Clelland Maths

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ADDING & SUBTRACTING FRACTIONS

Evaluate $3\frac{2}{3} - 1\frac{1}{4}$. 2

Evaluate

$$\frac{2}{3}\left(\frac{1}{5} + \frac{3}{4}\right).$$

Give your answer in its simplest form. 2

MULTIPLYING & DIVIDING FRACTIONS

Evaluate $2\frac{4}{5} \times \frac{2}{7}$.

Give your answer in its simplest form. 2

Evaluate $2\frac{1}{6} \div \frac{8}{9}$.

Give your answer in its simplest form. 2

APPRECIATION

The number of visitors to a zoo in 2024 was 118 750.

The number of visitors is expected to increase by 4% each year over the next two years.

Calculate the expected number of visitors in 2026. 3

A caravan was bought for £20,000.

It depreciated by 11% in the first year.

It then depreciated by a further 6% each year over the next two years.

Calculate the value of the caravan three years after it was bought. 3

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REVERSE PERCENTAGES

This year the cost of Charley's car insurance is £278.40.

This is an increase of 16% on last year's cost.

Calculate the cost of Charley's insurance last year. 3

In a sale, the price of a wedding dress is reduced by 20%.

The sale price of the dress is £720.

Calculate the price of the dress before the sale. 3

SCIENTIFIC NOTATION

The mass of one atom of gold is 3.27×10^{-22} grams.

The mass of one atom of carbon is 6.1% of the mass of an atom of gold.

Calculate the mass of one atom of carbon.

Give your answer in scientific notation. 2

An ant colony occupies an area of 250 hectares.

There is an average of 1.22×10^{6} ants per hectare.

Calculate the number of ants in the colony.

Give your answer in scientific notation. 2

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SIMPLIFYING SURDS

Simplify $\sqrt{75}-\sqrt{3}$. 2

Expand and simplify $\sqrt{10}\left(\sqrt{10}-\sqrt{2}\right)+8\sqrt{5}$. 3

SURDS - RATIONALISE DENOMINATOR

Express $\frac{6}{\sqrt{10}}$ with a rational denominator.

Give your answer in its simplest form. 2

Express $\frac{\sqrt{2}}{\sqrt{40}}$ as a fraction with a rational denominator.

Give your answer in its simplest form. 3

LAWS OF INDICES

Expand and simplify fully $x\left(x^{\frac{1}{2}}+x^{-1}\right)$. 2

Simplify $\frac{5c^{-2}}{c^3\times c^4}$.

Give your answer with a **positive** power. 3

INDICES - FRACTIONAL

Simplify $\frac{a^4\times 3a}{\sqrt{a}}$. 3

Evaluate $8^{\frac{5}{3}}$. 2

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EXPANDING BRACKETS

Expand and simplify $(x+3)(x+5)+4(x-2)$. 3

Expand and simplify $(x+1)(x^2-4x+5)$. 3

ALGEBRAIC FRACTIONS - SIMPLIFYING

(a) Factorise y^2-6y. 1

(b) Hence simplify $\dfrac{y^2-6y}{y^2-3y-18}$. 2

(a) Factorise $4x^2-25$. 1

(b) Hence simplify $\dfrac{4x^2-25}{2x^2-x-10}$. 3

ALGEBRAIC FRACTIONS - ADD SUBTRACT

Express

$$\frac{2}{x+5}+\frac{3}{x-4}, \quad x \neq -5, x \neq 4$$

as a single fraction in its simplest form. 3

Express

$$\frac{5}{x-1}-\frac{4}{x}, \quad x \neq 1, \ x \neq 0$$

as a single fraction in its simplest form. 3

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ALGEBRAIC FRACTIONS - MULTIPLAY AND DIVIDE

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Express $\frac{4}{x+2} \div \frac{5}{(x+2)^2}$, $x \neq -2$ as a single fraction in its simplest form. 2

Express

$$\frac{n}{n^2-4} \div \frac{3}{n-2}, \quad n \neq -2, n \neq 2$$

as a single fraction in its simplest form. 3

FUNCTIONS

A function is defined as $f(x) = 3x + 7$.

(a) Evaluate $f(6)$. 1

(b) Given that $f(p) = 19$, find the value of p. 2

Given that $f(x) = (x+3)^2$, evaluate $f(7)$. 2

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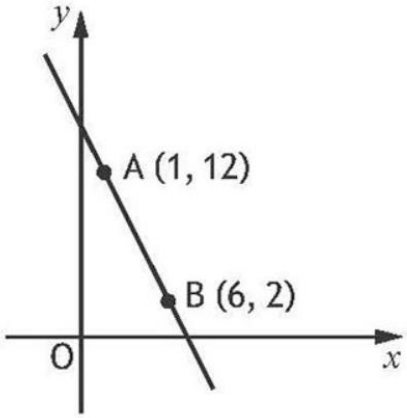
STRAIGHT LINE

The diagram shows the straight line passing through points A and B.



Find the equation of the line AB.

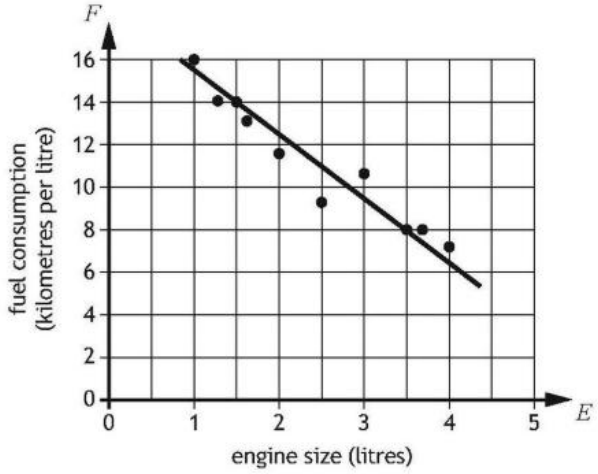
Give the equation in its simplest form. 3

Find the equation of the line passing through the points (–3,–1) and (–5,7).

Give the equation in its simplest form. 3

The fuel consumption of a group of cars is recorded.

The scattergraph shows the relationship between the fuel consumption, F kilometres per litre, and the engine size, E litres, of the cars.



A line of best fit has been drawn.

(a) Find the equation of the line of best fit in terms of F and E.
Give the equation in its simplest form. 3

STRAIGHT LINE

A straight line has equation $x+4y-24=0$.

Find the gradient of this line. 2

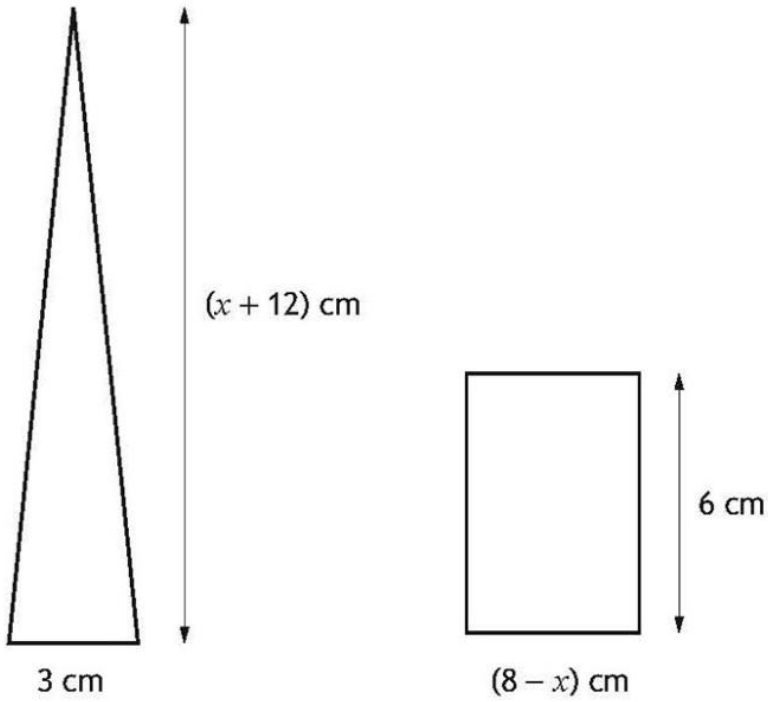
14. A straight line has equation $2x-5y=20$.

Find the coordinates of the point where this line crosses the y-axis. 2

LINEAR EQUATIONS

Solve the equation $\frac{5x+1}{2}=\frac{4x}{3}+1$. 3

A triangle and rectangle are shown in the diagram.



(a) Find an expression for the area of the triangle. 1

(b) Given that the area of the triangle is equal to the area of the rectangle, find algebraically the value of x. 4

LINEAR INEQUATIONS

Solve, algebraically, the inequation

$$5(x-2)+4<7x+8.$$

Solve, algebraically, the inequation $\frac{x+1}{3}-2>\frac{3x}{5}$. 3

SIMULTANEOUS EQUATIONS

On Bob's lorry there are 7 stacks of paving slabs and 3 stacks of edging blocks.

The total weight of these stacks is 2400 kilograms.

Let p be the weight of a stack of paving slabs and e be the weight of a stack of edging blocks.

(a) Write down an equation in p and e to illustrate this information. 1

Imran has 3 stacks of paving slabs and 4 stacks of edging blocks on his lorry.

The total weight of these stacks is 1300 kilograms.

(b) Write down an equation in p and e to illustrate this information. 1

Beth has 6 stacks of paving slabs and 5 stacks of edging blocks on her lorry.

(c) Calculate the **total weight** of the stacks of paving slabs and edging blocks on Beth's lorry. 4

SIMULTANEOUS EQUATIONS

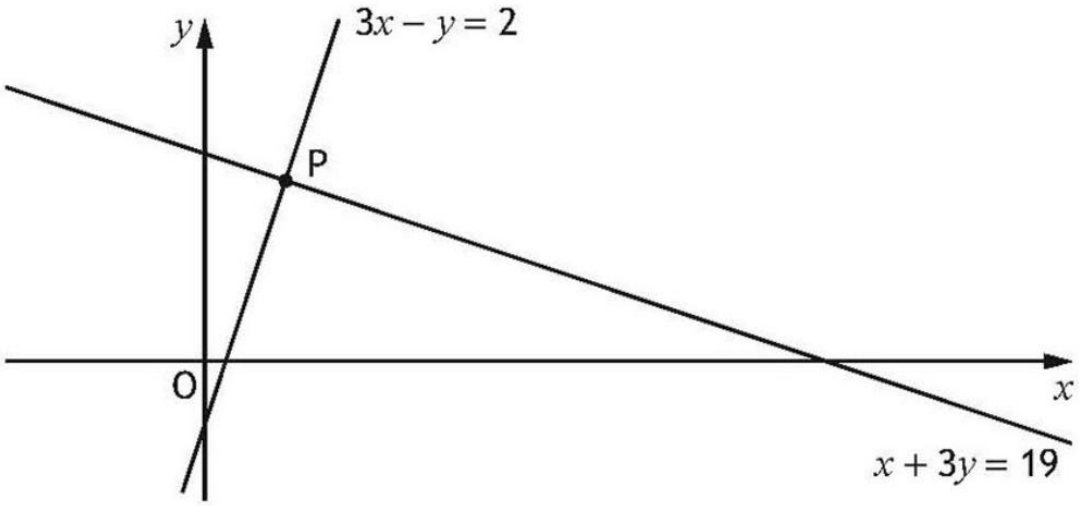
Solve, algebraically, the system of equations

$$2p - 7r = 11$$
$$3p + 2r = 4$$

3

The graph below shows two straight lines with the equations:

- $3x - y = 2$
- $x + 3y = 19$



The lines intersect at the point P.

