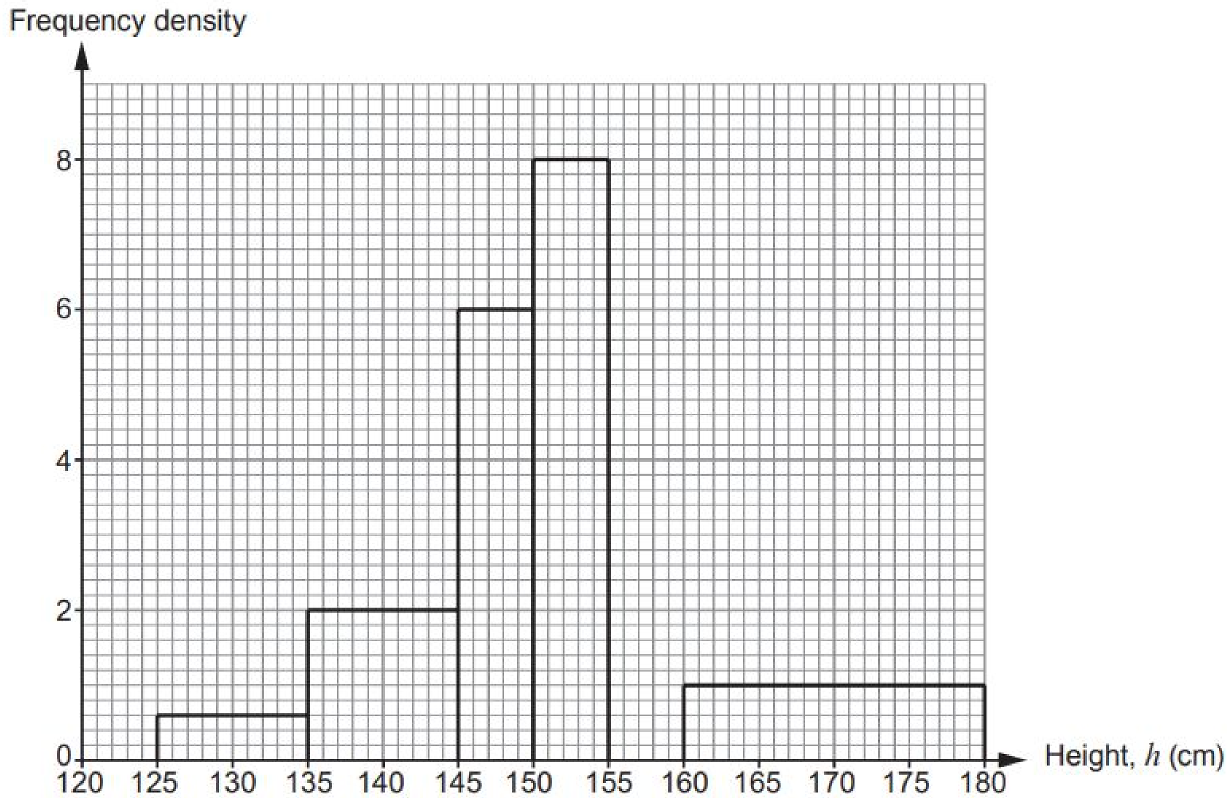
Not to scale

(a) Calculate the deceleration of the tram as it approaches the town hall.

(b) Calculate the distance travelled by the tram between the library and the town hall.

(c) What was the maximum speed of the tram as it travelled between the library and the town hall?
Give your answer in **kilometres per hour**.

13. The heights of all the Year 11 girls at a school were measured.
Nia has started to draw a histogram of the results.



(a) There were 24 girls in Year 11 whose heights were in the group $155 < h \leqslant 160$ cm.
Use this information to complete Nia's histogram.

In the following equation, *n* is an integer greater than 1.

$$\left(\sqrt{2}\right)^n = k\sqrt{2}$$

(a) **(i)** Find *k* when $n = 7$.

(ii) Find *n* when $k = 64$.

(b) Show that $\dfrac{14}{3-\sqrt{2}}$ can be written in the form $a + b\sqrt{2}$.

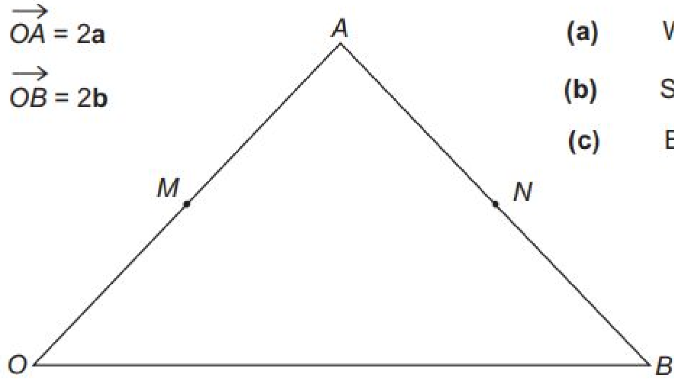
In triangle *OAB*

M is the midpoint of *OA*.

N is the midpoint of *AB*.

$\overrightarrow{OA} = 2\mathbf{a}$

$\overrightarrow{OB} = 2\mathbf{b}$



(a) Write down *AB* in terms of **a** and **b**.

(b) Show that $\overrightarrow{MN} = \mathbf{b}$

(c) Explain why triangles *AMN* and *AOB* are similar.

A group of musicians is surveyed about the instruments they can play.

Each of these musicains can play guira, piano and drums, or a combination of the three.

38 can play guitar.

31 can play drums.

33 can play piano.

19 can **only** play guitar.

7 can play all three instruments.

13 can play piano and drums.

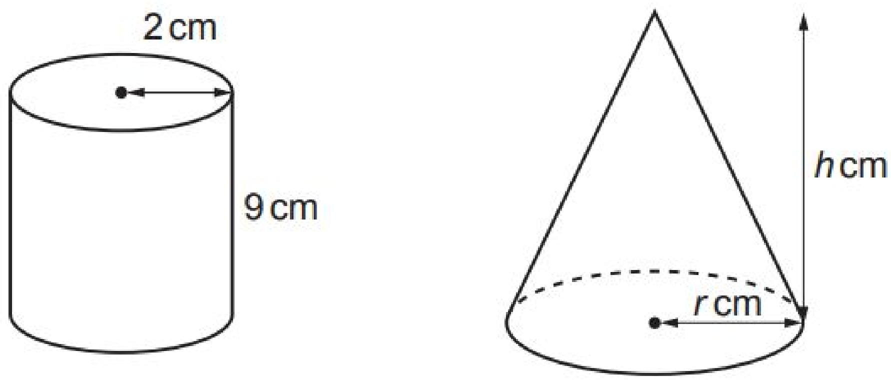
12 can play guitar and piano.

Using a Venn Diagram:

(a) Find the number of musicians who can play guitar and drums.

(b) Find the total number of musicians.

The diagram shows a cylinder and a cone.



The cylinder has radius 2 cm and height 9 cm.
The cone has radius r cm and height h cm.

The ratio $r : h$ is 1 : 4.
The volume of the cone is **equal to** the volume of the cylinder.

Work out the value of $\boldsymbol{r}$.

[The volume V of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]