Bearings
Difficulty: Easy

Model Answers 1

Level	IGCSE
Subject	Maths (0580/0980)
Exam Board	CIE
Topic	Trigonometry
Sub-Topic	Bearings
Paper	Paper 2
Difficulty	Easy
Booklet	Model Answers 1

Time allowed: **24 minutes**

Score: **/19**

Percentage: **/100**

Grade Boundaries:

CIE IGCSE Maths (0580)

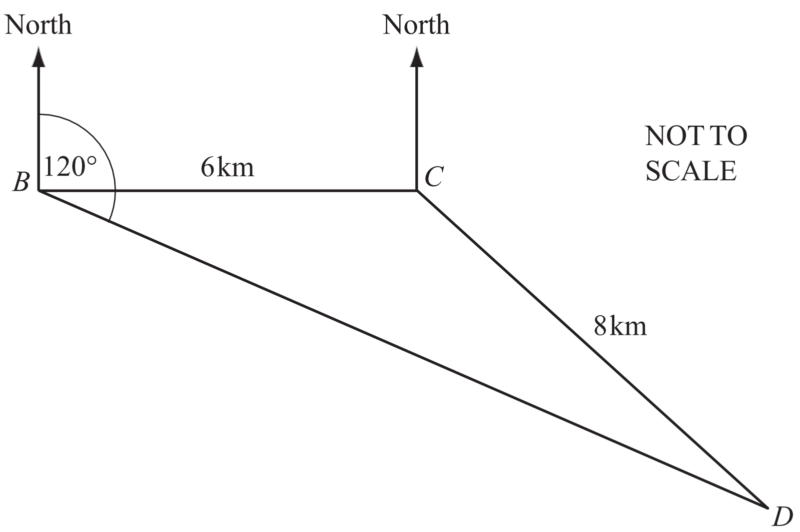
A*	A	B	C	D	E
>88%	76%	63%	51%	40%	30%

CIE IGCSE Maths (0980)

9	8	7	6	5	4	3
>94%	85%	77%	67%	57%	47%	35%

Assembled by A-S

A helicopter flies from its base B to deliver supplies to two oil rigs at C and D.
C is 6 km due east of B and the distance from C to D is 8 km.
D is on a bearing of 120° from B.

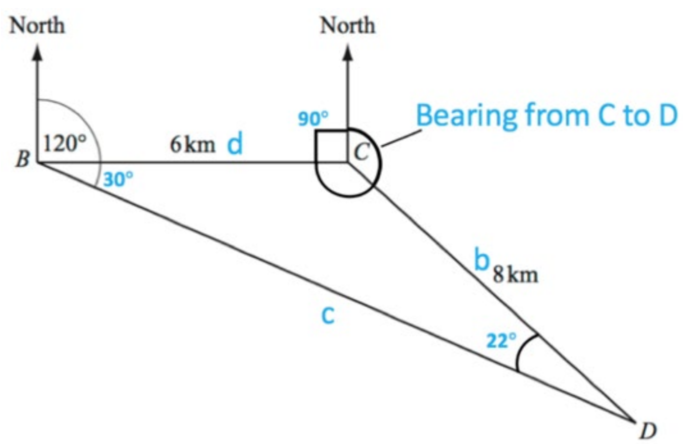


Find the bearing of D from C. [5]

To find the bearing of D from C we'll need to find the size of the angle BCD, and then take that angle, and 90°, away from 360°. This is going to require us to use the 'Sine Rule' to find out the angles inside the triangle.

The 'Sine Rule' can be used to find either the length of a side of a triangle, or an angle in a triangle – it goes like this:

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$



Angle DCB = 120° $-$ 90° $=$ 30°

So, applying the Sine rule:

$$\frac{8}{\sin 30} = \frac{6}{sinD}$$

$$\sin D\left(\frac{8}{\sin 30}\right) = 6$$

$$\sin D = \frac{6}{\left(\frac{8}{\sin 30}\right)}$$

$$D = \sin^{-1}\left(\frac{6}{\left(\frac{8}{\sin 30}\right)}\right)$$

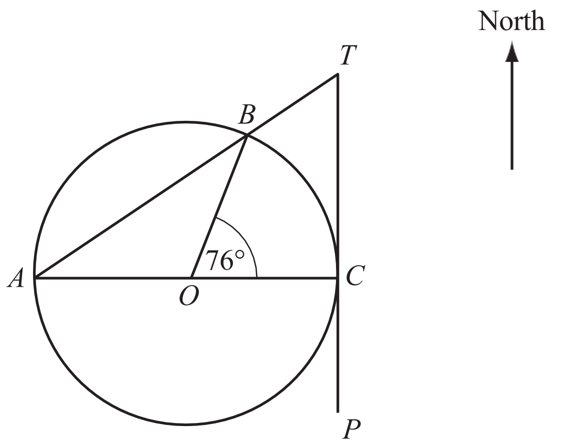
$$D = 22.0\,°$$

All angles within a triangle add up to 180°, so

$$BCD = 180 - 30 - 22$$

$$BCD = 128°$$

Bearing from C to D $= \mathbf{360 - 90 - 128 = 142°}$



AOC is a diameter of the circle, centre *O*.
AT is a straight line that cuts the circle at *B*.
PT is the tangent to the circle at *C*.
Angle *COB* = 76°.

(a) Calculate angle *ATC*. [2]

PT is a tangent on the circle at C. Therefore, PT is perpendicular on AC, the diameter of the circle.

In the triangle OAB, both OB and OA are radius in the circle of centre C.

OA = OB, making the triangle OAB isosceles.

In the isosceles triangle OAB, the angles OAB and OBA are congruent.

AC is the diameter of the circle, therefore the angle AOB is 180° minus the angle COB.

Angle AOB = 180° - 76° = 104°

The sum of all 3 angles in a triangle is 180°.

Angle OBA x 2 + angle AOB = 180°

Angle OBA x 2 = 76°

Angle OBA = 38°

In the triangle ATC, the sum of all 3 angles is 180°.

Angle TCA + angle TAC + angle ATC = 180°

Angle ATC = 180° - 90° - 38°

Angle ATC = 52°

(b) *T* is due north of *C*.

Calculate the bearing of *B* from *C*. [2]

The bearing is calculated towards right, therefore the bearing of B form C will be 360° minus the angle TCB.

In the angle OCB, OC = OB since both are the radius in the circle of centre O.

The angle OCB is isosceles, therefore the angles OCB and OBC are congruent.

2 x angle OCB = 180° - 76°

Angle OCB = 52°

Angle BCT = 90° - 52° (since the angle TCA is 90°)

Angle BCT = 38°

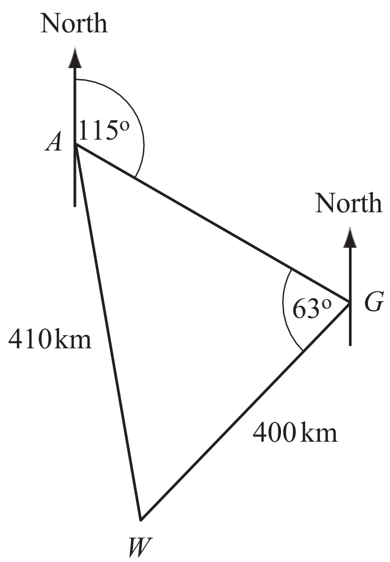
The bearing of B from C is: 360° - angle BCT

Bearing of B from C = 360° - 38°

Bearing of B from C = 322°

Assembled by A.S.

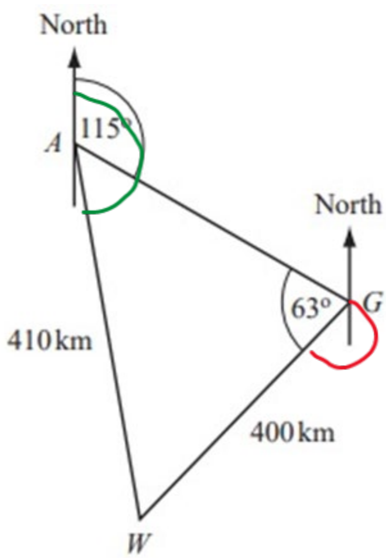
A plane flies from Auckland (A) to Gisborne (G) on a bearing of 115°.
The plane then flies on to Wellington (W). Angle AGW = 63°.



NOT TO SCALE

(a) Calculate the bearing of Wellington from Gisborne. [2]

The bearing of W from G goes form the North line, anticlockwise, all the way around to the line connecting W and G.



The bearing of W from G is marked in red on the figure above.

The 2 arrows pointing towards North are parallel, therefore the bearing from G to A summed up with the bearing from A to G will give 180°.

The bearing from G to A is:

180° - 115° = 65°

This angle, the bearing from G to W and the angle AGW are angles around a single point, G. Therefore, their sum will be equal to 360°

The bearing from G to W is:

360° - 65° - 63°

= **232°**

(b) The distance from Wellington to Gisborne is 400 kilometres.
The distance from Auckland to Wellington is 410 kilometres.

Calculate the bearing of Wellington from Auckland. [4]

The bearing of W from A is marked in green in the figure above.

The bearing of W from A is the sum of the angle GAW with the bearing from A to G, 115°.

In the triangle GAW, we can apply the sine rule to work out the size of the angle GAW

The sine rule is:

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

In our case, angle GAW = A, angle AGW = B, GW = a and AW = b

$$\frac{\sin GAW}{400 \text{ km}} = \frac{\sin 63°}{410 \text{ km}}$$

sin GAW = 0.869

angle GAW = 60.4°

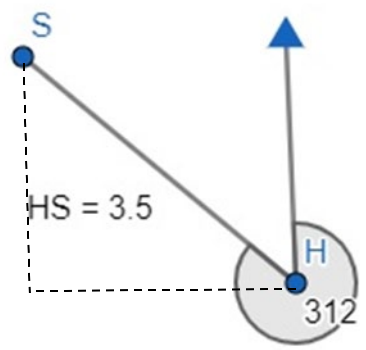
The bearing from W to A is:

60.4° + 115°

= **175.4°**

From a harbour, H, the bearing of a ship, S, is 312°. The ship is 3.5 km from the harbour.

(a) Draw a sketch to show this information.
Label H, S, the length 3.5 km and the angle 312°. [2]



The bearing is measured clockwise from the line pointing in the north clockwise.

(b) **Calculate** how far north the ship is of the harbour. [2]

In the right-angled triangle formed, the side representing how far north S is from H can be worked out using the sin of the opposite angle.

Opposite angle = 90° - 48° = 42°

HS = 3.5 km

$\sin 42° = \frac{\text{how far north}}{3.5\text{ km}}$

The ship is 2.34 km North form H.

2D Pythagoras & SOHCAHTOA
Difficulty: Easy

Model Answers 1

Level	IGCSE
Subject	Maths (0580/0980)
Exam Board	CIE
Topic	Trigonometry
Sub-Topic	2D Pythagoras & SOHCAHTOA
Paper	Paper 2
Difficulty	Easy
Booklet	Model Answers 1

Time allowed: **30 minutes**

Score: **/23**

Percentage: **/100**

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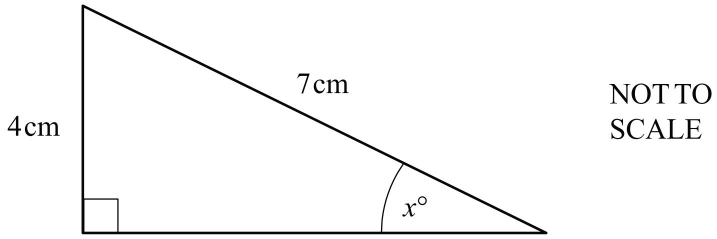


Calculate the value of x. [2]

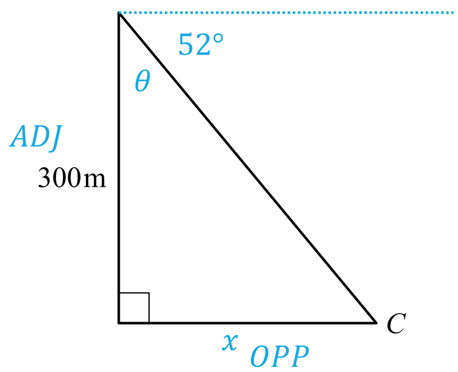
Use the trigonometric relation

$$\sin\theta = \frac{opp}{hyp}$$

$$\rightarrow \sin x = \frac{4}{7}$$

$$\rightarrow \boldsymbol{x = 34.8}$$

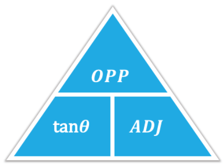
From the top of a building, 300 metres high, the angle of depression of a car, C, is 52°.