Find, **algebraically**, the coordinates of P. 3

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CHANGING THE SUBJECT

Change the subject of the formula $B = \frac{1}{4}kc^2 - 3c$ to k. 3

Change the subject of the formula $L = \sqrt{4kt - p}$ to k. 3

Change the subject of the formula $y = g\sqrt{x} + h$ to x. 3

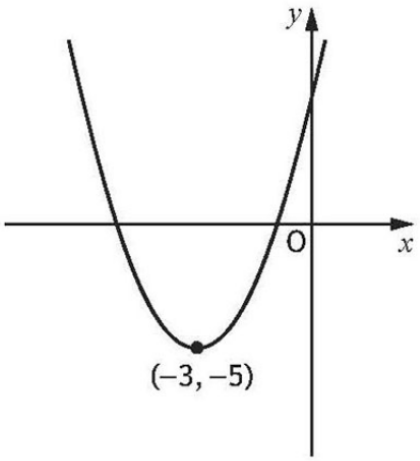
COMPLETING THE SQUARE

Express $x^2 + 10x + 19$ in the form $(x + a)^2 + b$. 2

Express $x^2 + 10x - 15$ in the form $(x + p)^2 + q$. 2

QUADRATIC GRAPHS - COMPLETING THE SQUARE

The diagram shows a parabola with equation of the form $y = (x + a)^2 + b$.



(a) State the value of a. 1

(b) State the value of b. 1

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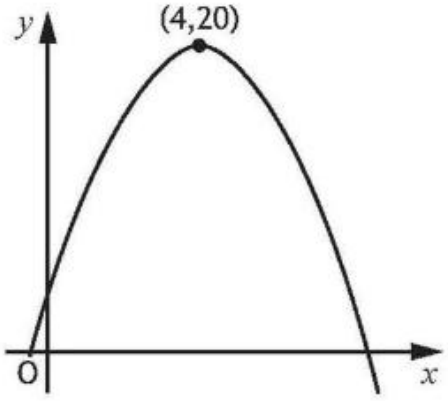
QUADRATIC GRAPHS - COMPLETING THE SQUARE

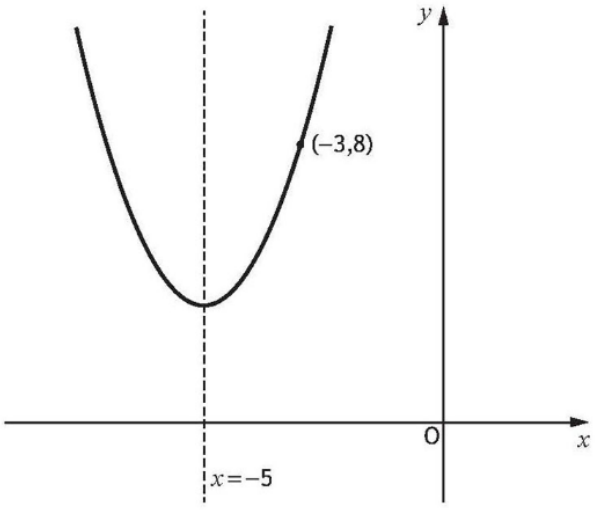
The graph shows a parabola.



The maximum turning point has coordinates (4,20) as shown in the diagram.

(a) Write down the equation of the axis of symmetry of the graph. 1

The graph below shows a parabola with equation of the form $y=(x+a)^2+b$.



The equation of the axis of symmetry of the parabola is $x=-5$.

(a) State the value of a. 1

The point (−3,8) lies on the parabola.

(b) Calculate the value of b. 2

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QUADRATIC GRAPHS - COMPLETING THE SQUARE

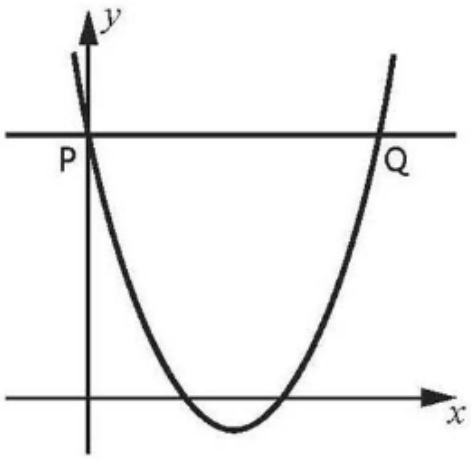
(a) Express x^2-6x+8 in the form $(x-a)^2+b$. 2

(b) Hence, or otherwise, state the coordinates of the turning point of the graph of $y=x^2-6x+8$. 1

The diagram shows the graph of $y=x^2-6x+8$.

A line PQ has been drawn parallel to the x-axis, where:

- P lies on the y-axis
- P and Q lie on the graph of $y=x^2-6x+8$.



(c) Find the coordinates of Q. 2

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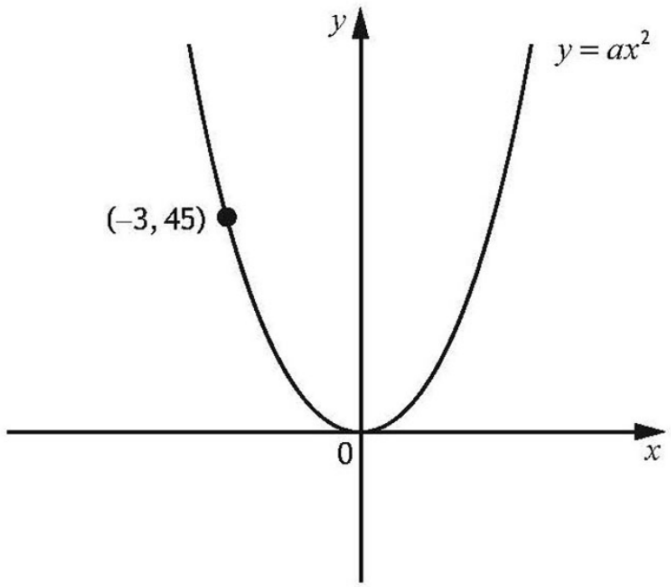
QUADRATIC GRAPHS - COMPLETING THE SQUARE

(a) Express $x^2+8x+15$ in the form $(x+a)^2+b$. 2

(b) Hence, or otherwise, state the coordinates of the turning point of the graph of $f(x)=x^2+8x+15$. 1

QUADRATIC GRAPHS - $y = ax^2$

The diagram below shows part of the graph of $y=ax^2$.



Find the value of a. 2

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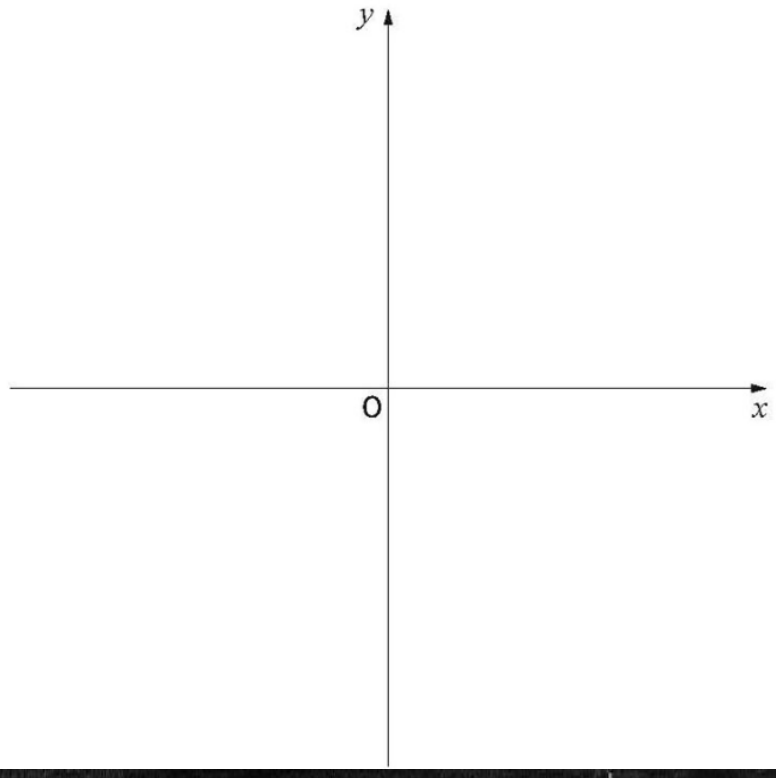
SKETCHING QUADRATIC GRAPHS

Sketch the graph of $y = (x+1)(x-3)$ using the axes provided below.

On your sketch, show clearly the points of intersection with the x-axis and the y-axis, and the coordinates of the turning point. 3



Sketch the graph of $y = (x-3)^2 + 1$.

On your sketch, show clearly the coordinates of the turning point and the point of intersection with the y–axis. 3

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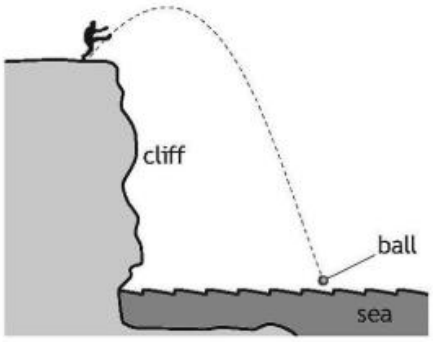
QUADRATICS – SOLVING BY FACTORISING

Solve

$$x^2 - 11x + 24 = 0.$$ 2

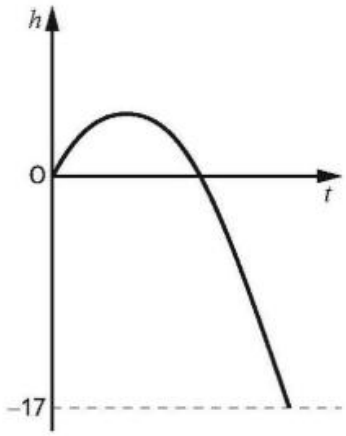
A ball is kicked from a clifftop.



The height, h metres, of the ball relative to the clifftop after t seconds is given by $h = 12t - 5t^2$.

(a) Calculate the height of the ball above the clifftop after 2 seconds. 1

The graph below represents the height, h metres, of the ball relative to the clifftop after t seconds.



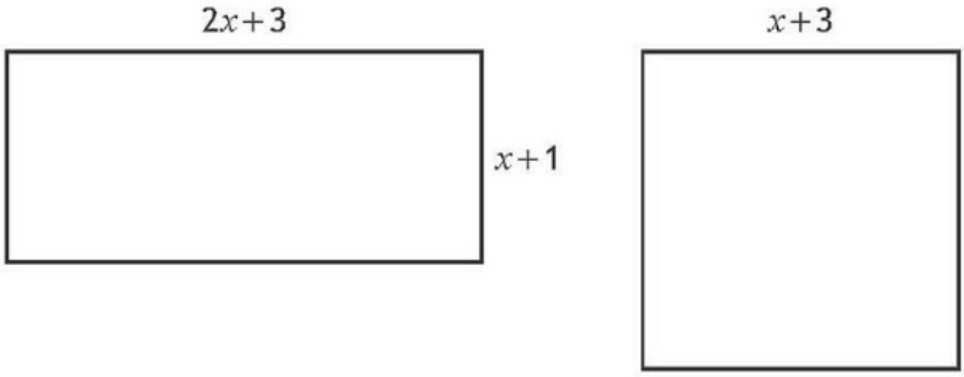
The sea is 17 metres below the clifftop.

(b) After how many seconds will the ball hit the sea? 4

QUADRATICS – SOLVING BY FACTORISING

The diagrams of a rectangle and square are shown below.

All measurements are in centimetres.



(a) Find an expression for the area of the **rectangle**. 1

(b) Given that the area of the rectangle is equal to the area of the square, show that $x^2 - x - 6 = 0$. 2

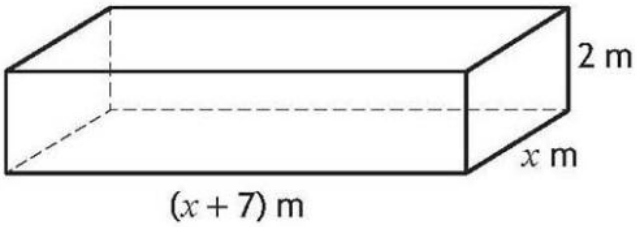
(c) Hence find, algebraically, the length and breadth of the rectangle. 3

QUADRATICS - QUADRATIC FORMULA

Solve the equation $3x^2 + 8x + 1 = 0$.

Give your answers correct to 2 decimal places. 3

A storage unit, built in the shape of a cuboid, is shown.



It has length $(x+7)$ metres, breadth x metres and height 2 metres.

The volume of this unit is 45 cubic metres.

(a) Show that $2x^2 + 14x - 45 = 0$. 2

(b) Calculate x, the breadth of the storage unit.

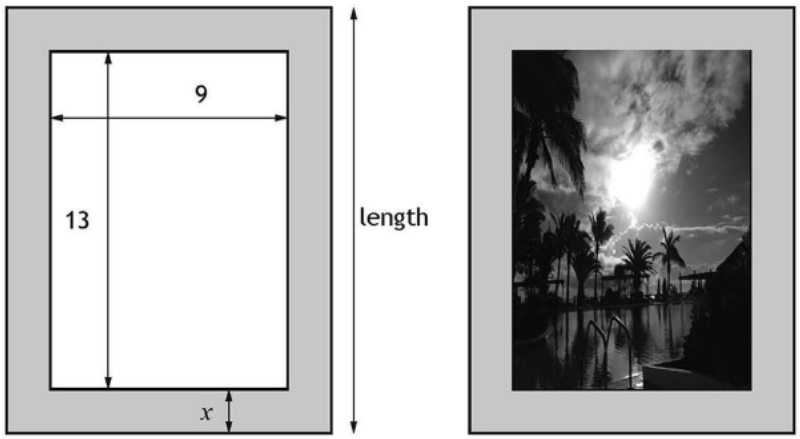
Give your answer correct to 1 decimal place. 4

QUADRATICS - QUADRATIC FORMULA

A rectangular picture measuring 9 centimetres by 13 centimetres is placed on a rectangular piece of card.

The area of the card is 270 square centimetres.

There is a border x centimetres wide on all sides of the picture.



(a) (i) Write down an expression for the length of the card in terms of x. 1

(ii) Hence show that $4x^2 + 44x - 153 = 0$. 2

(b) Calculate x, the width of the border.
Give your answer correct to one decimal place. 4

QUADRATICS - NATURE OF THE ROOTS

Determine the nature of the roots of the function $f(x) = 3x^2 + 2x + 1$. 2

Determine the nature of the roots of the function $f(x) = 4x^2 + 6x - 1$. 2

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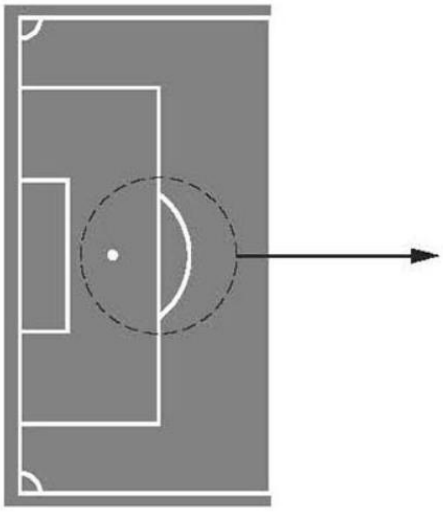
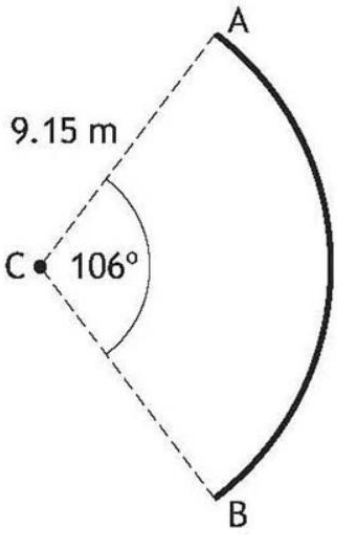
ARC LENGTH

The diagram shows part of a football pitch.





The penalty spot is marked at point C.

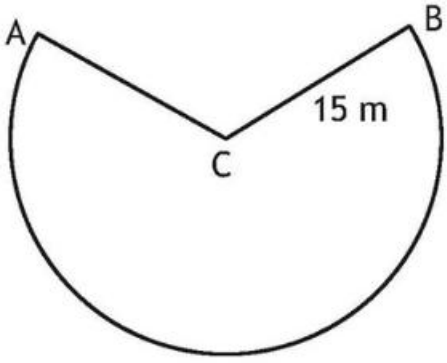
AB is an arc of a circle, centre C, radius 9.15 metres.

Calculate the length of the arc AB. 3

ARC LENGTH

An attraction at a theme park has a carriage attached to an arm.

The arm swings from A to B along the arc of a circle, centre C, as shown in the diagram below.



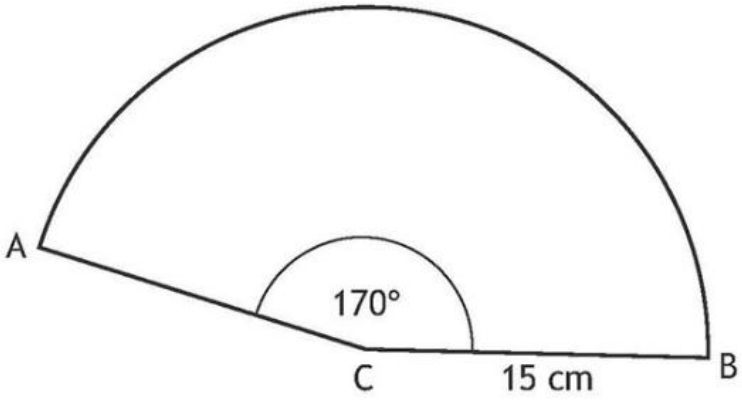
- The length of the arm, CB, is 15 metres.
- The length of the major arc, AB, is 69.4 metres.

Calculate the size of the reflex angle ACB. 3

AREA OF A SECTOR

A party hat is made in the shape of a cone, as shown.

The piece of card used for making the hat is a sector of a circle, centre C.



The radius of the circle is 15 centimetres and angle ACB is 170°.

Calculate the area of the sector. 3

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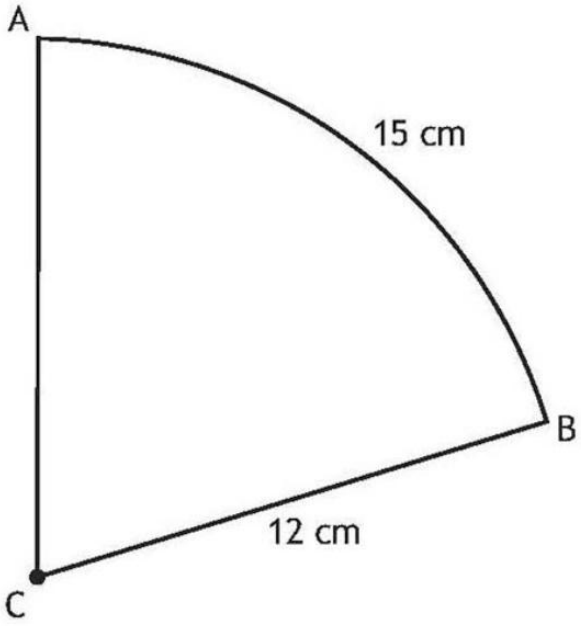
AREA OF A SECTOR

The diagram shows a sector of a circle, centre C.



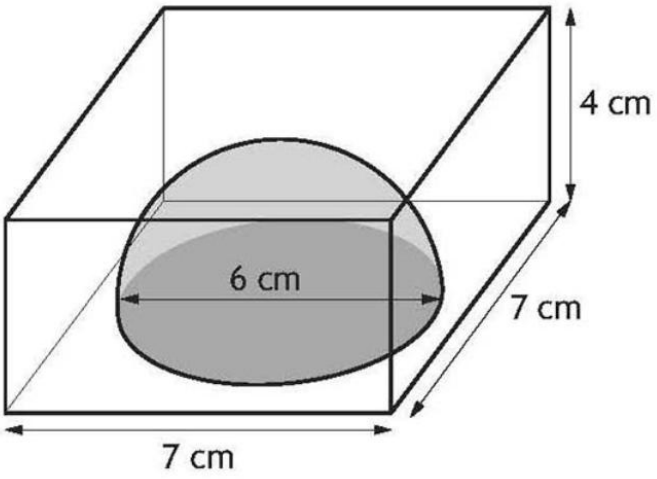
The radius of the circle is 12 centimetres.

The length of arc AB is 15 centimetres.

Calculate the area of the sector. 3

A paperweight is in the shape of a cuboid.

It consists of a hemisphere of red glass surrounded by clear glass.



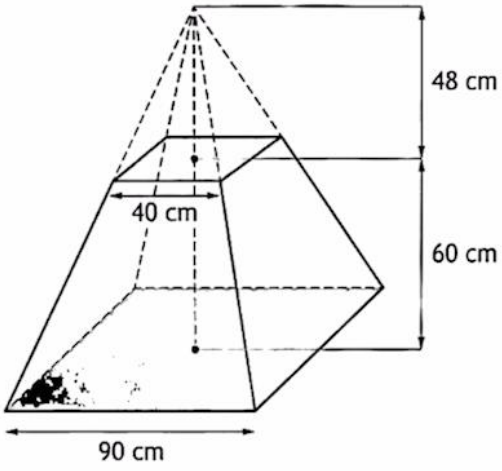
The cuboid has height 4 centimetres and a square base of length 7 centimetres.

The hemisphere has diameter 6 centimetres.

Calculate the volume of clear glass in the paperweight.

Give your answer correct to 2 significant figures. 4

9. A concrete block is in the shape of a large pyramid with a small pyramid removed.



The large pyramid has a square base of length 90 centimetres.

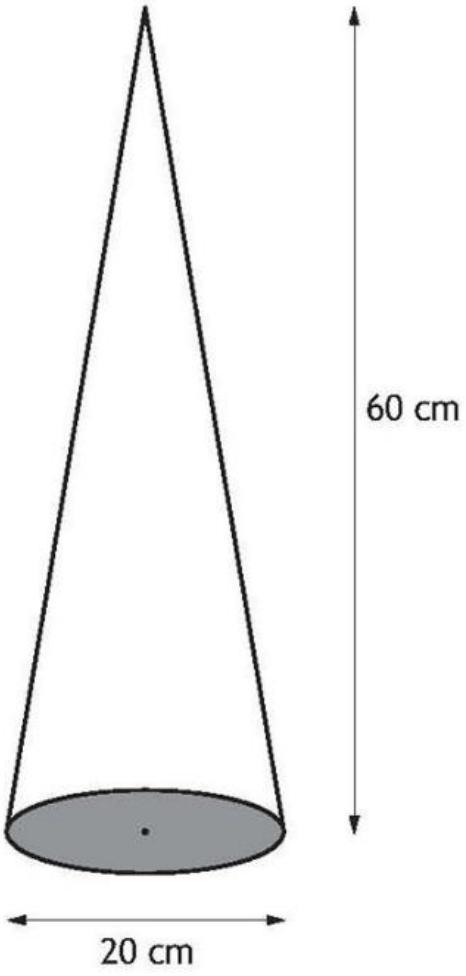
The small pyramid has a square base of length 40 centimetres and a height of 48 centimetres.

The block has height 60 centimetres.

Calculate the volume of the block. 4

VOLUME

The diagram below shows a cone with diameter 20 centimetres and height 60 centimetres.



Calculate the volume of the cone. 2

Take $\pi = 3.14$.

VOLUME

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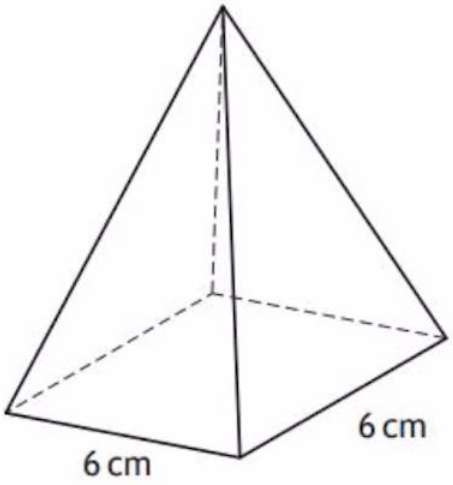
17. A square based pyramid is shown in the diagram below.