NOT TO SCALE

Calculate the horizontal distance from the car to the base of the building. [3]

The angle at the top of the triangle, θ, is given by:



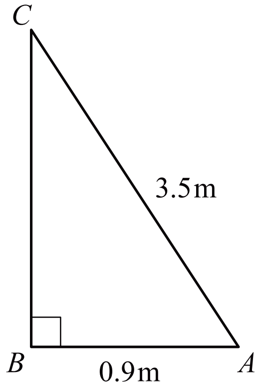
$$\theta = 90 - 52 = 38°$$

Use $SOHCAHTOA$ to find the distance x:

$$OPP = ADJ \times \tan\theta$$

$$x = 300 \times \tan 38$$

$$\mathbf{x = 234}$$ **metres** (to 3 significant figures)



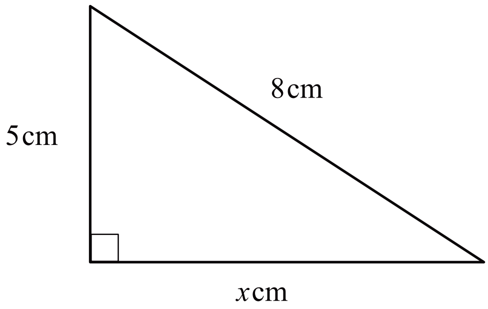
NOT TO SCALE

Calculate angle BAC. [2]

Using the trigonometry for a right angled triangle (SOHCAHTOA) we are given the adjacent length and the hypotenuse. Thus we need to use cosine to find the angle BAC:

$$\cos BAC = \frac{0.9}{3.5} \textit{and therefore } BAC = cos^{-1}\left(\frac{0.9}{3.5}\right)$$

$$= 75°$$



NOT TO SCALE

Calculate the value of x. [3]

The triangle is a right angle triangle, therefore we can use Pythagora's rule to work out the value of x.

$$(8cm)^2 = (5cm)^2 + (x\ cm)^2$$

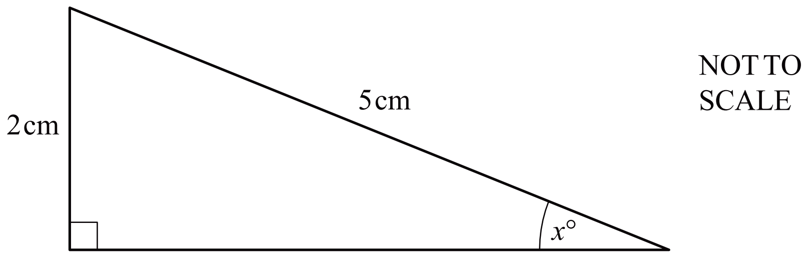
$$64 = 25 + x^2$$

Subtract 25 from both sides of the equation.

$$39 = x^2$$

Take the positive root.

$$\boldsymbol{x = 6.24}$$



Calculate the value of x. [2]

The value of x can be calculated using trigonometry (the triangle is a right-angle triangle).

$$\sin(x) = \frac{opposite}{hypotenuse}$$

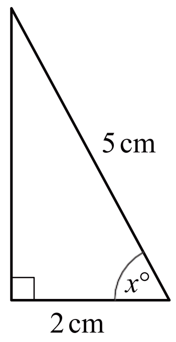
$$\sin(x) = \frac{2cm}{5cm}$$

Take arcsin of both sides.

$$x = \arcsin\left(\frac{2}{5}\right)$$

Use a calculator to get the value of x.

$$x = \mathbf{23.6}°$$



NOT TO SCALE

Calculate the value of x. [2]

The angle is a right-angle triangle, therefore to calculate the value of x, we can use trigonometry.

$$\cos(x) = \frac{adjacent}{hypotenuse}$$

In our case, the adjacent side has a length 2cm and the hypotenuse is 5cm

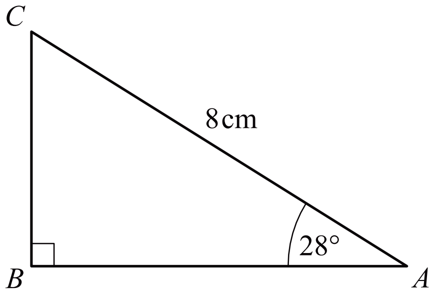
$$\cos(x) = \frac{2cm}{5cm}$$

Take arccosine of both sides of the equation.

$$x = \arccos\left(\frac{2}{5}\right)$$

Use your calculator to work out the value of x.

$$\boldsymbol{x = 66.4°}$$



NOT TO SCALE

Calculate the length of AB. [2]

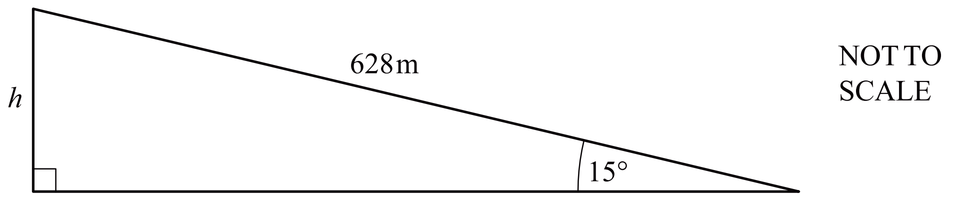
Use the trigonometric relation

$$\cos\theta = \frac{adj}{hyp}$$

$$\rightarrow \cos 28 = \frac{AB}{8}$$

$$\rightarrow AB = 8\cos 28$$

$$= 7.06$$



Calculate the length h.
Give your answer correct to 2 significant figures. [3]

Since this is a right-angled triangle, we can apply basic trigonometry:

An acronym, TOACAHSOH, is useful when remember trigonometric ratios where:

$$tan(angle) = \frac{opp}{adjacent}, \quad cos(angle) = \frac{adjacent}{hypotenuse},$$

$$sin(angle) = \frac{opp}{hypotenuse}$$

In this diagram, the opposite to the angle is h, and the hypotenuse is 628m.

The sine relation would be most appropriate in this situation:

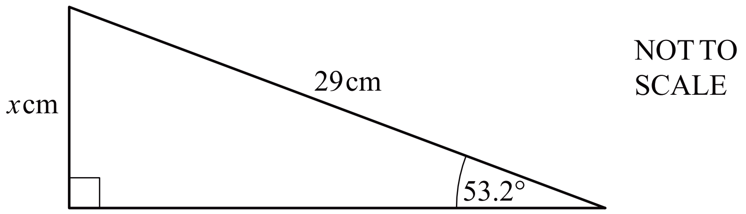
$$sin(15°) = \frac{h}{628}$$

$$h = 162.5\ m$$

$$\approx \mathbf{160\ m\ (2sf)}$$

Note: Rounding to 2 significant figures gives us 160 as any value below 165 has to be rounded down to 160.

163 is not correct here as it is in 3 significant figures.



Calculate the value of x. [2]

Use the trigonometric relation

$$\sin\theta = \frac{opp}{hyp}$$

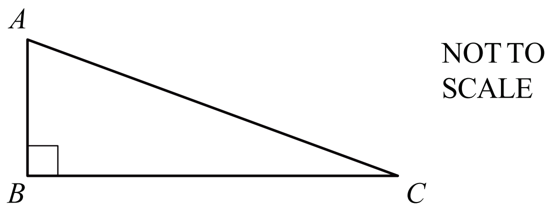
To get

$$hyp \times \sin\theta = opp$$

$$\rightarrow 29\sin 53.2 = x$$

$$\rightarrow \boldsymbol{x = 23.2}$$

In the right-angled triangle ABC, $\cos C = \dfrac{4}{5}$. Find angle A. [2]



First, calculate the size of *angle C* in degrees.

$$C° = 36.9°$$

The sum of all interior angles of a triangle must be 180°. Since ABC is a right angle triangle, we know that the size of *angle B* is 90°.

$$180° = A° + B° + C°$$

$$180° = A° + 90° + 36.9°$$

Hence rearrange and find the size of *angle A*.

$$A° = 180° - 90° - 36.9°$$

$$\mathbf{A° = 53.1°}$$

2D Pythagoras & SOHCAHTOA
Difficulty: Easy

Model Answers 2

Level	IGCSE
Subject	Maths (0580/0980)
Exam Board	CIE
Topic	Trigonometry
Sub-Topic	2D Pythagoras & SOHCAHTOA
Paper	Paper 2
Difficulty	Easy
Booklet	Model Answers 2

Time allowed: **32 minutes**

Score: **/25**

Percentage: **/100**

Grade Boundaries:

CIE IGCSE Maths (0580)

A*	A	B	C	D	E
>88%	76%	63%	51%	40%	30%

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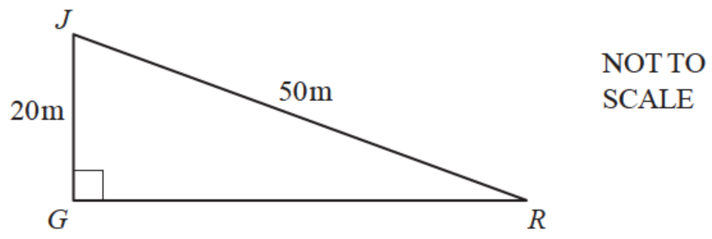


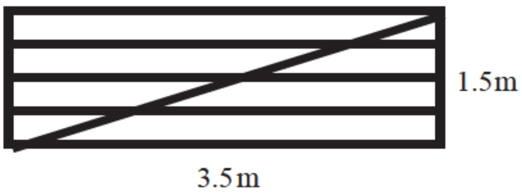
JGR is a right-angled triangle. *JR* = 50m and *JG* = 20m.
Calculate angle *JRG*. [2]

Using trigonometry we have

$$\sin JRG = \frac{opp}{hyp}$$

$$\rightarrow JRG = \sin^{-1}\left(\frac{20}{50}\right)$$

$$= \mathbf{23.6}$$



NOT TO SCALE

The diagram represents a rectangular gate measuring 1.5m by 3.5m.
It is made from eight lengths of wood.
Calculate the total length of wood needed to make the gate. [3]

We need 5 times the length of the rectangle plus 2 times

the height plus the hypotenuse of the triangle.

We find the hypotenuse using Pythagoras'

$$c^2 = a^2 + b^2$$

$$\rightarrow c^2 = 3.5^2 + 1.5^2$$

$$= 14.5$$

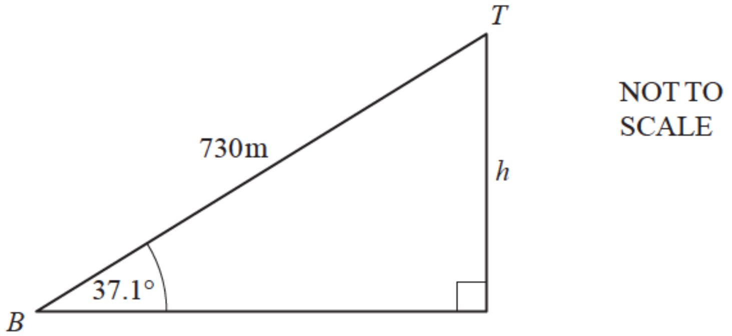
$$\rightarrow c = 3.8$$

Hence

$$5 \times 3.5 + 2 \times 1.5 + 3.8$$

$$= \mathbf{24.3}$$

The diagram represents the ski lift in Queenstown New Zealand.



(a) The length of the cable from the bottom, B, to the top, T, is 730 metres.

The angle of elevation of T from B is 37.1°.

Calculate the change in altitude, h metres, from the bottom to the top. [2]

Use the trigonometric relation

$$\sin\theta = \frac{opp}{hyp}$$

$$\rightarrow \sin 37.1 = \frac{h}{730}$$

$$\rightarrow h = 730 \sin 37.1$$

$$= \mathbf{440}$$

(b) The lift travels along the cable at 3.65 metres per second.

Calculate how long it takes to travel from B to T.