The square base has length 6 centimetres.

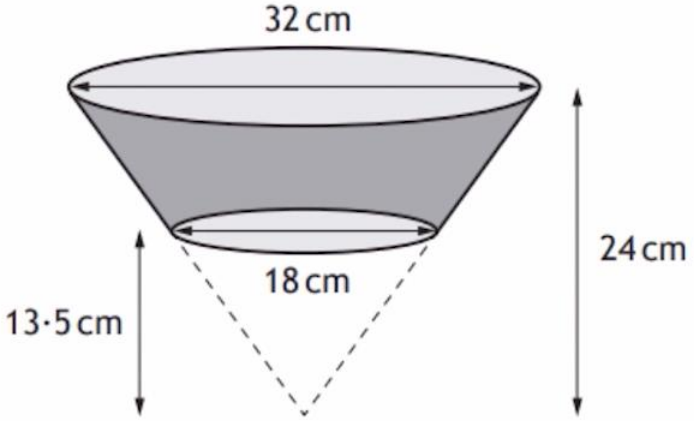
The volume is 138 cubic centimetres.

Calculate the height of the pyramid.

7. A carton is in the shape of a large cone with a small cone removed.

The large cone has diameter of 32 cm and height 24 cm.

The small cone has diameter of 18 cm and height 13·5 cm.

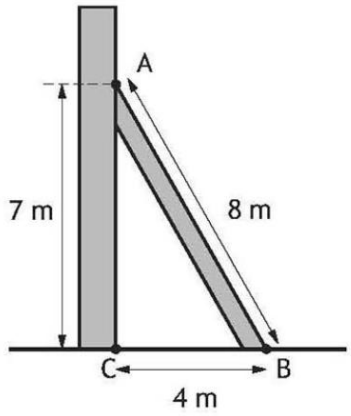


Calculate the volume of the carton.

Give your answer correct to 2 significant figures. 5

CONVERSE OF PYTHAGORAS

A wooden beam is used to support a wall built on horizontal ground as shown in the diagram.



The edge of the beam, AB, is 8 metres long.

C is at the foot of the wall.

A is 7 metres from C.

B is 4 metres from C.

Determine whether the wall is perpendicular to the ground.

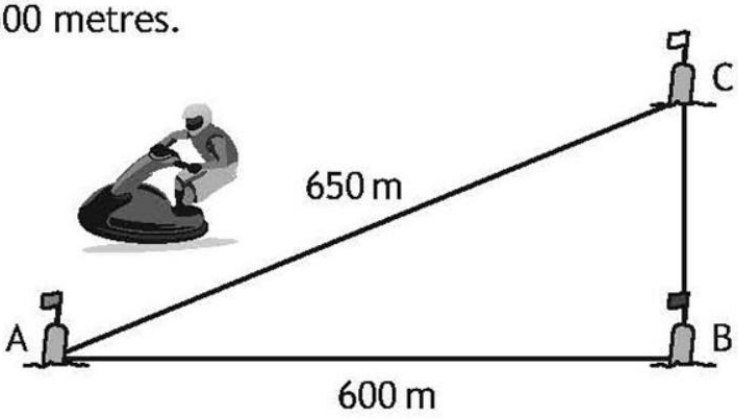
Justify your answer. 4

The diagram shows the course for a jet-ski race.

The course is indicated by markers A, B and C.

The total length of the course is 1500 metres.

- B is 600 metres from A
- C is 650 metres from A
- C is due north of B



Determine whether B is due east of A.

Justify your answer. 4

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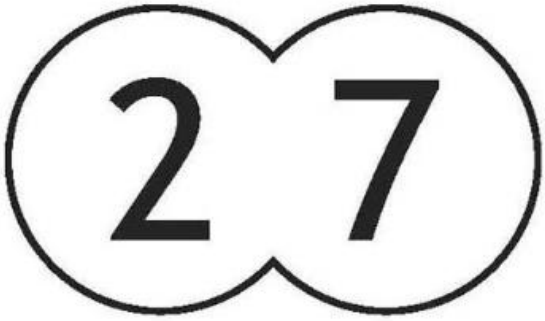
PYTHAGORAS IN CIRCLES

Clelland Maths

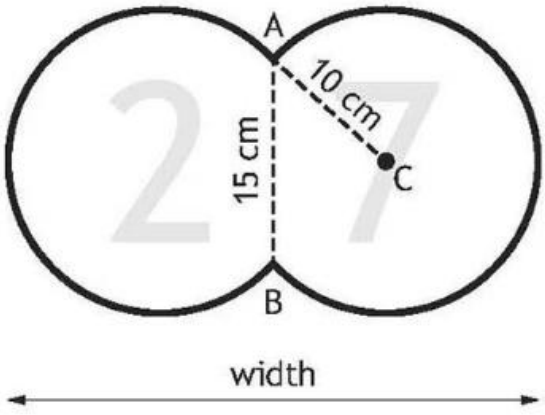
MARK

Karen buys a door-number sign for her house.

The sign consists of parts of two identical circles.



AB is a chord to both circles.



- AB has length 15 centimetres.
- The radius AC has length 10 centimetres.

Calculate the width of the sign. 4

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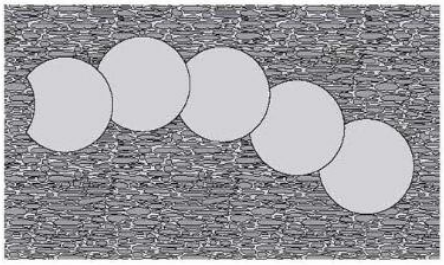
PYTHAGORAS IN CIRCLES

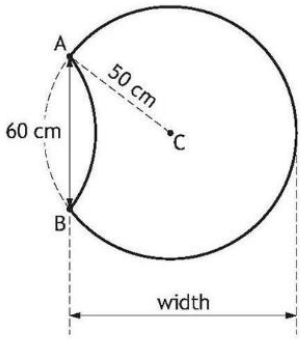
Alan buys some identical paving slabs to make a path.

Each slab is part of a circle.



The diagram below shows a single slab.

The diagram below shows a single slab.

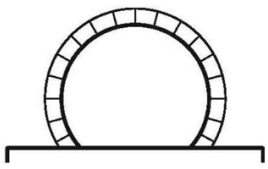


The circle, centre C, has a radius of 50 centimetres.

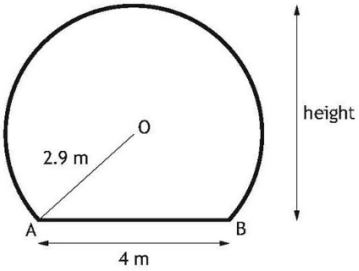
Length AB is 60 centimetres.

Calculate the width of the paving slab. 4

A train tunnel has a circular cross-section with a horizontal floor.



A diagram of the cross-section is shown below.



- The centre of the circle is O.
- Chord AB is 4 metres.
- The radius OA is 2.9 metres.

Calculate the height of the tunnel. 4

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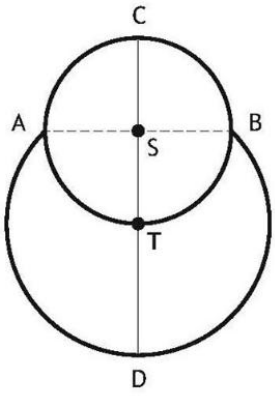
PYTHAGORAS IN CIRCLES

The picture shows a cartoon snowman.

The diagram below represents the snowman.



- The head is a small circle, centre S, with diameter 15 centimetres
- The body is part of a larger circle, centre T
- The point T lies on the circumference of the small circle
- The points A and B lie on the circumferences of both circles

Calculate CD, the height of the snowman. 4

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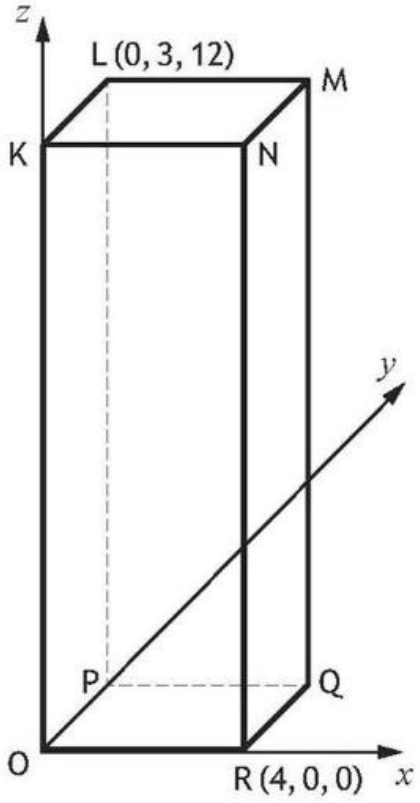
3D PYTHAGORAS

The diagram shows a cuboid, KLMNOPQR, relative to the coordinate axes.



L has coordinates (0, 3, 12).

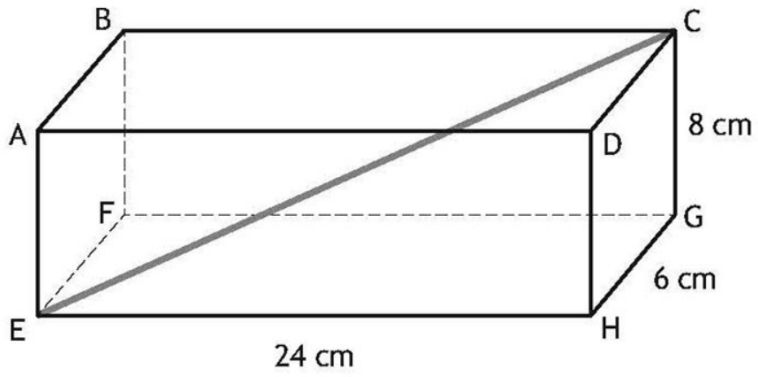
R has coordinates (4, 0, 0).

(a) Write down the coordinates of M. 1

(b) Calculate the length of the space diagonal OM. 3

3D PYTHAGORAS

The diagram shows a cuboid, ABCDEFGH.



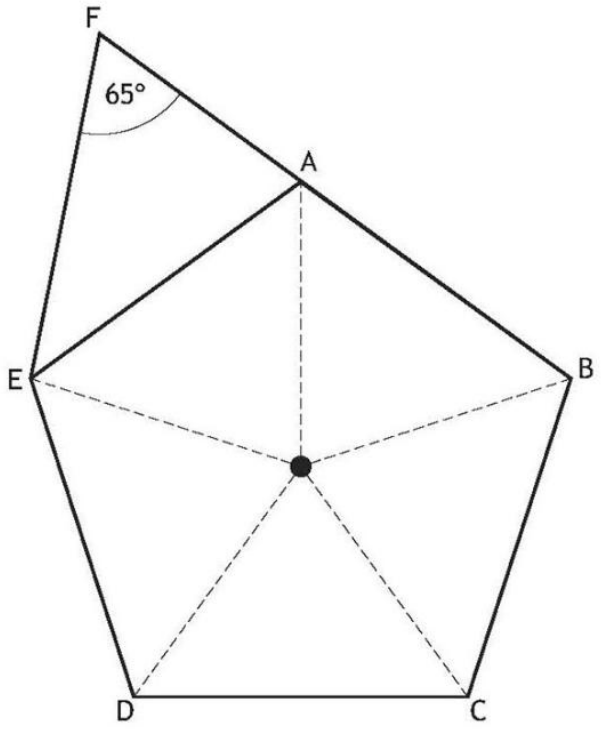
- The length of the cuboid, EH, is 24 centimetres.
- The breadth of the cuboid, HG, is 6 centimetres.
- The height of the cuboid, CG, is 8 centimetres.

Calculate the length of EC, the space diagonal of the cuboid. 3

Angles in Polygons

In the diagram, ABCDE is a regular pentagon.

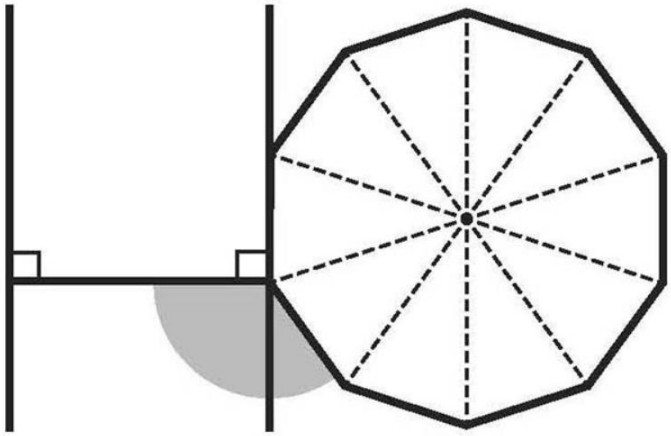
- Angle EFA is 65°.
- FAB is a straight line.



Calculate the size of angle FEA. 2

A logo consists of an H shape and a regular decagon.

The diagram represents the logo.



Calculate the size of the shaded angle. 2

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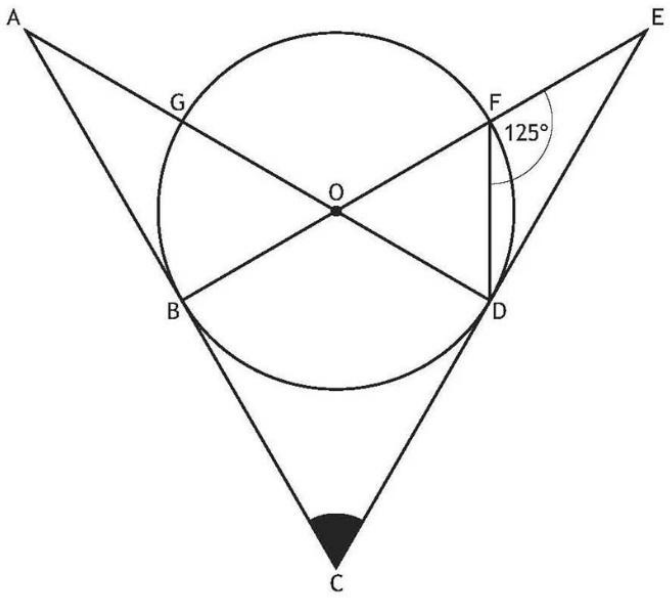
Angles in circles

The diagram below shows a circle centre O.

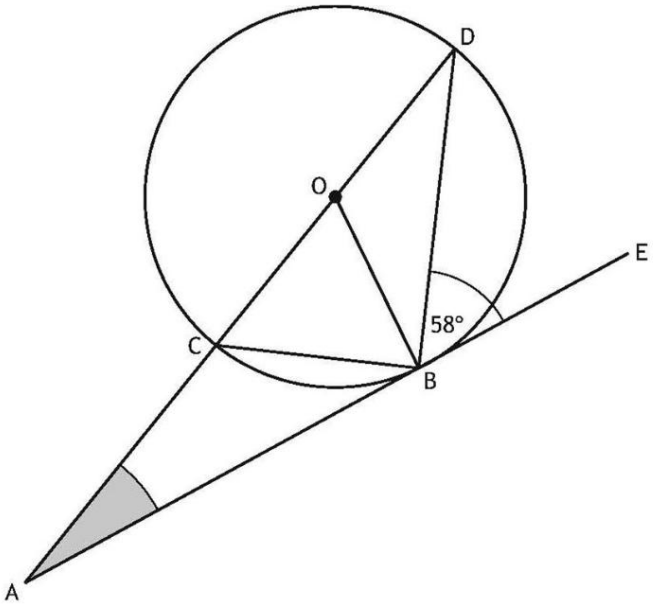
- AC is a tangent to the circle at the point B.
- CE is a tangent to the circle at the point D.
- DG and BF are diameters of the circle.
- Angle DFE is 125°.



Calculate the size of shaded angle BCD. 3

In the diagram shown below:

- ABE is a tangent to the circle centre O
- Angle DBE is 58°



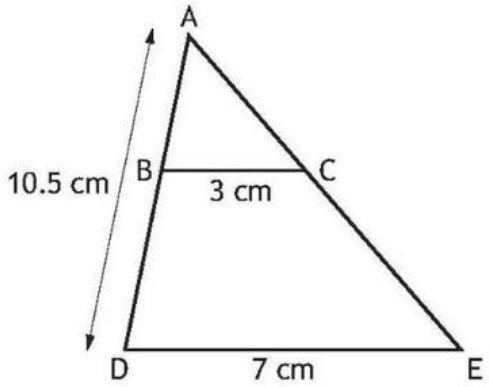
Calculate the size of angle CAB. 3

SIMILAR LENGTHS

Clelland Maths

In the diagram, triangles ABC and ADE are mathematically similar.

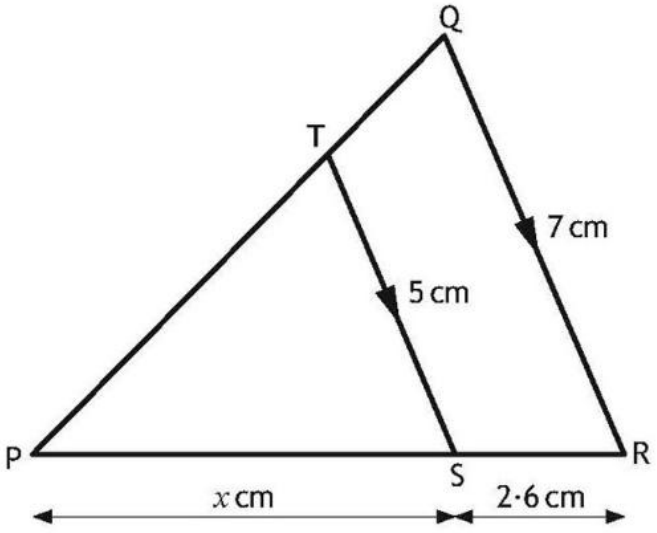
- BC = 3 centimetres
- DE = 7 centimetres
- AD = 10.5 centimetres



Calculate the length of BD. 3

In the diagram below:

- TS is parallel to QR
- TS = 5 centimetres
- QR = 7 centimetres
- SR = 2·6 centimetres



The length of PS is x centimetres.

Calculate the value of x. 3

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SIMILAR AREAS/VOLUMES

Two model aircraft are mathematically similar.

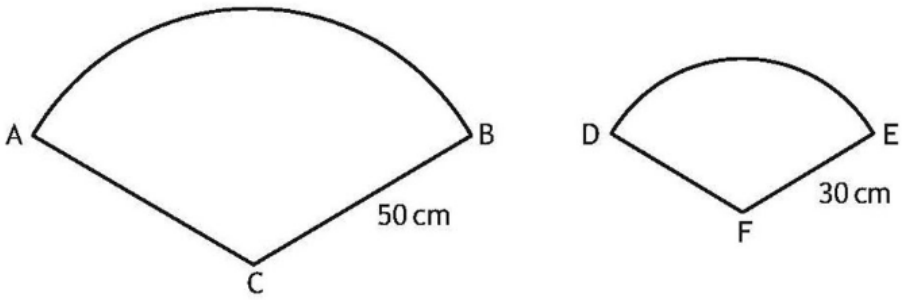
The small model is 14 centimetres long, and the area of one wing is 24 square centimetres.

The large model is 31.5 centimetres long.

Calculate the **area** of one wing of the large model. 3

In the diagram

- ABC is a sector of a circle, centre C
- DEF is a sector of a circle, centre F.



The sectors are mathematically similar.

The area of the larger sector, ABC, is 2750 square centimetres.

(a) Calculate the area of the smaller sector, DEF. 3

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SIMILAR AREAS/VOLUMES

Clelland Maths

A cinema sells popcorn in two different sized cartons.

The small carton is 16 centimetres deep and has a volume of 576 cubic centimetres.

The large carton is 24 centimetres deep and has a volume of 1125 cubic centimetres.

(a) Show that the two cartons are **not** mathematically similar. 3

The large carton is redesigned so that the two cartons are **now** mathematically similar.

The volume of the redesigned large carton is 1500 cubic centimetres.

(b) Calculate the depth of the redesigned large carton. 2

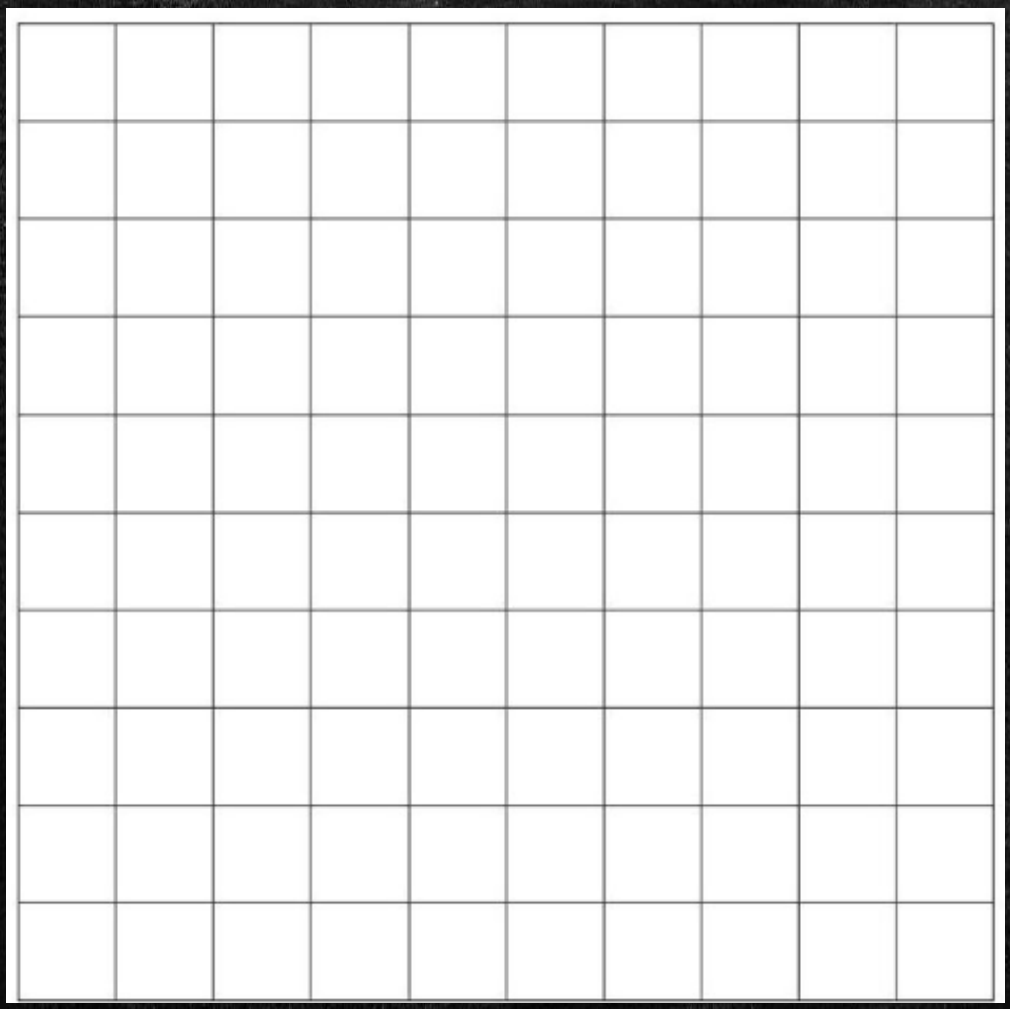
ADDING AND SUBTRACTING VECTORS

Given $\mathbf{a} = \begin{pmatrix} 3 \\ 4 \\ -1 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 5 \\ 3 \\ 2 \end{pmatrix}$, find the resultant vector $3\mathbf{a} + \mathbf{b}$.

Express your answer in component form. 2

Vectors $\mathbf{p}$ and $\mathbf{q}$ have components $\mathbf{p} = \begin{pmatrix} 5 \\ 2 \end{pmatrix}$ and $\mathbf{q} = \begin{pmatrix} 1 \\ -3 \end{pmatrix}$.