Give your answer in minutes and seconds. [2]

Use speed time distance relation

$$speed = \frac{distance}{time}$$

$$\rightarrow 3.65 = \frac{730}{time}$$

$$\rightarrow time = \frac{730}{3.65}$$

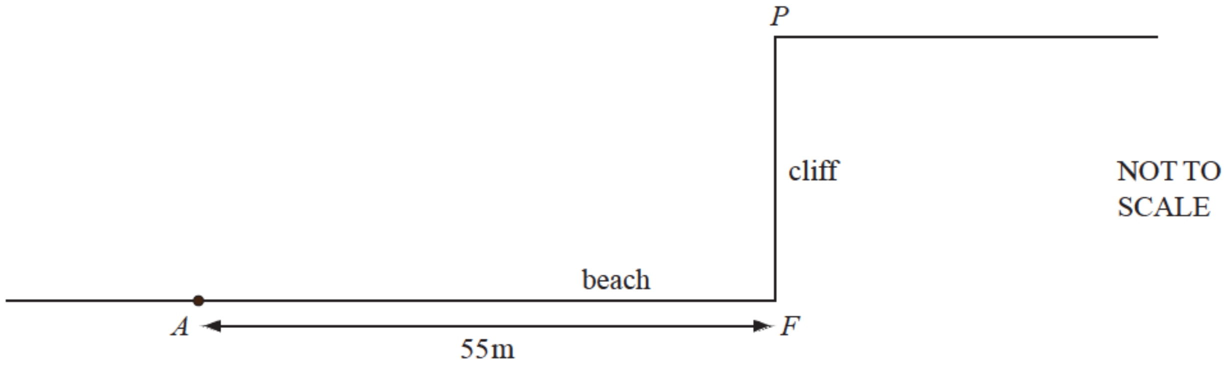
$$= 200\ s$$

Convert into minutes

$$200 \div 60$$

$$= 3\frac{1}{3}m$$

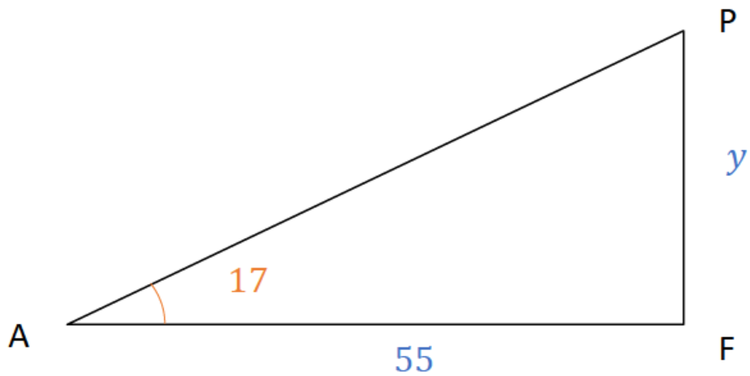
$$= \mathbf{3m\ 20s}$$



The diagram shows a point P at the top of a cliff.
The point F is on the beach and vertically below P.
The point A is 55m from F, along the horizontal beach.
The angle of elevation of P from A is 17°.

Calculate PF, the height of the cliff. [3]

. Need to find height of the cliff, y.



Use the trigonometric relation

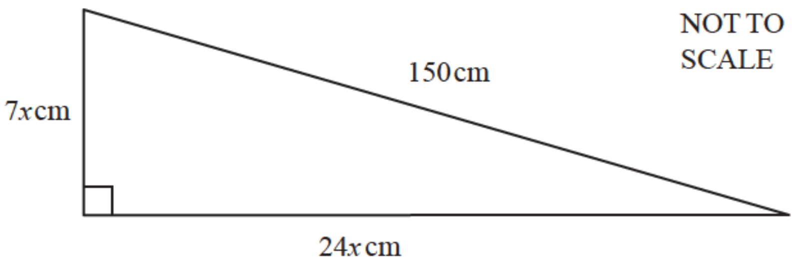
$$\tan\theta = \frac{opp}{adj}$$

To write

$$\tan 17 = \frac{y}{55}$$

$$\rightarrow y = 55\tan 17$$

$$= \mathbf{16.8}$$



The right-angled triangle in the diagram has sides of length $7x$ cm, $24x$ cm and 150 cm.

(a) Show that $x^2 = 36$. [2]

Using Pythagoras' Theorem, we obtain:

$(7x)^2 + (24x)^2 = 150^2$

$49x^2 + 576x^2 = 22500$

$625x^2 = 22500$

$x^2 = 36$

(b) Calculate the perimeter of the triangle. [1]

From a), we obtain that:

$x = \pm 6$

The side of a triangle is positive value:

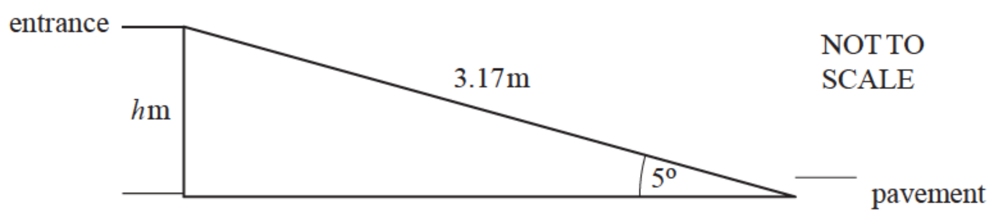
$x = 6$

The perimeter represents the sum of all the sides.

$P = 7x + 24x + 150$ cm

$P = 31 \times 6 + 150$

$P = 336$ cm



A shop has a wheelchair ramp to its entrance from the pavement.
The ramp is 3.17 metres long and is inclined at 5° to the horizontal.
Calculate the height, h metres, of the entrance above the pavement.
Show all your working. [2]

In a right-angled triangle, sin A = $\frac{\text{oppsoite}}{\text{hypothenuse}}$

In our case:

$\sin 5^\circ = \frac{h}{3.17\text{ m}}$

h = 3.17 m x sin 5°

Using a calculator, we work out that sin 5° = 0.087.

h = 3.17 m x 0.087

h = 0.276

Calculate the value of $(\cos 40^{\circ})^2 + (\sin 40^{\circ})^2$. [2]

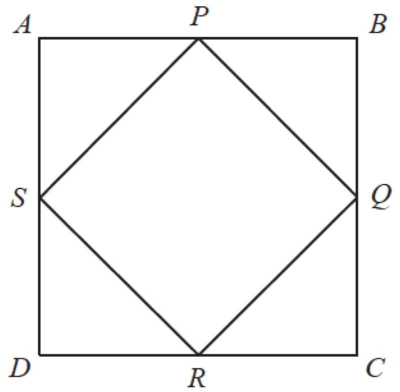
We need to use the following trigonometric formula:

$$\boxed{\sin^2(a) + \cos^2(a) = 1}$$

In our case, a = 40°.

$\sin^2(40°) + \cos^2(40°) = 1$

A square $ABCD$, of side 8 cm, has another square, $PQRS$, drawn inside it.
P, Q, R and S are at the midpoints of each side of the square $ABCD$, as shown in the diagram.



NOT TO SCALE

(a) Calculate the length of PQ. [2]

Since P and Q are the mid-points of AB and BC, respectively.

Therefore, PB = BQ = $\frac{8 \text{ cm}}{2}$

PB = BQ = 4 cm

In the right-angled triangle PBQ, PQ represents the hypothenuse.

Using Pythagoras' Theorem, we can work out the length of PQ.

$PQ^2 = PB^2 + QB^2$

$PQ^2 = 4^2 + 4^2 \text{ cm}^2$

$PQ^2 = 32 \text{ cm}^2$

PQ = 5.66 cm

(b) Calculate the area of the square $PQRS$. [1]

For a square, the area represents the side squared.

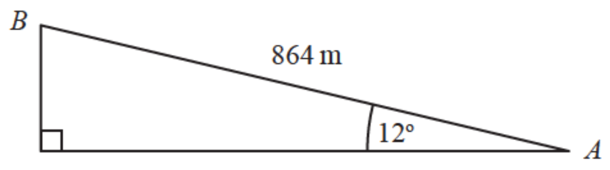
A_{square} = side^2

In our case, we know that PQ = 5.65 cm from a).

$A_{square} = 5.65^2\ cm^2$

$A_{square} = 32.0\ cm^2$

A mountain railway AB is of length 864 m and rises at an angle of 12° to the horizontal.
A train is 586 m above sea level when it is at A.
Calculate the height above sea level of the train when it reaches B. [3]



NOT TO SCALE

In a right-angled triangle:

sin a = $\frac{\text{opposite}}{\text{hypothenuse}}$

In our case:

sin 12° = $\frac{\text{h}}{\text{864 m}}$

Using a calculator, we work out that sin 12° = 0.207.

h = 864 m x 0.207

h = 180 m

Therefore, the height above sea level when the train reaches B is the height above sea level when the train reaches A plus the difference in height between the points A and B.

The height above sea level in B = 180 m + 586 m

The height above sea level in B = 766 m

2D Pythagoras & SOHCAHTOA
Difficulty: Hard

Model Answers 1

Level	IGCSE
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Exam Board	CIE
Topic	Trigonometry
Sub-Topic	2D Pythagoras & SOHCAHTOA
Paper	Paper 2
Difficulty	Hard
Booklet	Model Answers 1

Time allowed: **32 minutes**

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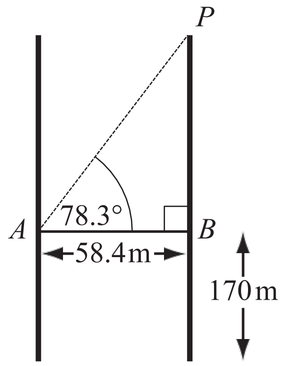
9	8	7	6	5	4	3
>94%	85%	77%	67%	57%	47%	35%



The line AB represents the glass walkway between the Petronas Towers in Kuala Lumpur.
The walkway is 58.4 metres long and is 170 metres above the ground.
The angle of elevation of the point P from A is 78.3°.

Calculate the height of P above the ground. [3]

Use the trigonometric relation

$$\tan\theta = \frac{opp}{adj}$$

to find BP as

$$\tan 78.3 = \frac{BP}{58.4}$$

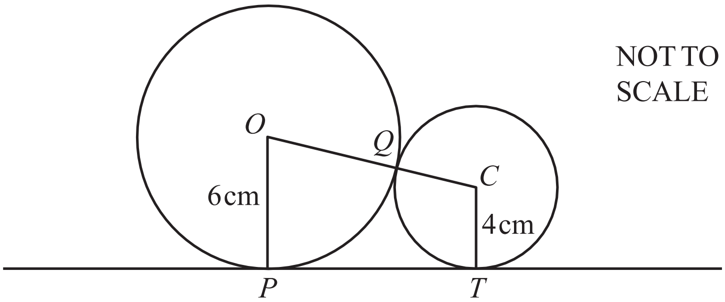
$$\rightarrow BP = 58.4 \tan 78.3$$

$$= 282$$

Hence the height is

$$282 + 170$$

$$= \mathbf{452}$$



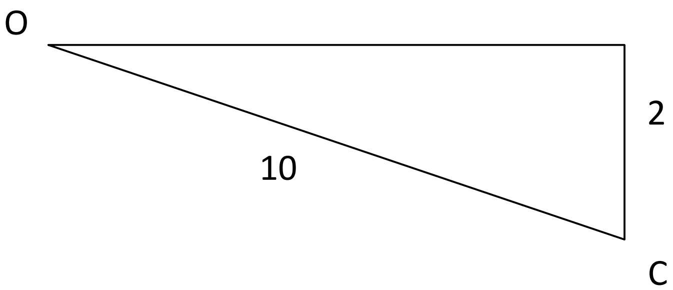
Two circles, centres O and C, of radius 6 cm and 4 cm respectively, touch at Q.
PT is a tangent to both circles.

(a) Write down the distance OC. [1]

$6 + 4$

$= \mathbf{10}$

(b) Calculate the distance PT. [3]



We consider the above triangle.

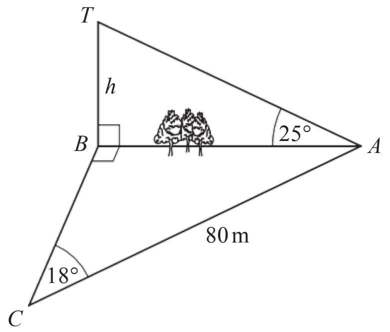
We use Pythagoras' to find PT as

$$PT^2 + 2^2 = 10^2$$

$$\rightarrow PT^2 = 100 - 4$$

$$= 96$$

$$\rightarrow \boldsymbol{PT = 9.80}$$



Mahmoud is working out the height, h metres, of a tower BT which stands on level ground.
He measures the angle TAB as 25°.
He cannot measure the distance AB and so he walks 80 m from A to C, where angle ACB = 18° and angle ABC = 90°.

Calculate

(a) the distance AB, [2]

In the right-angled triangle ABC with AC as hypothenuse:

sin BCA = $\frac{BA}{\text{AC}}$

sin 18° = $\frac{BA}{80\text{ m}}$

BA = 24.72 m

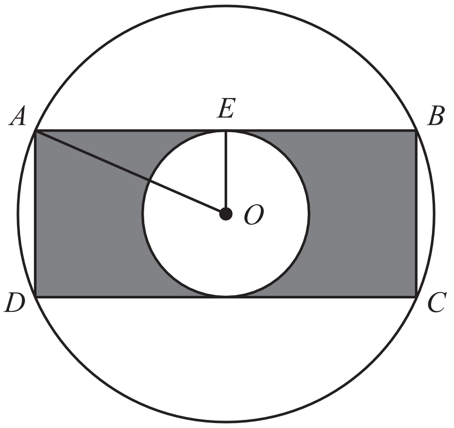
(b) the height of the tower, BT. [2]

In the right-angled triangle BTA with AT as hypothenuse:

tan TAB = $\frac{h}{\text{AB}}$

tan 15° = $\frac{h}{24.7\text{ m}}$

h = 11.5 m



NOT TO SCALE

A, B, C and D lie on a circle, centre O, radius 8 cm.
AB and CD are tangents to a circle, centre O, radius 4 cm.
$ABCD$ is a rectangle.

(a) Calculate the distance AE. [2]

In the right-angled triangle AOE, the side AO = 8 cm and OE = 4 cm.