Draw the resultant vector $\mathbf{p} + \mathbf{q}$ on the grid. 2



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Clelland Maths

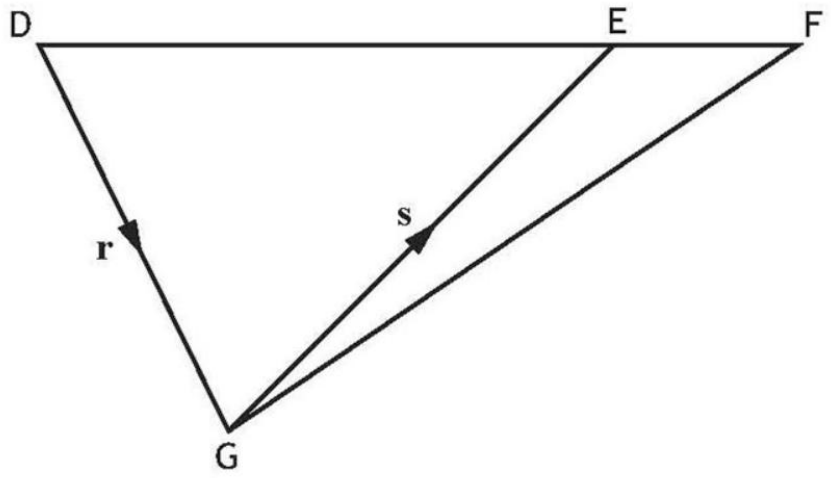
MAGNITUDE OF A VECTOR

Find $|\mathbf{p}|$, the magnitude of vector $\mathbf{p} = \begin{pmatrix} 6 \\ 27 \\ -18 \end{pmatrix}$. 2

Find $|\mathbf{r}|$, the magnitude of vector $\mathbf{r} = \begin{pmatrix} 24 \\ -12 \\ 8 \end{pmatrix}$. 2

VECTOR PATHWAYS

In the diagram, $\overrightarrow{DG}$ and $\overrightarrow{GE}$ are represented by the vectors $\mathbf{r}$ and $\mathbf{s}$ respectively, and $\overrightarrow{DE} = 3\overrightarrow{EF}$.



Express $\overrightarrow{GF}$ in terms of $\mathbf{r}$ and $\mathbf{s}$.

Give your answer in its simplest form. 2

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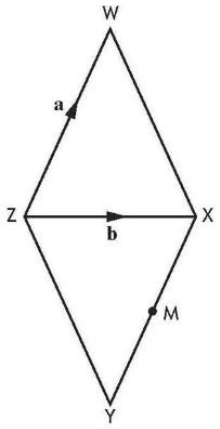
VECTOR PATHWAYS

The diagram shows a rhombus WXYZ with a diagonal ZX drawn.



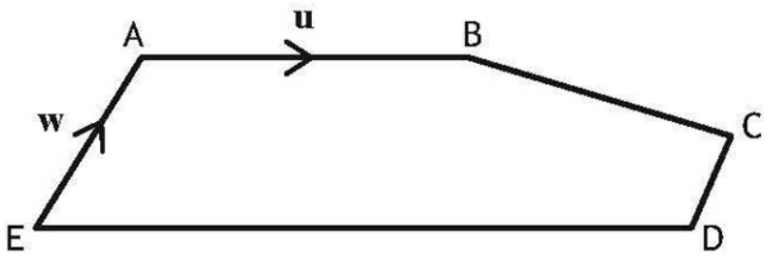
$\overrightarrow{ZW}$ represents vector **a** and $\overrightarrow{ZX}$ represents vector **b**.

(a) Express $\overrightarrow{WX}$ in terms of **a** and **b**. 1

M is the mid-point of XY.

(b) Express $\overrightarrow{WM}$ in terms of **a** and **b**.
Give your answer in its simplest form. 2

In the diagram below, $\overrightarrow{AB}$ and $\overrightarrow{EA}$ represent the vectors **u** and **w** respectively.



- $\overrightarrow{ED} = 2\overrightarrow{AB}$
- $\overrightarrow{EA} = 2\overrightarrow{DC}$

Express $\overrightarrow{BC}$ in terms of **u** and **w**.

Give your answer in its simplest form. 2

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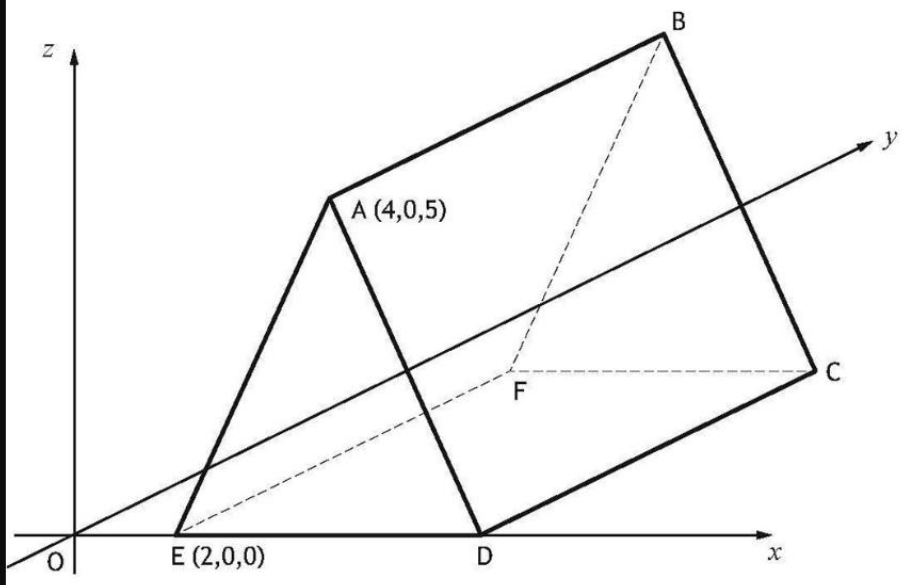
3D COORDINATES

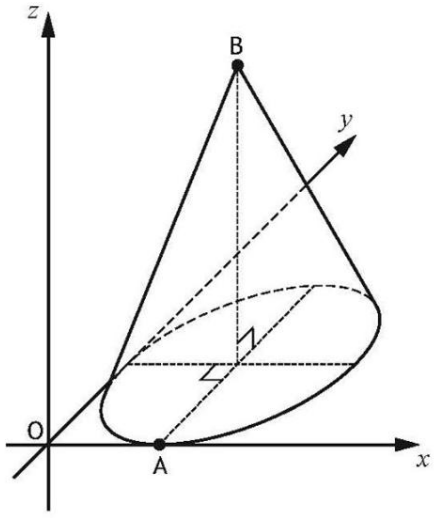
The diagram shows a triangular prism, ABCDEF, relative to the coordinate axes.



- AD = AE.
- DC = 8 units.
- Edges EF, DC and AB are parallel to the y-axis.

Write down the coordinates of B and C. **2**

The diagram shows a cone with diameter 6 units and height 8 units.



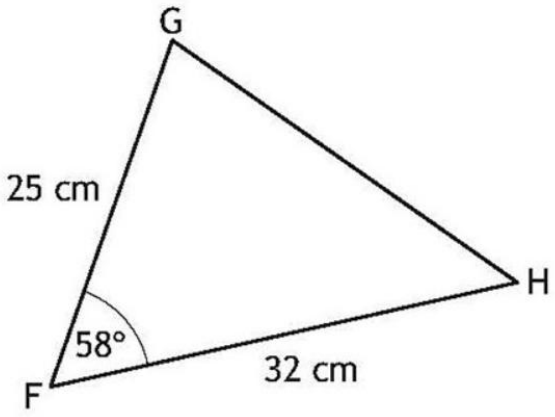
- The x-axis and the y-axis are tangents to the base
- A is the point of contact between the base and the x-axis
- B is directly above the centre of the base

Write down the coordinates of A and B. **2**

Area of a Triangle

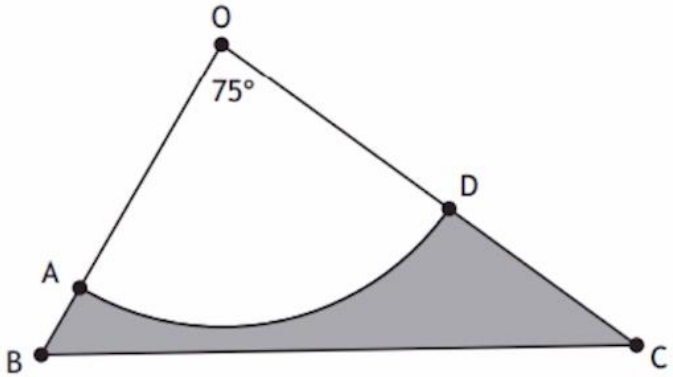
The diagram shows triangle FGH.

- FG = 25 centimetres
- FH = 32 centimetres
- Angle GFH = 58°



Calculate the area of triangle FGH. 2

17. In the diagram below AOD is a sector of a circle, with centre O, and BOC is a triangle.



In sector AOD:

- radius = 30 centimetres
- angle AOD = 75°.

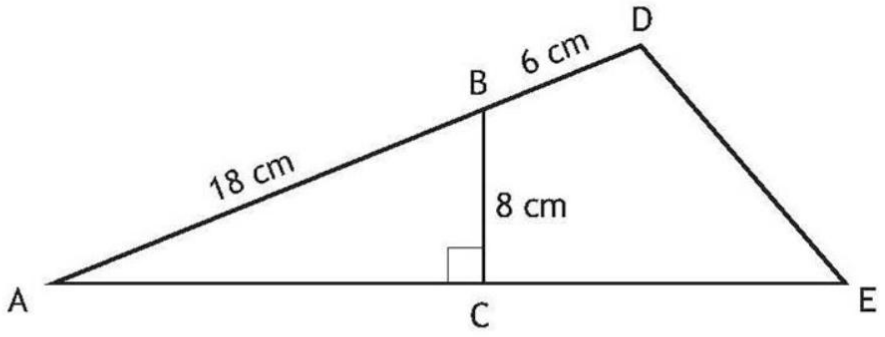
In triangle OBC:

- OB = 38 centimetres
- OC = 55 centimetres.

Area of a Triangle

In the diagram:

- AC is perpendicular to BC
- AB = 18 centimetres
- BD = 6 centimetres
- BC = 8 centimetres.



The **area** of triangle ADE is 160 square centimetres.

Calculate the length of AE. 4

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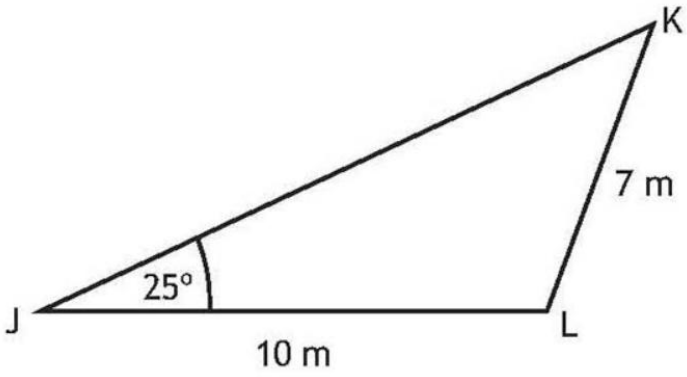
Sine Rule Angle

The diagram shows triangle JKL.

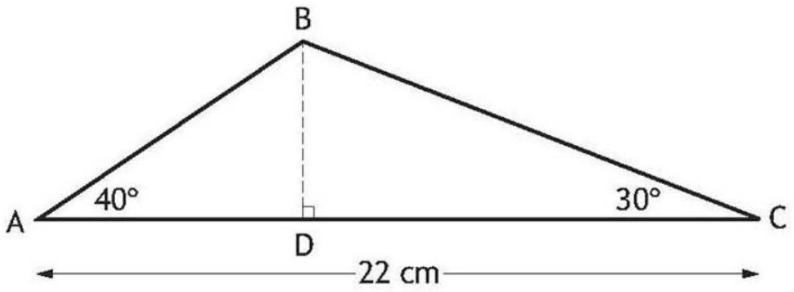
- Angle KJL = 25°
- JL = 10 metres
- KL = 7 metres



Calculate the size of angle JKL. 3

Sine Rule Length

In triangle ABC:



- AC = 22 centimetres
- angle BAC = 40°
- angle BCA = 30°
- BD is perpendicular to AC.

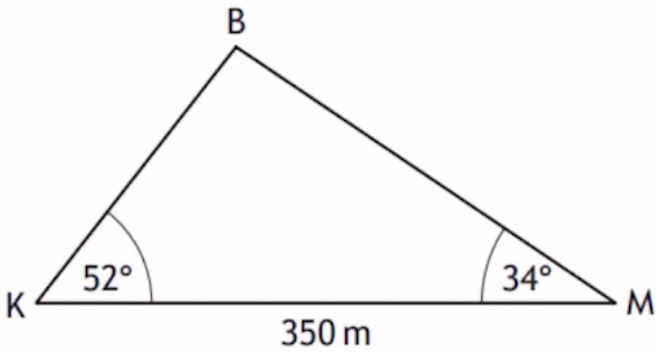
Calculate the length of BD. 5

Clelland Maths

Sine Rule Length

19. Katy and Mona are looking up at a hot-air balloon.

In the diagram below, K, M and B represent the positions of Katy, Mona and the balloon respectively.



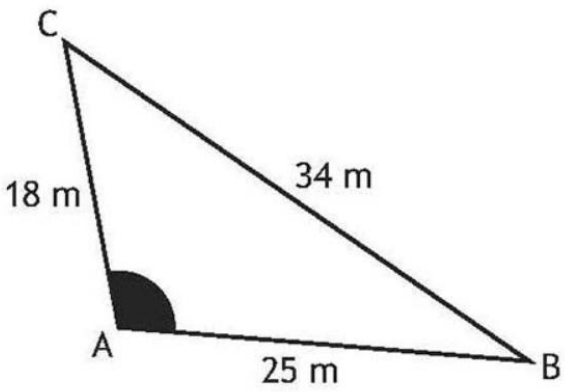
- The angle of elevation of the balloon from Katy is 52°
- The angle of elevation of the balloon from Mona is 34°
- Katy and Mona are 350 metres apart on level ground

Calculate the height of the hot-air balloon above the ground. **5**

COSINE RULE ANGLE

In triangle ABC:

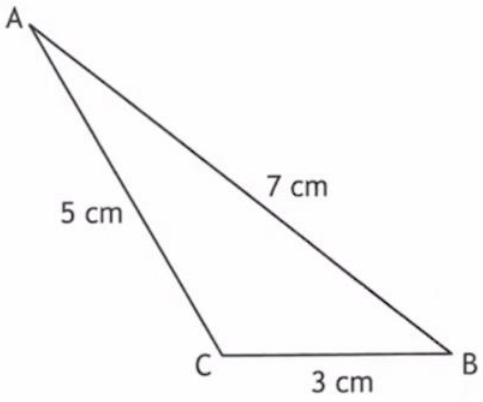
- AB = 25 metres
- AC = 18 metres
- BC = 34 metres.



Calculate the size of the shaded angle at A. 3

COSINE RULE ANGLE

9. The diagram shows triangle ABC.



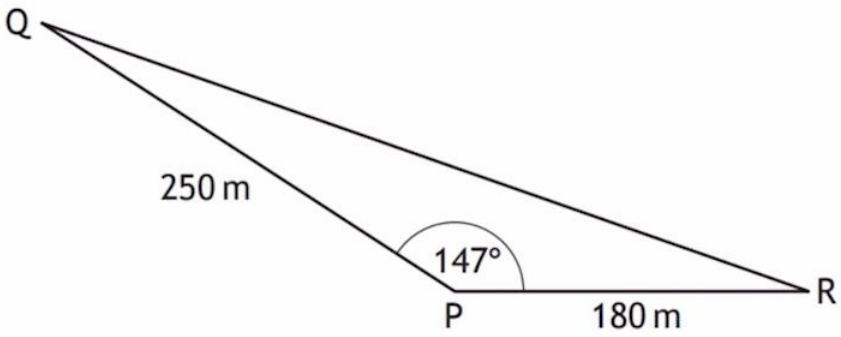
- AB = 7 centimetres
- BC = 3 centimetres
- AC = 5 centimetres

Calculate the value of cos B.

Give your answer in its simplest form.

COSINE RULE LENGTH

3. A piece of land is in the shape of a triangle as shown.



- PQ = 250 metres
- PR = 180 metres
- angle QPR = 147°

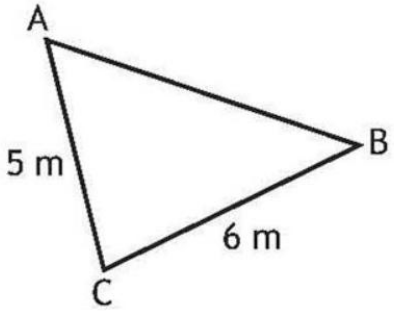
The owner wishes to build a fence along the side QR.

Calculate the length of the fence.

COSINE RULE LENGTH

In triangle ABC:

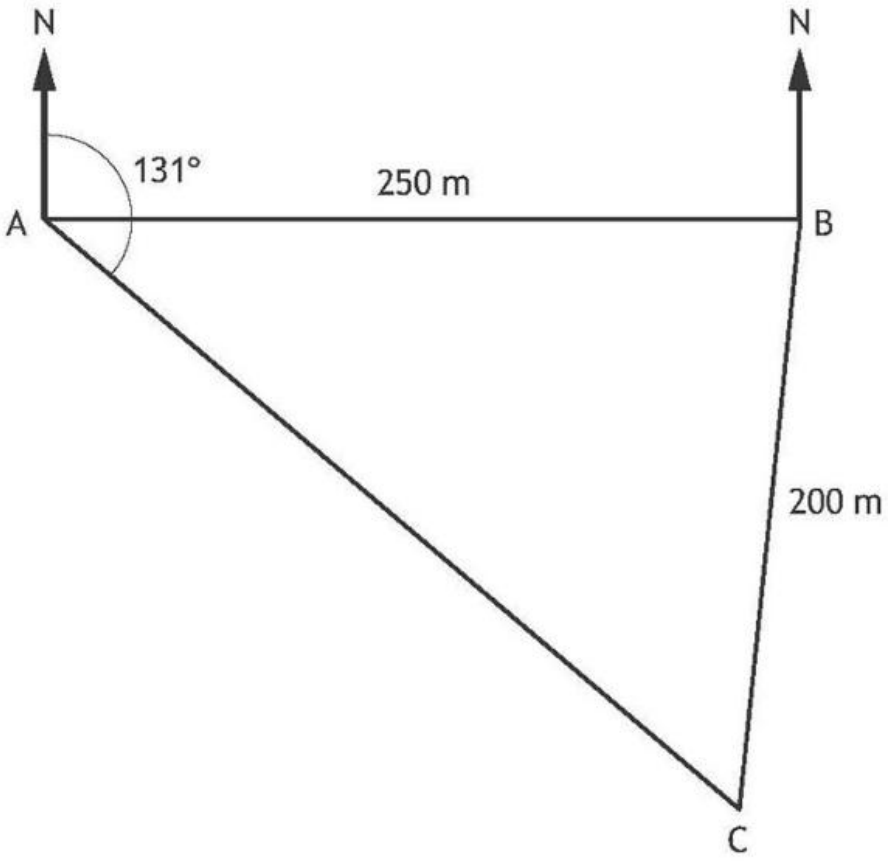
- AC = 5 metres
- BC = 6 metres
- $\cos C = \frac{1}{5}$.



Calculate the length of AB. 3

BEARINGS

In the diagram A, B and C represent the positions of three checkpoints in an orienteering course.



- B is 250 metres **east** of A.
- The bearing of C from A is 131°.
- C is 200 metres from B.

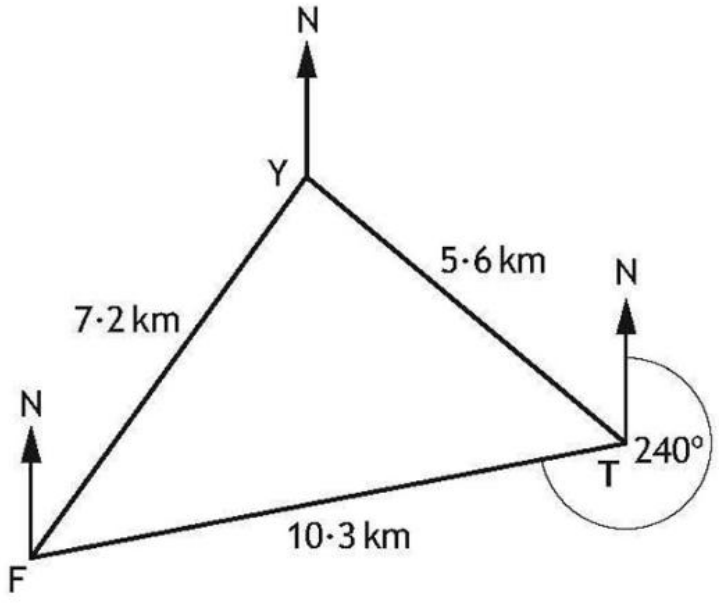
Calculate the bearing of C from B.

Do not use a scale drawing. 4

BEARINGS

A ferry and a trawler receive a request for help from a stranded yacht.

On the diagram the points F, T and Y show the positions of the ferry, the trawler and the yacht respectively.



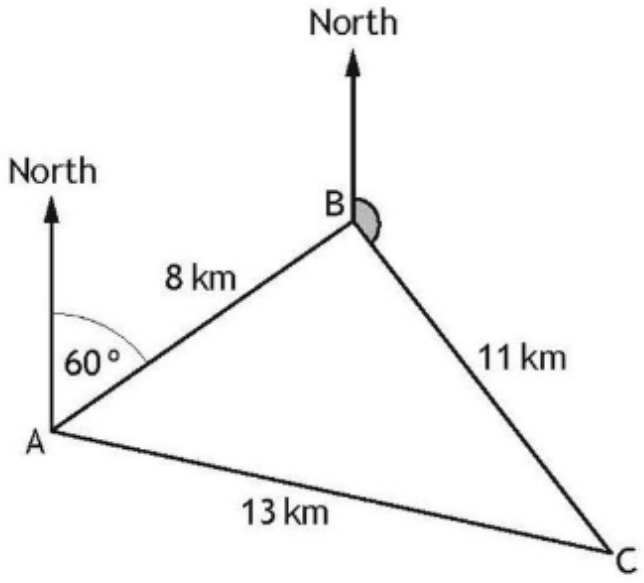
- FY is 7·2 kilometres.
- TY is 5·6 kilometres.
- FT is 10·3 kilometres.
- F is on a bearing of 240° from T.

Calculate the bearing of the yacht from the trawler. 4

BEARINGS

Clelland Maths

In a race, boats sail round three buoys represented by A, B, and C in the diagram below.



B is 8 kilometres from A on a bearing of 060°.

C is 11 kilometres from B.

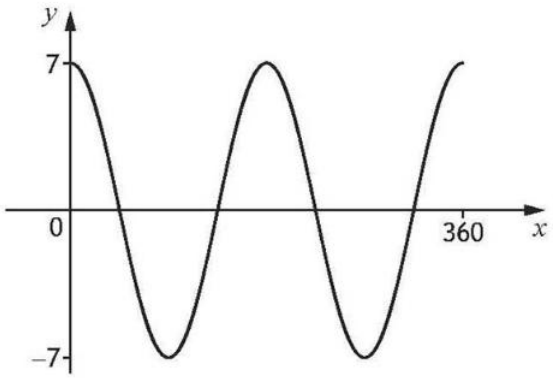
A is 13 kilometres from C.