Using the Pythagoras' Theorem, we can work out the length of the side AE.

$AE^2 + OE^2 = AO^2$

$AE^2 = 8^2 - 4^2$

$AE^2 = 64 – 16$

$AE^2 = 48$

AE = 6.93 cm

(b) Calculate the shaded area. [3]

The shaded area in the diagram represents the area of the rectangle minus the area of the small circle.

The formula for the area of the rectangle is:

A = length x width

In our case, the length is the side AB and the width is the side AD.

The side AD is equal to the diameter or the small circle, size which is double the radius OE.

AD = 4 cm x 2

AD = 8 cm

The length AB is double the side AE.

AB = 6.93 cm x 2

AB = 13.86 cm

Therefore, the area of the rectangle is:

$A_{rectangle}$ = 13.86 cm x 8 cm

$A_{rectangle}$ = 110.88 cm^2

The formula for the area of the circle is:

$A = \pi r^2$

The radius of the small circle is OE = 4 cm.

$A_{circle} = \pi 4^2 \ cm^2$

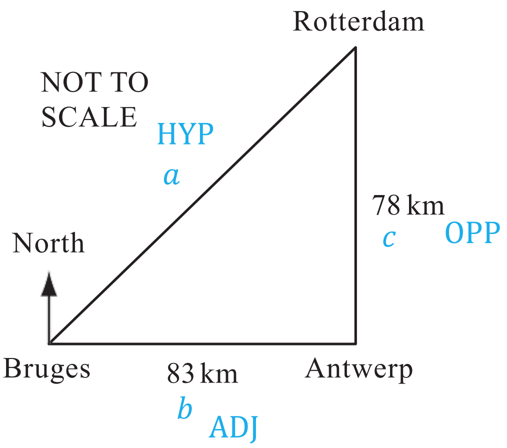
A_{circle} = 50.26 cm^2

The area of the shaded area is:

$A = A_{rectangle} - A_{circle}$

A = 110.88 cm^2 – 50.26 cm^2

A = 60.6 cm^2



Antwerp is 78 km due South of Rotterdam and 83 km due East of Bruges, as shown in the diagram.

Calculate

(a) the distance between Bruges and Rotterdam, [2]

This is a right angled triangle so we use Pythagoras' Theorem:

$$a^2 = b^2 + c^2$$

$$BR^2 = 83^2 + 78^2$$

$$BR = \sqrt{83^2 + 78^2}$$

$$\boldsymbol{BR = 114\ \textbf{km}} \text{ (to nearest km)}$$

(b) the bearing of Rotterdam from Bruges, correct to the nearest degree. [3]

Use SOHCAHTOA to find angle RBA:

$$\tan RBA = \frac{\text{OPP}}{\text{ADJ}}$$

$$\tan RBA = \frac{78}{83}$$

$$RBA = \tan^{-1}\left(\frac{78}{83}\right)$$

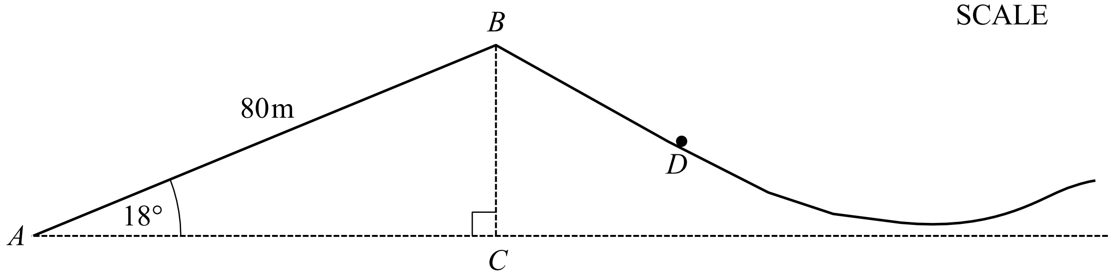
$$RBA = 43° \text{ (to nearest degree)}$$

Bearings are measured clockwise from the North line so

subtract RBA from $90°$ and give as a three figure bearing

$$90 - 43 = 47$$

so **Bearing** $= \mathbf{047°}$



The diagram shows the start of a roller-coaster ride at a fairground.
A car rises from A to B along a straight track.

(a) $AB = 80$ metres and angle $BAC = 18°$.
Calculate the vertical height of B above A. [2]

The vertical height of B above A is the height BC.

In the right-angled triangle with the hypothenuse AB:

$\sin 18° = \frac{\text{BC}}{80 \text{ m}}$

BC = 80 m x 0.309

BC = 24.7 m

(b) The car runs down the slope from B to D, a distance of s metres.
Use the formula $s = t(p + qt)$ to find the value of s, given that $p = 4$, $t = 3$ and $q = 3.8$. [2]

s = t(p + qt)

s = 3(4 + 3.8 x 3)

s = 46.2

Sine & Cosine Rules
Difficulty: Easy

Model Answers 1

Level	IGCSE
Subject	Maths (0580/0980)
Exam Board	CIE
Topic	Trigonometry
Sub-Topic	Sine & Cosine Rules
Paper	Paper 2
Difficulty	Easy
Booklet	Model Answers 1

Time allowed: **26 minutes**

Score: **/20**

Percentage: **/100**

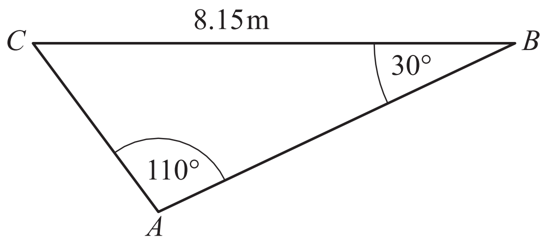
Grade Boundaries:

CIE IGCSE Maths (0580)

A*	A	B	C	D	E
>88%	76%	63%	51%	40%	30%

CIE IGCSE Maths (0980)

9	8	7	6	5	4	3
>94%	85%	77%	67%	57%	47%	35%



NOT TO SCALE

Calculate AC. [3]

Use the sine rule

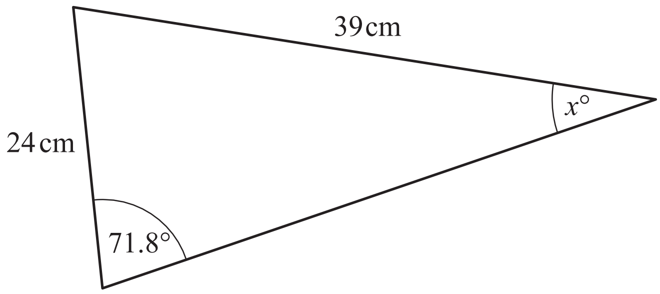
$$\frac{\sin A}{a} = \frac{\sin B}{b}$$

to write

$$\frac{\sin 110}{8.15} = \frac{\sin 30}{AC}$$

$$\rightarrow AC = \frac{8.15 \sin 30}{\sin 110}$$

$$= \mathbf{4.34}$$



NOT TO SCALE

Find the value of x. [3]

Use the sine rule

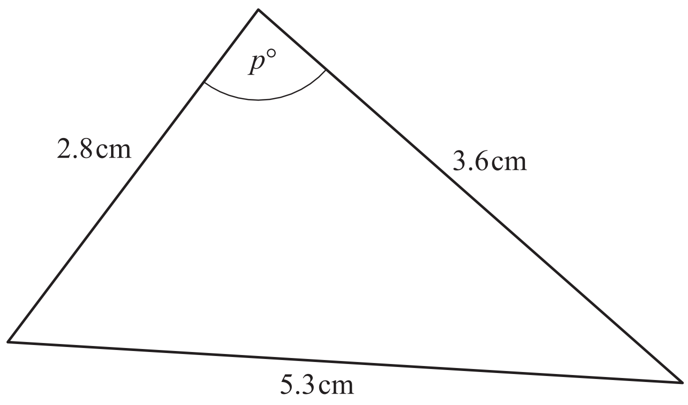
$$\frac{\sin A}{a} = \frac{\sin B}{b}$$

$$\rightarrow \frac{\sin 71.8}{39} = \frac{\sin x}{24}$$

$$\rightarrow \sin x = \frac{24 \sin 71.8}{39}$$

$$= 0.5846$$

$$\rightarrow \boldsymbol{x = 35.8}$$



NOT TO SCALE

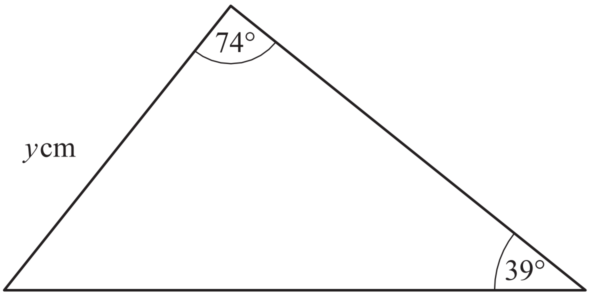
Find the value of p. [4]

Applying the cosine rule to this question, work out the angle A, where a=5.3, b=2.8 and c=3.6:

$$cosA = \left(\frac{b^2 + c^2 - a^2}{2\,bc}\right)$$

$$A = cos^{-1}\left(\frac{2.8^2 + 3.6^2 - 5.3^2}{2 \times 3.6 \times 2.8}\right)$$

$$A = 111.2°$$



Calculate the value of y. [3]

The value of y can be found using the sine rule.

$$\frac{y}{\sin(39°)} = \frac{12.4cm}{\sin(74°)}$$

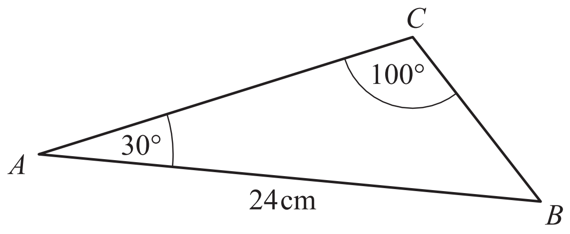
Multiply both sides of the equation by sin(39°)

$$y = \frac{12.4cm}{\sin(74°)} \times \sin(39°)$$

Use a calculator to work out the sine values.

$$y = \frac{12.4cm}{0.961} \times 0.629$$

$$y = \mathbf{8.12cm}$$



NOT TO SCALE

Use the sine rule to calculate BC. [3]

The size of BC can be found using the sine rule.

$$\frac{\text{BC}}{\sin(BAC)} = \frac{AB}{\sin(ACB)}$$

$$\frac{\text{BC}}{\sin(30°)} = \frac{24cm}{\sin(100°)}$$

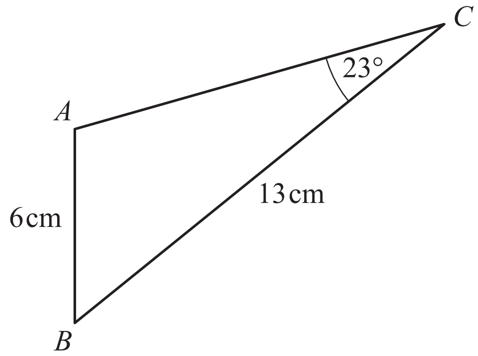
Multiply both sides of the equation by sin(30°)

$$BC = \frac{24cm}{\sin(100°)} \times \sin(30°)$$

Use a calculator

$$\text{BC} = \frac{24cm}{0.984} \times 0.5$$

$$\text{BC} = \mathbf{12.2cm}$$



NOT TO SCALE

In triangle ABC, $AB = 6$ cm, $BC = 13$ cm and angle $ACB = 23°$.
Calculate angle BAC, which is obtuse. [4]

Use the sine rule

$$\frac{\sin A}{a} = \frac{\sin B}{b}$$

Where angle A and side a are opposite one another (and the same for B and b)

$$\rightarrow \frac{\sin 23}{6} = \frac{\sin BAC}{13}$$

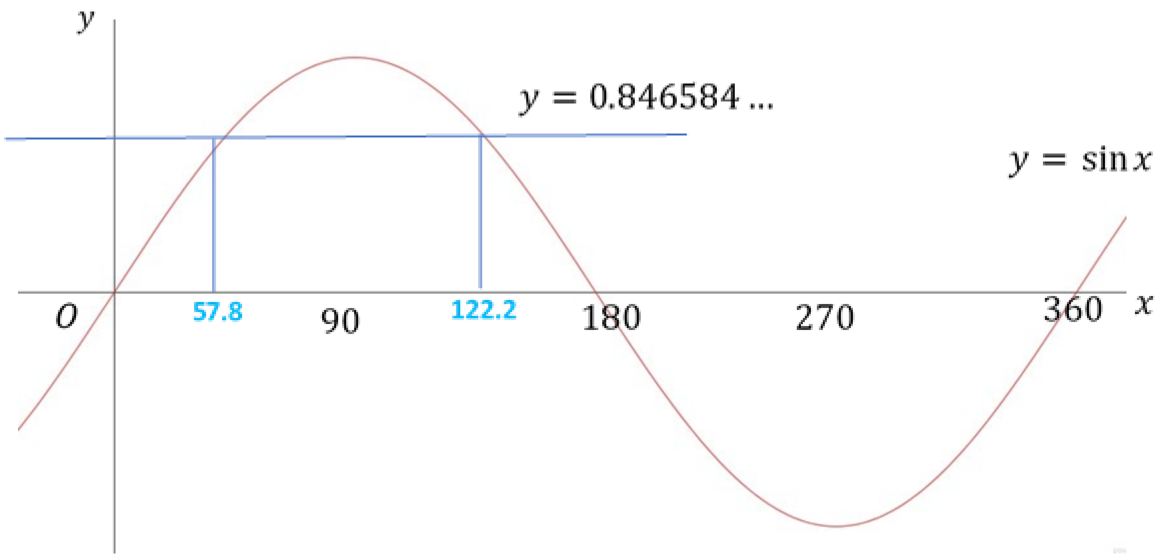
$$\rightarrow \sin BAC = \frac{13 \sin 23}{6}$$

$$= 0.846584..$$

$$\rightarrow BAC = \sin^{-1} 0.846584 \ldots$$

$$= 57.8$$

Our angle is *obtuse,* so it must be greater than 90˚. We can use the graph below to see that there are two solutions, one that we have found, and one that is greater than 90 and hence the real solution.