(a) Calculate the size of angle ABC. 3

(b) Hence find the size of the shaded angle. 2

TRIG GRAPHS

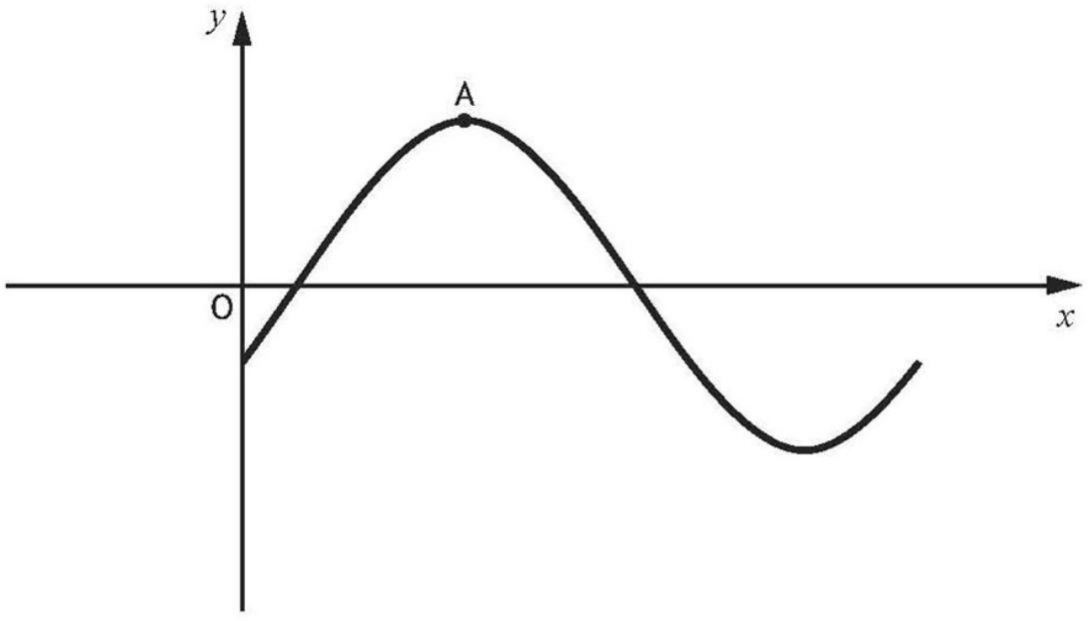
The graph of $y = a\cos bx°$, $0 \leq x \leq 360$, is shown.



(a) State the value of a. 1

(b) State the value of b. 1

Part of the graph of $y = 2\sin(x - 30)°$ is shown in the diagram.



The graph has a maximum turning point at A.

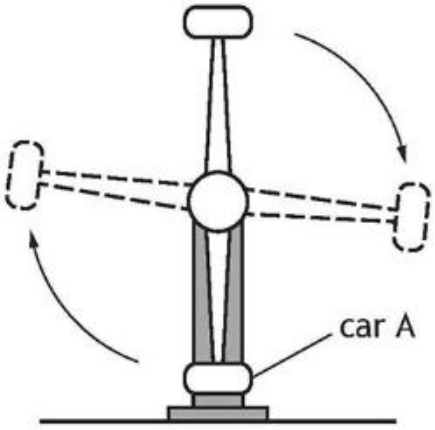
State the coordinates of A. 2

TRIG EQUATIONS

Solve the equation $17\sin x° + 1 = 9$, for $0 \leq x < 360$. 3

A ride at a theme park has a car attached to each end of a rotating arm.

The starting position of car A is shown in the diagram.



As the arm rotates clockwise, the height, h metres, of car A above the ground in each rotation is given by

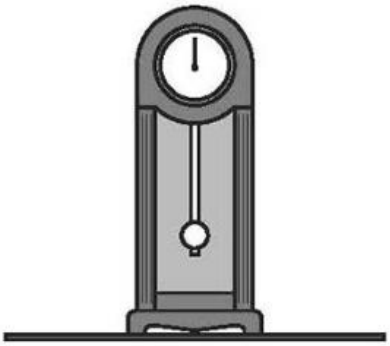
$$h = 10 - 8\cos x°, \quad 0 \leq x < 360$$

where $x°$ is the angle the arm has turned from car A's starting position.

Calculate the **two** values of x for which the height of car A is 13 metres above the ground. 4

TRIG EQUATIONS

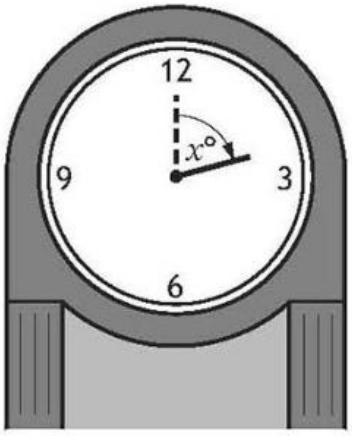
Anna has a grandfather clock in her house.



The height of the tip of the hour hand above the floor, in centimetres, is given by

$$h = 20\cos x° + 147$$

where $x°$ is the angle the **hour hand** has rotated through since 12 o'clock.



Calculate the first two values of x for which the tip of the hour hand is 150 centimetres above the floor. 4

TRIG EQUATIONS - RELATED ANGLES

Given that $\sin 30° = 0.5$, state the value of $\sin 330°$. 1

TRIG - RELATED VALUES

Write the following in order of size starting with the smallest.

$\cos 90°$ $\cos 100°$ $\cos 300°$

Justify your answer. 2

TRIG IDENTITIES

Express $3\cos^2 x° - 1$ in the form $a + b\sin^2 x°$.

Show your working. 2

Simplify $\dfrac{\sin x° + 2\cos x°}{\cos x°}$. 2

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MEDIAN AND IQR

The prices, in pounds (£), of the cameras on display in a shop are listed below.

155 160 190 210 230 240

(a) Calculate the median and the interquartile range of these prices. 3

On a website, a sample of camera prices have a median of £195 and an interquartile range of £73.

(b) Make two valid comments comparing the **prices** of the cameras in the shop and on the website. 2

9. A magazine company conducted a survey of the ages of its readers.

A sample of ten readers' ages, in years, are shown below.

33 55 38 47 36 41 42 41 35 31

(a) Calculate the median and interquartile range of the ages of readers for this sample. 3

A newspaper company also conducted a survey of the ages of its readers.

The median age of a sample of its readers was 41 years and the interquartile range was 9 years.

(b) Make two valid comments comparing the ages of the readers of the magazine and the ages of the readers of the newspaper. 2

STANDARD DEVIATION

The weights, in kilograms, of a sample of rugby players in Scotland are shown.

93 103 99 105 88 106 92

(a) Calculate the mean and standard deviation of these weights. 4

A sample of rugby players in France has a mean weight of 105 kilograms and a standard deviation of 5.9 kilograms.

(b) Make two valid comments comparing the **weights** of the rugby players in the samples from Scotland and France. 2

A school netball team recorded the number of sit-ups each player completed in a minute.

The numbers for the seven players were:

29 27 24 31 22 19 30

(a) Calculate the mean and standard deviation of the numbers of sit-ups. 4

Some players in the school's hockey team also recorded the number of sit-ups they completed in a minute.

Their numbers gave a mean of 29 and a standard deviation of 3.2.

(b) Make two valid comments comparing the numbers of sit-ups of the players in the netball team and the hockey team. 2

STANDARD DEVIATION

Clelland Maths

12. Gym members are asked to fill out a questionnaire to rate the quality of service provided.

They are asked to give a rating on a scale of 1 to 6.

The ratings given by five members were as follows:

1 4 6 3 6

In its simplest form, the standard deviation of these ratings can be written as $\frac{a\sqrt{b}}{2}$.

Find the values of a and b. **4**

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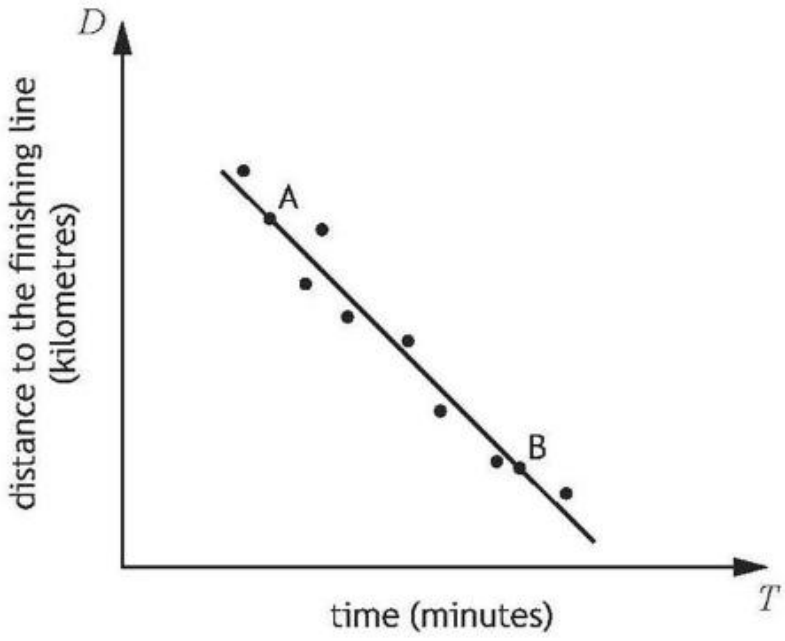
SCATTERGRAPH

In a car rally, competitors start at different times.

The scattergraph shows the relationship between the length of time they have been driving, T minutes, and the distance to the finishing line, D kilometres.



A line of best fit has been drawn.

Point A represents a competitor who has been driving for 3 minutes and is 26 kilometres from the finishing line.

Point B represents a competitor who has been driving for 10 minutes and is 12 kilometres from the finishing line.

(a) Find the equation of the line of best fit in terms of D and T.

Give the equation in its simplest form. 3

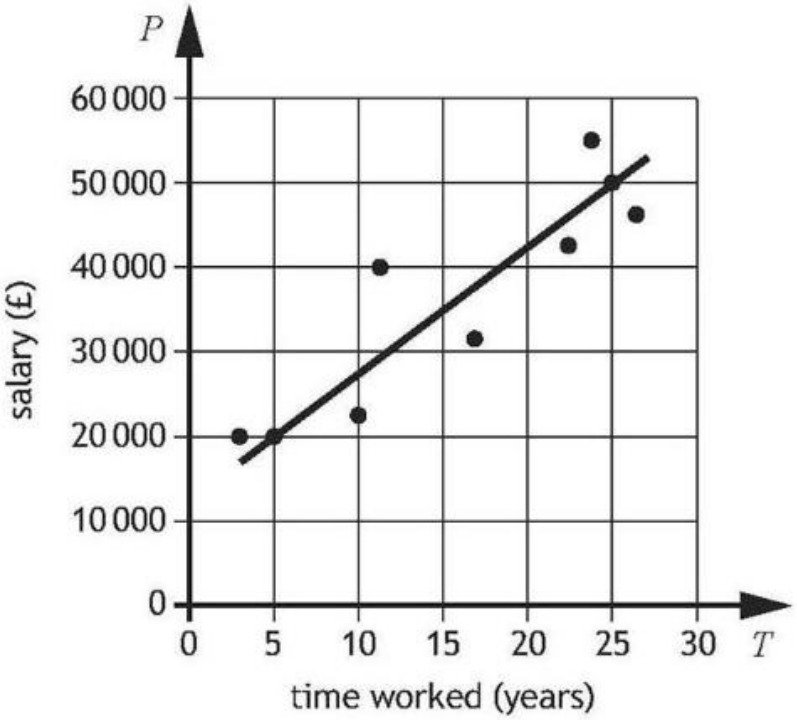
Another competitor has been driving for 7 minutes.

(b) Use your equation from part (a) to estimate the distance the competitor is from the finishing line. 1

SCATTERGRAPH

A business recorded the salaries of a sample of its employees and the length of time they have worked for the business.

The scattergraph shows the relationship between their salary, P pounds, and the length of time, T years, they have worked.



A line of the best fit has been drawn.

(a) Find the equation of the line of best fit in terms of P and T.
Give the equation in its simplest form. 3

(b) Use your equation from part (a) to estimate the salary of an employee who has worked for the business for 8 years. 1

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