Find the real solution as

$$180 - 57.8$$

$$= \mathbf{122.2}$$

Sine & Cosine Rules
Difficulty: Hard

Model Answers 1

Level	IGCSE
Subject	Maths (0580/0980)
Exam Board	CIE
Topic	Trigonometry
Sub-Topic	Sine & Cosine Rules
Paper	Paper 2
Difficulty	Hard
Booklet	Model Answers 1

Time allowed: **36 minutes**

Score: **/28**

Percentage: **/100**

Grade Boundaries:

CIE IGCSE Maths (0580)

A*	A	B	C	D	E
>88%	76%	63%	51%	40%	30%

CIE IGCSE Maths (0980)

9	8	7	6	5	4	3
>94%	85%	77%	67%	57%	47%	35%

A triangle has sides of length 2 cm, 8 cm and 9 cm.

Calculate the value of the largest angle in this triangle. [4]

We can use the cosine rule to work out the largest angle in the triangle. The largest angle would be opposite the largest side, in this case 9 cm.

Cosine rule:

$a^2 = b^2 + c^2 - 2bc \cos A$

In our case, a = 9 cm, b = 8 cm, c = 2 cm and angle A is the one we want to work out.

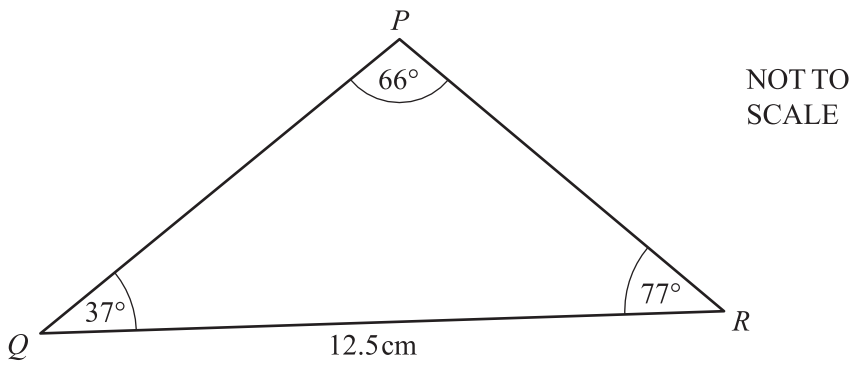
$9^2 = 8^2 + 2^2 - 2 \times 8 \times 2 \times \cos A$

$81 = 68 - 32 \times \cos A$

$\cos A = \frac{68-81}{32}$

$\cos A = -0.406$

$A = 113.9°$



Calculate PR. [3]

Sine rule is

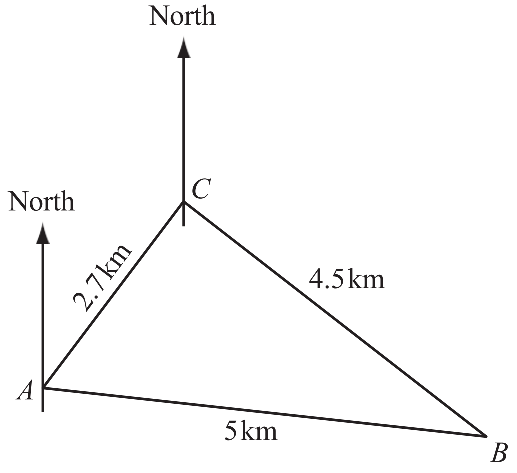
$$\frac{\sin A}{a} = \frac{\sin B}{b}$$

Hence

$$\frac{PR}{\sin 37} = \frac{12.5}{\sin 66}$$

$$\rightarrow PR = \frac{12.5 \sin 37}{\sin 66}$$

$$= \mathbf{8.23}$$



NOT TO SCALE

The diagram shows 3 ships *A*, *B* and *C* at sea.

$AB = 5$ km, $BC = 4.5$ km and $AC = 2.7$ km.

(a) Calculate angle *ACB*.
Show all your working. [4]

We know the size of all 3 sides in the triangle ABC, therefore, we can

use cosine rule to work out cos ACB and then the size of the angle ACB.

Cosine rule:

$$a^2 = b^2 + c^2 - 2bc \times \cos A$$

where a = AB, cos A = cos ACB, b = AC and c = CB.

We substitute the values that we know and make cos A the subject of the equation.

$$\cos ACB = \frac{2.7^2 + 4.5^2 - 5^2}{2 \times 2.7 \times 4.5}$$

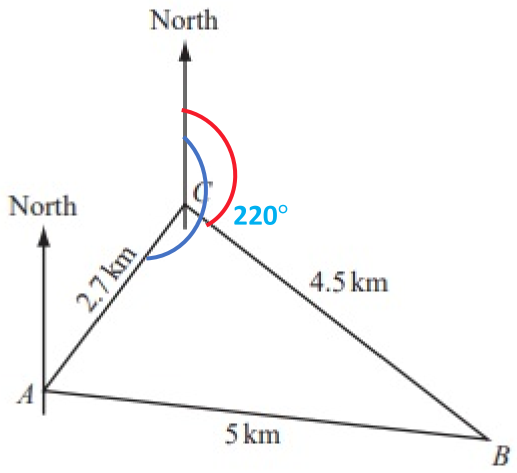
$$\cos ACB = \frac{2.54}{24.3}$$

$$\cos ACB = 0.104$$

angle ACB = 84°

(b) The bearing of A from C is $220°$.

Calculate the bearing of B from C. [1]



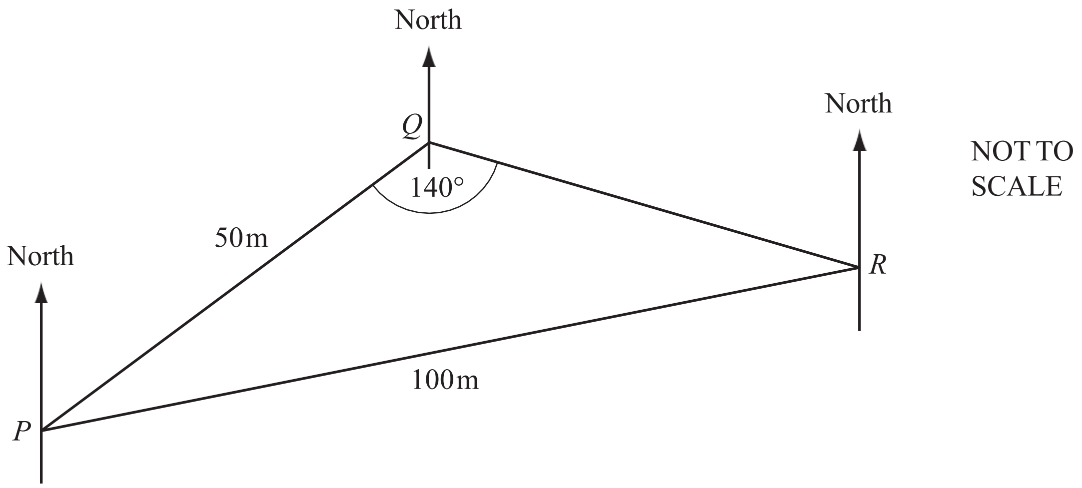
The bearing of A from C is represented in blue on the diagram above, measuring 220°.

The bearing of B from C is represented in red on the diagram above.

By looking at the diagram, we can observe that the bearing of B from C is equal to the bearing of A from C minus the angle ACB.

From a), we know that angle ACB = 84°.

Bearing of B from C = 220° - 84° = 136°



The diagram shows three points P, Q and R on horizontal ground.

$PQ = 50$ m, $PR = 100$ m and angle $PQR = 140°$.

(a) Calculate angle PRQ. [3]

Using the sine rule

$$\frac{\sin A}{a} = \frac{\sin B}{b}$$

(where angle A and side a are opposite one another)

we have

$$\frac{\sin 140}{100} = \frac{\sin PRQ}{50}$$

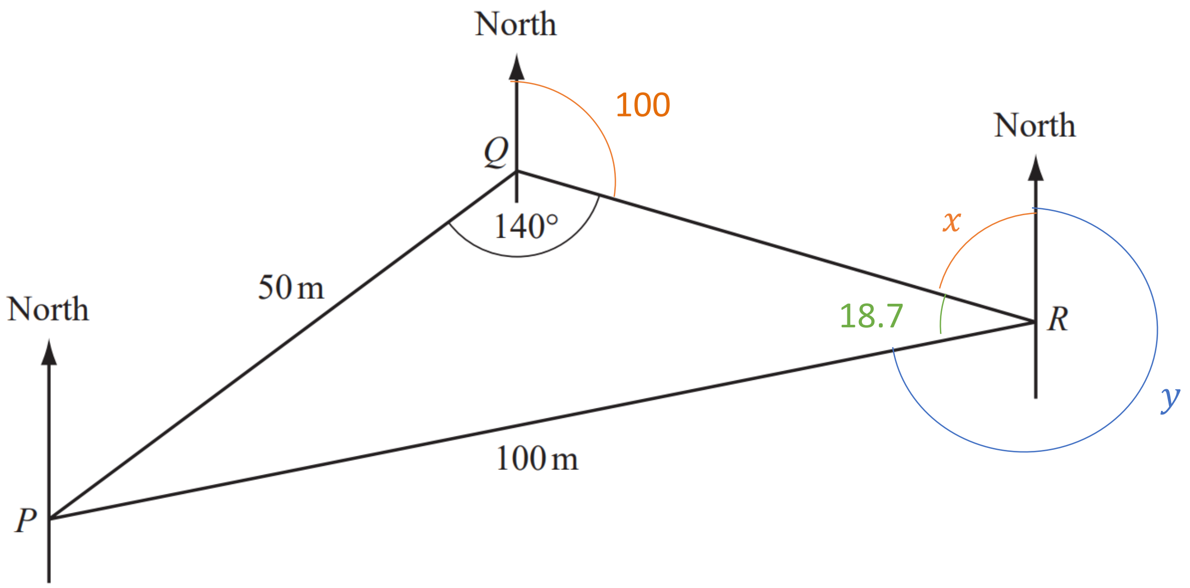
$$\rightarrow \sin PRQ = \frac{50 \sin 140}{100}$$

$$= 0.32$$

$$\rightarrow \boldsymbol{PRQ = 18.7}$$

(b) The bearing of R from Q is 100°.

Find the bearing of P from R. [2]



We need to find the angle y.

Firstly, we have that

$$100 + x = 180$$

$$\rightarrow \boldsymbol{x = 80}$$

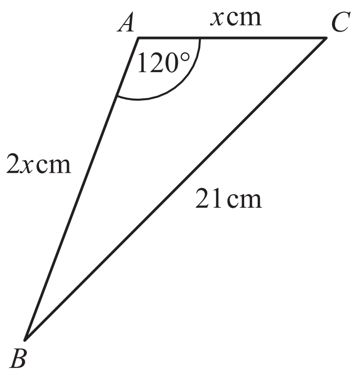
Now we have that

$$x + y + 18.7 = 360$$

$$\rightarrow y + 80 + 18.7 = 360$$

$$\rightarrow \boldsymbol{y = 261.3}$$

NOT TO SCALE



In triangle ABC, $AB = 2x$ cm, $AC = x$ cm, $BC = 21$ cm and angle $BAC = 120°$.
Calculate the value of x. [3]

Using the cosine rule

$$\boldsymbol{a^2 = b^2 + c^2 - 2bc\cos A}$$

we have

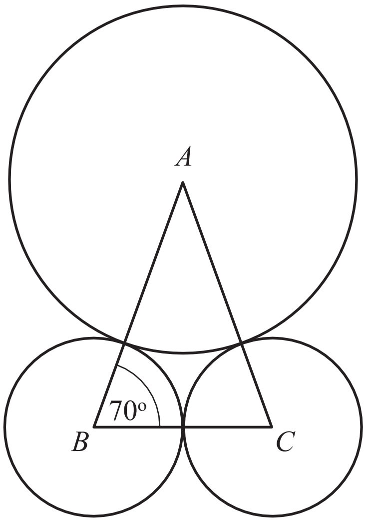
$$21^2 = x^2 + (2x)^2 - 2(2x)(x)\cos 120$$

$$\rightarrow 441 = 5x^2 - 4x^2\left(-\frac{1}{2}\right)$$

$$\rightarrow 441 = 7x^2$$

$$\rightarrow x^2 = \frac{441}{7}$$

$$\rightarrow \boldsymbol{x = \pm 7.94}$$



NOT TO SCALE

The diagram shows three touching circles.
A is the centre of a circle of radius x centimetres.
B and C are the centres of circles of radius 3.8 centimetres. Angle $ABC = 70°$.
Find the value of x. [3]

The circles are touching, therefore, we can deduce that:

AB = AC = x + 3.8 cm

Similarly,

BC = 3.8 cm x 2 = 7.6 cm

In the triangle ABC we ca use the sine rule to work out the size of AB = AC.

Sine rule:

$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

Where a is a side in the triangle and A is the angle opposite side a.

In our case, we can write this as:

$$\frac{AC}{\sin 70°} = \frac{7.6\ cm}{\sin BAC}$$

AB = AC, therefore the triangle is isosceles.

We can calculate angle BAC as:

Angle BAC = 180

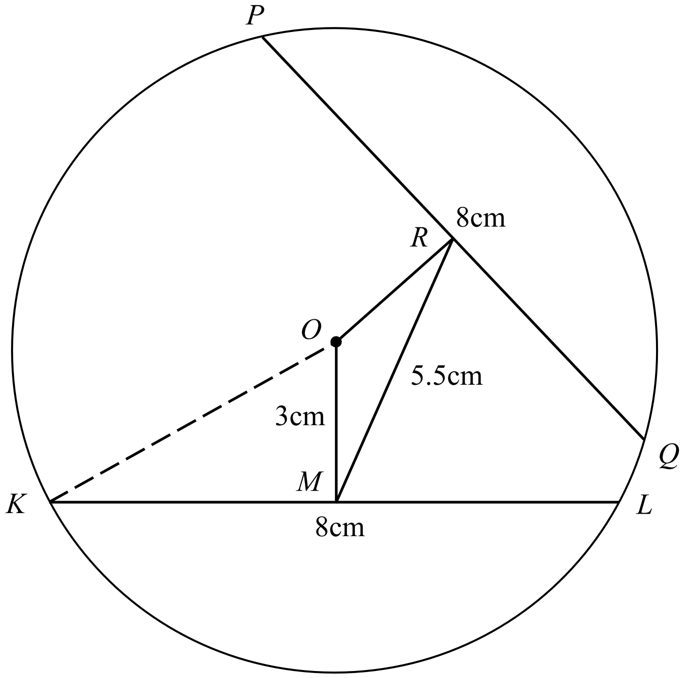
Angle BAC = 180 - 2 x 70 = 40

Using Sine Rule:

AC/Sin 70 = 7.6/sin40

AC = 11.1104...

x = 11.11 - 3.8 = 7.3



In the circle, centre O, the chords KL and PQ are each of length 8 cm.
M is the mid-point of KL and R is the mid-point of PQ. $OM = 3$ cm.

(a) Calculate the length of OK. [2]

OM is perpendicular on the chord KL.

In the right-angled triangle OMK with OM perpendicular

on MK we can use Pythagoras' Theorem:

$OM^2 + KM^2 = OK^2$

$OK = \sqrt{3^2 + 4^2}$

OK = 5 cm

(b) *RM* has a length of 5.5 cm. Calculate angle *ROM*. [3]

The 2 chords are equal, therefore, OM and OR are also equal and perpendicular on the 2 chords.

OM = OR = 3 cm

In the triangle OMR we can use the cosine rule to work out the size of the angle ROM.

We can use the cosine rule to work out the size of x

Cosine rule:

$a^2 = b^2 + c^2 - 2bc \cos A$

where a, b and c are sides in the triangle and A is the angle opposite side a.

In our case:

$5.5^2 = 3^2 + 3^2 - 2 \times 3 \times 3 \times \cos ROM$

x = 133°

Area of a Triangle
Difficulty: Easy

Model Answers 1

Level	IGCSE
Subject	Maths (0580/0980)
Exam Board	CIE
Topic	Trigonometry
Sub-Topic	Area of a Triangle
Paper	Paper 2
Difficulty	Easy
Booklet	Model Answers 1

Time allowed: **23 minutes**

Score: **/18**

Percentage: **/100**

Grade Boundaries:

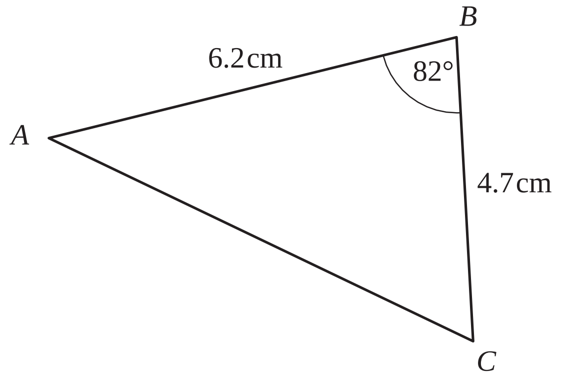
CIE IGCSE Maths (0580)

A*	A	B	C	D	E
>88%	76%	63%	51%	40%	30%

CIE IGCSE Maths (0980)

9	8	7	6	5	4	3
>94%	85%	77%	67%	57%	47%	35%

(a)



NOT TO SCALE

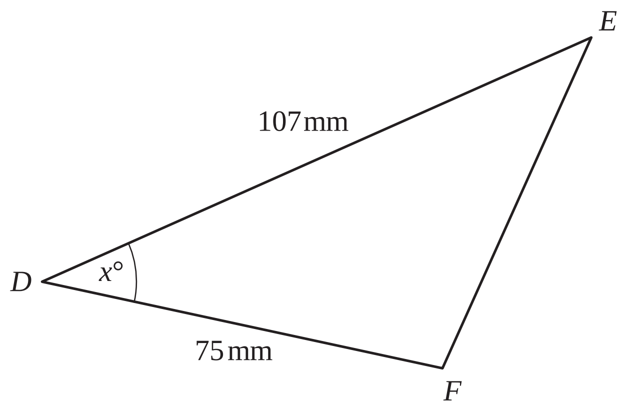
Calculate the area of triangle ABC. [2]

Area $= \frac{1}{2} ac\sin B$

Area $= \frac{1}{2} \times 4.7 \times 6.2 \times \sin 82$

Area $= \mathbf{14.4}$ cm² (to 3 significant figures)

(b)



NOT TO SCALE

The area of triangle DEF is 2050 mm^2.

Work out the value of x. [2]

Area $= \frac{1}{2} efc\sin D$

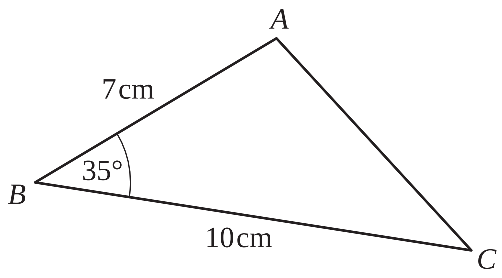
$2050 = \frac{1}{2} \times 75 \times 107 \times \sin x$

Divide to get $\sin x$ on its own and then use

$x = \sin^{-1}\left(\frac{2050}{\frac{1}{2}\times 75\times 107}\right)$

$\sin^{-1}$ (Shift sin) on a calculator

$\boldsymbol{x = 30.7°}$ (to 1 decimal place)



NOT TO SCALE

(a) Calculate the area of triangle ABC. [2]

Area of a triangle is

$$A = \frac{1}{2}ab\sin C$$

$$A = \frac{1}{2} \times 7 \times 10 \times \sin 35$$

$$A = \underline{\mathbf{20.1}}\ (3sf)$$

(b) Calculate the length of AC. [4]

Using the cosine rule

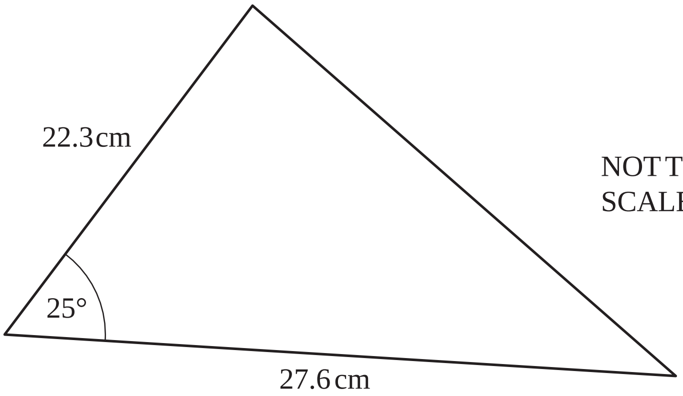
$$c^2 = a^2 + b^2 - 2ab\cos C$$

$$c^2 = 100 + 49 - 140\cos 35$$

$$c^2 = 34.3$$

$$c = \sqrt{34.3}$$

$$c = \underline{\mathbf{5.86}}\ (3sf)$$

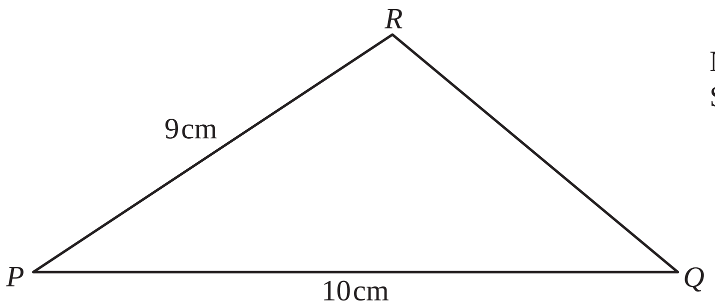


Calculate the area of this triangle. [2]

Use the equation, area = $\frac{1}{2}absinC$, where a and b are lengths of two of the sides of a triangle, and C is the angle formed at the point the two side meet:

$$\frac{1}{2} \times 22.3 \times 27.6 \times \sin(25)$$

$$= 130cm^2$$



NOT TO SCALE

The area of triangle PQR is 38.5cm^2.

Calculate the length QR. [6]

The area of a triangle PQR is given as:

$$Area = \frac{1}{2} PR \times PQ \times \sin(RPQ)$$

$$38.5\ cm^2 = \frac{1}{2}(9cm) \times (10cm) \times \sin(RPQ)$$

Divide both sides by $\frac{1}{2}(9cm) \times (10cm)$

$$\frac{38.5cm^2}{\frac{1}{2}(9cm) \times (10cm)} = \sin(RPQ)$$

Take arcsin of both sides to get the value of RPQ

$$angle\ RPQ = \arcsin\left(\frac{38.5}{0.5 \times 9 \times 10}\right)$$

$$angle\ RPQ = 58.8°$$

The length QR can be found using the cosine rule.

$$QR^2 = PR^2 + PQ^2 - 2 \times PR \times PQ \times \cos(RPQ)$$

$$QR^2 = (9cm)^2 + (10cm)^2 - 2 \times (9cm) \times (10cm) \times \cos(58.8°)$$

$$QR^2 = (81 + 100 - 93.19)cm^2$$

$$QR^2 = 87.81\ cm^2$$

Take square root of both sides to get the final answer:

$$\boldsymbol{QR = 9.37\ cm}$$

Area of a Triangle
Difficulty: Hard

Model Answers 1

Level	IGCSE
Subject	Maths (0580/0980)
Exam Board	CIE
Topic	Trigonometry
Sub-Topic	Area of a Triangle
Paper	Paper 2
Difficulty	Hard
Booklet	Model Answers 1

Time allowed: **21 minutes**

Score: **/16**

Percentage: **/100**

Grade Boundaries:

CIE IGCSE Maths (0580)

A*	A	B	C	D	E
>88%	76%	63%	51%	40%	30%

CIE IGCSE Maths (0980)

9	8	7	6	5	4	3
>94%	85%	77%	67%	57%	47%	35%

In a triangle PQR, $PQ = 8$ cm and $QR = 7$ cm.
The area of this triangle is $17\,\text{cm}^2$.

Calculate the two possible values of angle PQR. [3]

Area of a triangle is

$$A = \frac{1}{2}ab\sin C$$

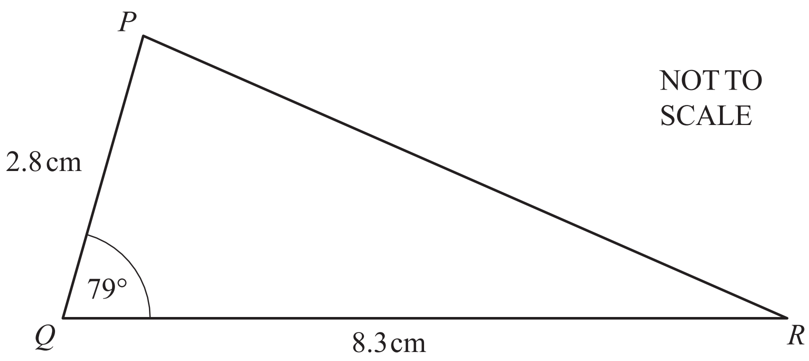
Hence

$$17 = \frac{1}{2}(8)(7)\sin PQR$$

$$\rightarrow \sin PQR = \frac{17}{28}$$

$$\rightarrow PQR = 37.4, \qquad 180 - 37.4$$

$$= \mathbf{37.4}, \qquad \mathbf{142.6}$$



(a) Calculate the area of triangle *PQR*. [2]

We know a formula to find the area of a triangle

$$Area\ of\ a\ triangle = \frac{1}{2} a\ b \sin(C)$$

$$Area = \frac{1}{2} \times 2.8 \times 8.3 \times \sin(79°)$$

We will plug this into our calculator

$$Area = 11.40650787 \ldots$$

$$\boldsymbol{Area = 11.4cm^2\ (3.s.f)}$$

(b) Triangle *PQR* is enlarged by scale factor 4.5 .

Calculate the area of the enlarged triangle. [2]

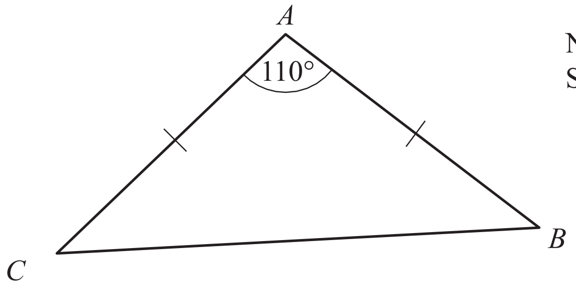
When a shape is enlarged by a scale factor k, the area is enlarged by the square of the scale factor, k^2.

$$Area\ of\ enlarged\ triangle = Area\ of\ initial\ triangle \times k^2$$

$$New\ area = 11.4 \times 4.5^2$$

$$New\ area = 230.9817844\ldots$$

$$\boldsymbol{New\ area = 231cm^2(3.s.f)}$$



Triangle ABC is isosceles with $AB = AC$.
Angle $BAC = 110°$ and the area of the triangle is $85\,\text{cm}^2$.

Calculate AC. [3]

The area of a triangle is:

$$A = \frac{1}{2}ab\sin C$$

Hence:

$$85 = \frac{1}{2}(AC)(AB)\sin 110$$

We know that $AC = AB$ so we can call that length x

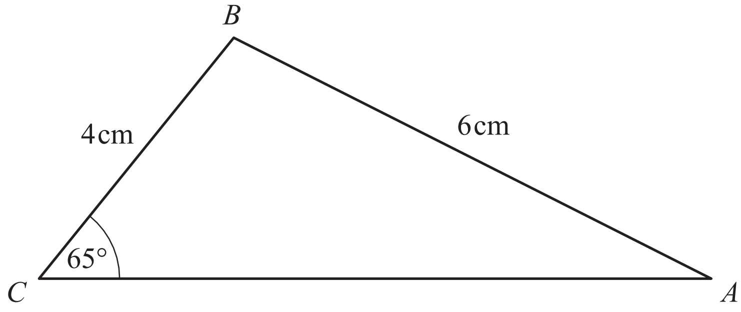
$$\rightarrow 85 = \frac{1}{2}x^2 \sin 110$$

Multiply through by 2 and divide through by sin 110

$$x^2 = \frac{170}{\sin 110}$$

$$= 180.91$$

$$\rightarrow \boldsymbol{x = 13.45}$$



NOT TO SCALE

In triangle ABC, $AB = 6$ cm, $BC = 4$ cm and angle $BCA = 65°$.

Calculate

(a) angle CAB, [3]

Using the Sine Rule,

$$\frac{6}{\sin(65)} = \frac{4}{\sin(CAB)}$$

$$\boldsymbol{Angle\ CAB = 37.2°}$$

(b) the area of triangle ABC. [3]

Do not mistake this as a right angled triangle.

Using angle sum of triangle,

$$Angle\ CBA = 180° - 65° - 37.2°$$

$$= 77.83°$$

Area of triangle:

$$\frac{1}{2}\ a\ b\ sin(c) = \frac{1}{2}(4)(6)\ sin(77.83)$$

$$\boldsymbol{= 11.73\ cm^2}$$

3D Pythagoras & SOHCAHTOA
Difficulty: Easy

Model Answers 1

Level	IGCSE
Subject	Maths (0580/0980)
Exam Board	CIE
Topic	Trigonometry
Sub-Topic	3D Pythagoras & SOHCAHTOA
Paper	Paper 2
Difficulty	Easy
Booklet	Model Answers 1

Time allowed: **31 minutes**

Score: **/24**

Percentage: **/100**

Grade Boundaries:

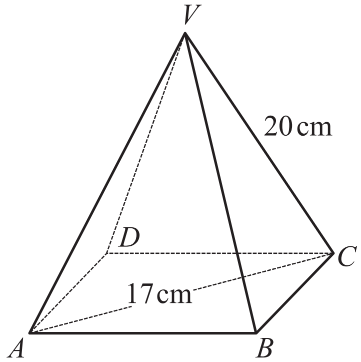
CIE IGCSE Maths (0580)

A*	A	B	C	D	E
>88%	76%	63%	51%	40%	30%

CIE IGCSE Maths (0980)

9	8	7	6	5	4	3
>94%	85%	77%	67%	57%	47%	35%

The diagram shows a pyramid with a square base $ABCD$.
All the sloping edges of the pyramid are 20 cm long and $AC = 17$ cm.

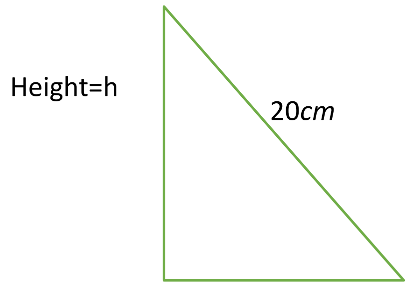


NOT TO SCALE

Calculate the height of the pyramid. [3]

We can draw a right-angled triangle from the very top of the pyramid to the base. This cuts the diagonal across the base in half. The triangle therefore looks like this:

Using Pythagorus, we can find the height:



$\frac{17}{2} = 8.5cccc$

$$a^2 = b^2 + c^2$$

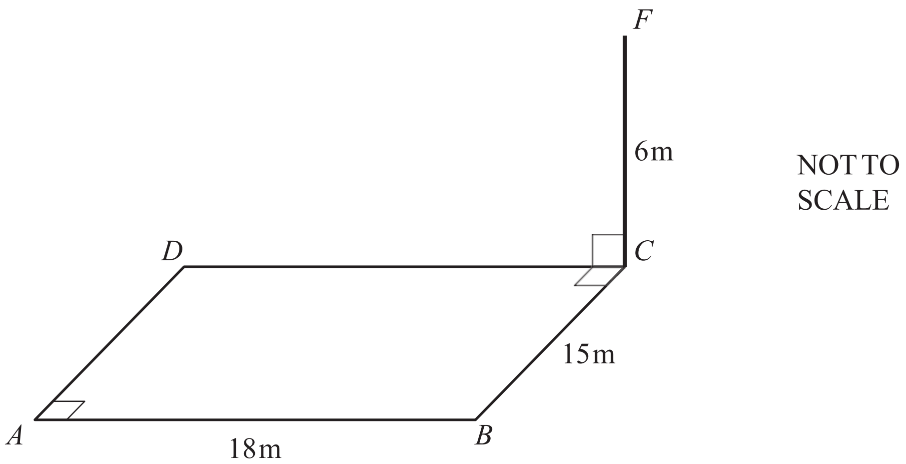
$$20^2 = 8.5^2 + h^2$$

$$h^2 = 20^2 - 8.5^2$$

$$h = \sqrt{20^2 - 8.5^2}$$

We can plug this into our calculator: $h = 18.1038 \ldots$

$$\boldsymbol{h = 18.1cm\ (3.s.f)}$$



The diagram shows a rectangular playground $ABCD$ on horizontal ground.
A vertical flagpole CF, 6 metres high, stands in corner C.
$AB = 18$ m and $BC = 15$ m.

Calculate the angle of elevation of F from A. [4]

In order to calculate the angle of elevation of F from A, we first need to calculate the length of AC. This is done using Pythagoras Theorem, since the angle ABC is a right angle triangle.

$$AC^2 = AB^2 + BC^2$$

$$AC^2 = 18^2 + 15^2$$

Take square root of both sides.

$$AC = \sqrt{324 + 225}\ m$$

$$AC = 23.43\ m$$

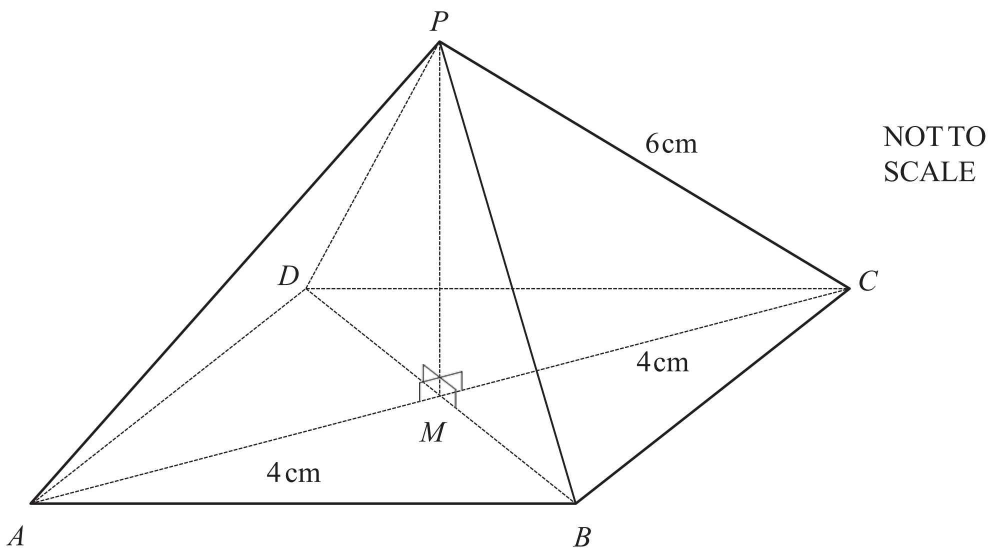
To get the angle of elevation (angle CAF), we use trigonometry. The angle ACF is a right angle triangle.

$$\tan CAF = \frac{CF}{AC}$$

$$\text{angle } CAF = \arctan\left(\frac{6}{23.43}\right)$$

$$\text{angle } CAF = \arcsin(0.256)$$

By using a calculator, we get the result: **angle (of elevation) CAF = 14.4° (1dp)**



The diagram shows a pyramid on a square base *ABCD* with diagonals, *AC* and *BD*, of length 8cm.
AC and *BD* meet at *M* and the vertex, *P*, of the pyramid is vertically above *M*.
The sloping edges of the pyramid are of length 6cm.

Calculate

(a) The perpendicular height, *PM*, of the pyramid, [3]

Use Pythagoras' Theorem

$$PM^2 = 6^2 - 4^2$$

$$= 20$$

$$\rightarrow PM = 2\sqrt{5}$$

$$\mathbf{4.47}$$

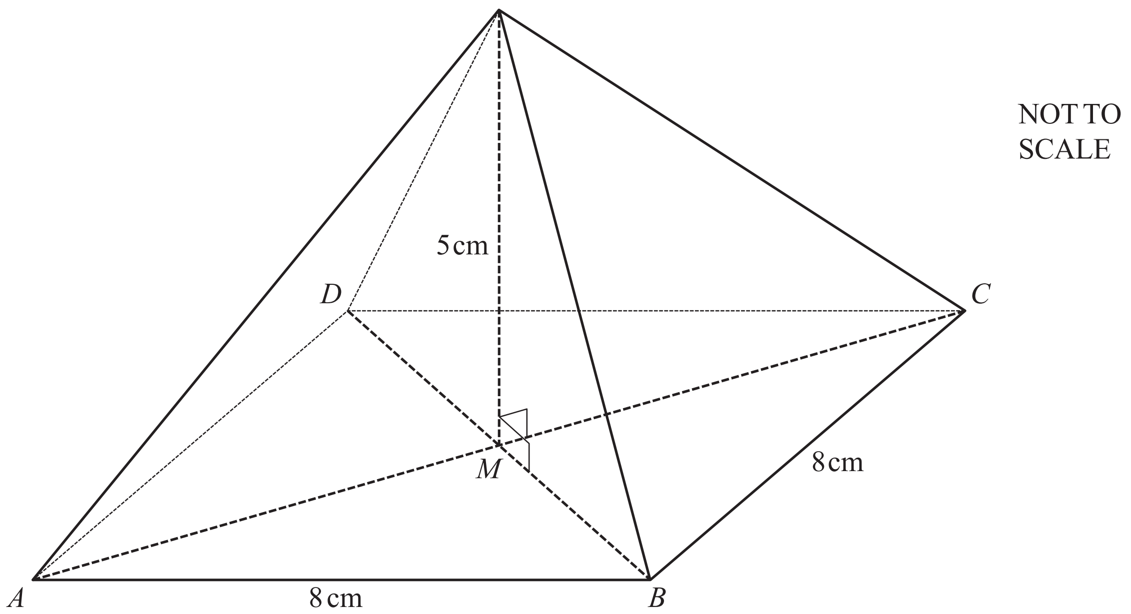
(b) The angle between a sloping edge and the base of the pyramid. [3]

Use the trigonometric relation

$$\boldsymbol{\cos\theta = \frac{adj}{hyp}}$$

$$\rightarrow \cos\theta = \frac{4}{6}$$

$$\rightarrow \boldsymbol{\theta = 48.2}$$



The diagram shows a pyramid on a square base $ABCD$.
The diagonals of the base, AC and BD, intersect at M.
The sides of the square are 8 cm and the vertical height of the pyramid, PM, is 5 cm.

Calculate

(a) the length of the edge PB, [3]

We first need to find length BM.

We have that

$$BM = AM = \frac{1}{2}AC$$

And we can find AC using Pythagoras'

$$AC^2 = 8^2 + 8^2$$

$$= 128$$

$$\rightarrow AC = 8\sqrt{2}$$

$$\rightarrow BM = 4\sqrt{2}$$

Hence, again using Pythagoras', we have

$$BM^2 + 5^2 = PB^2$$

$$\rightarrow PB^2 = 32 + 25$$

$$= 57$$

$$\rightarrow \boldsymbol{PB = 7.55}$$

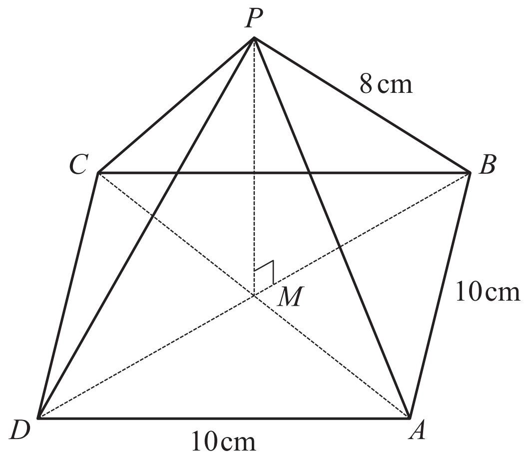
(b) the angle between PB and the base $ABCD$. [3]

Use the trigonometric relation

$$\tan\theta = \frac{opp}{adj}$$

$$\rightarrow \tan PBM = \frac{5}{4\sqrt{2}}$$

$$\rightarrow \boldsymbol{PBM = 41.5}$$



NOT TO SCALE

The diagram represents a pyramid with a square base of side 10 cm.

The diagonals AC and BD meet at M. P is vertically above M and PB = 8cm.

(a) Calculate the length of BD. [2]

We can use Pythagoras' whilst considering triangle DBA to find

$$DB^2 = 10^2 + 10^2$$

$$= 200$$

$$\rightarrow DB = 10\sqrt{2}$$

$$= \mathbf{14.1}$$

(b) Calculate MP, the height of the pyramid. [3]

We have that

$$BM = \frac{1}{2}BD$$

$$= 5\sqrt{2}$$

Now using Pythagoras' whilst considering triangle BMP, we have

$$8^2 = \left(5\sqrt{2}\right)^2 + PM^2$$

$$\rightarrow PM^2 = 64 - 50$$

$$= 14$$

$$\rightarrow \boldsymbol{PM = 3.74}$$

3D Pythagoras & SOHCAHTOA
Difficulty: Hard

Model Answers 1

Level	IGCSE
Subject	Maths (0580/0980)
Exam Board	CIE
Topic	Trigonometry
Sub-Topic	3D Pythagoras & SOHCAHTOA
Paper	Paper 2
Difficulty	Hard
Booklet	Model Answers 1

Time allowed: **30 minutes**

Score: **/23**

Percentage: **/100**

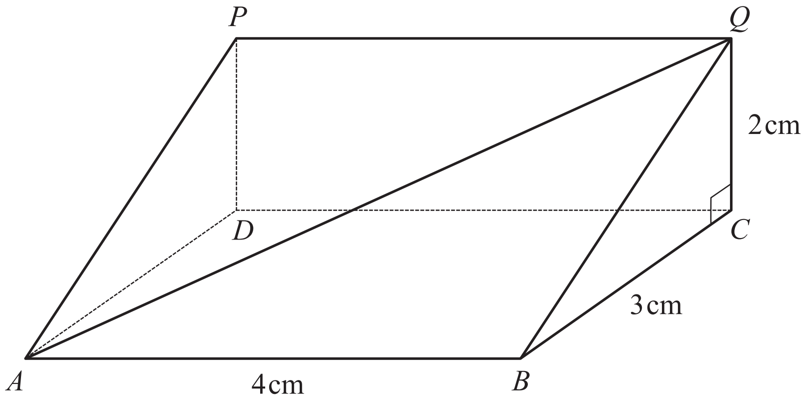
Grade Boundaries:

CIE IGCSE Maths (0580)

A*	A	B	C	D	E
>88%	76%	63%	51%	40%	30%

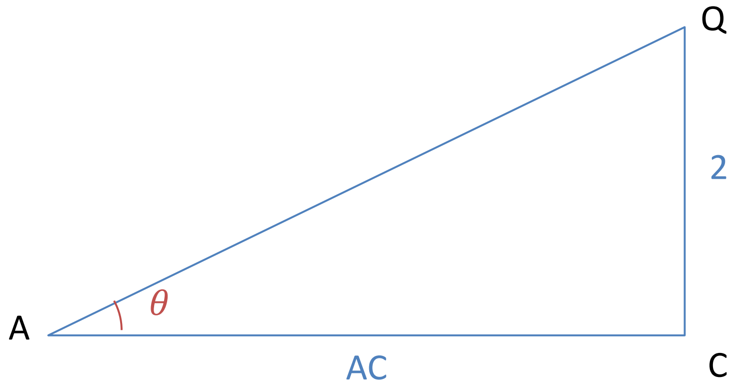
CIE IGCSE Maths (0980)

9	8	7	6	5	4	3
>94%	85%	77%	67%	57%	47%	35%



The diagram shows a prism of length 4 cm.
The cross section is a right-angled triangle.
$BC = 3$ cm and $CQ = 2$ cm.

Calculate the angle between the line AQ and the base, $ABCD$, of the prism. [4]



First, we find length AC using Pythagoras' Theorem

$$AC^2 = 4^2 + 3^2$$

$$= 25$$

$$\rightarrow AC = 5$$

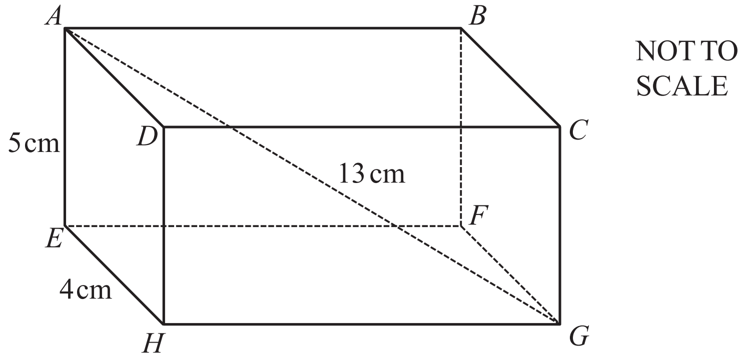
Now use the trigonometric ratio

$$\tan\theta = \frac{opp}{adj}$$

to find θ as

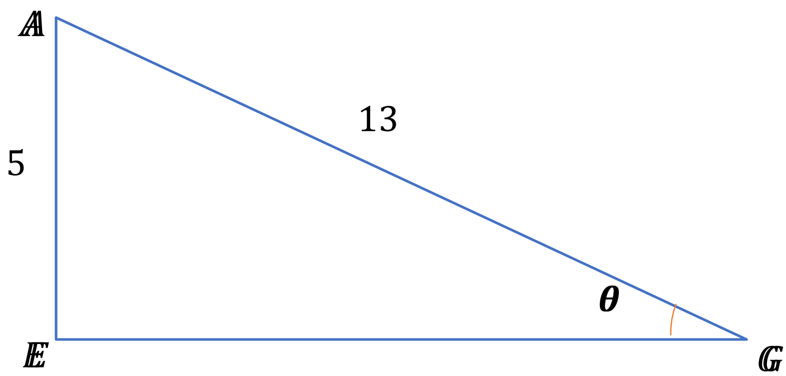
$$\theta = \tan^{-1}\frac{2}{5}$$

$$= \mathbf{21.8}$$



The diagram shows a cuboid *ABCDEFGH*.
$AE = 5$ cm, $EH = 4$ cm and $AG = 13$ cm.

Calculate the angle between the line *AG* and the base *EFGH* of the cuboid. [3]



Use the trigonometric relation

$$\sin\theta = \frac{opp}{hyp}$$

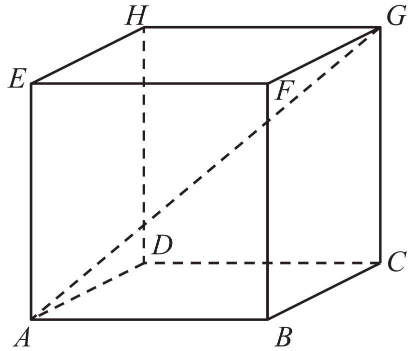
To write

$$\sin\theta = \frac{5}{13}$$

$$\rightarrow \theta = \sin^{-1}\frac{5}{13}$$

$$= \mathbf{22.6}$$

The diagram shows a cube *ABCDEFGH* of side length 26 cm.



NOT TO SCALE

Calculate the angle between *AG* and the base of the cube. [4]

. The length of AC is found with Pythagoras'

$$AC^2 = AB^2 + BC^2$$

$$= 2 \times 26^2$$

$$= 1352$$

$$\rightarrow AC = 26\sqrt{2}$$

The angle GAC is then found using the trigonometric relation

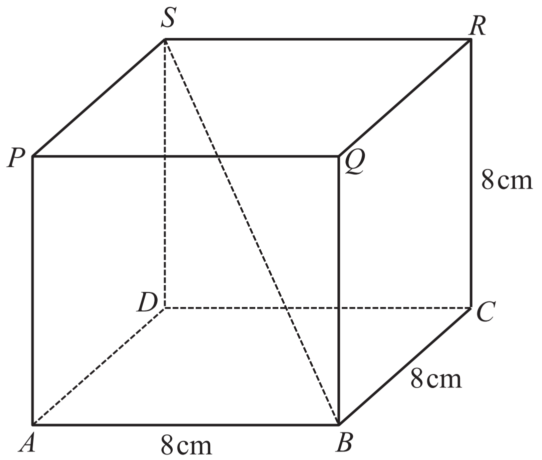
$$\tan\theta = \frac{opp}{adj}$$

$$\rightarrow \tan GAC = \frac{26}{26\sqrt{2}}$$

$$\rightarrow GAC = \tan^{-1}\frac{1}{\sqrt{2}}$$

$$\mathbf{= 35.3}$$

Question 4



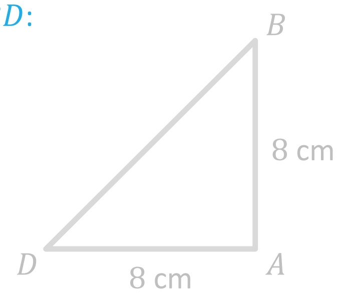
NOT TO SCALE

The diagram shows a cube of side length 8cm.

(a) Calculate the length of the diagonal BS.

[3]

Use Pythagoras Theorem in triangle ABD to find BD:

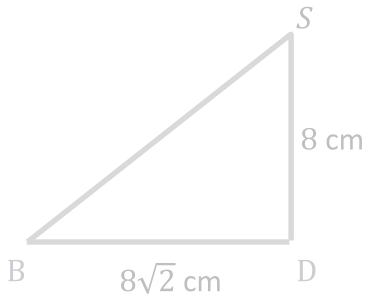


$$BD^2 = AB^2 + AD^2$$

$$BD^2 = 8^2 + 8^2 = 128$$

$$BD = \sqrt{128} = 8\sqrt{2}$$

And now use Pythagoras in triangle SBD to find SB:



$$SB^2 = BD^2 + SD^2$$

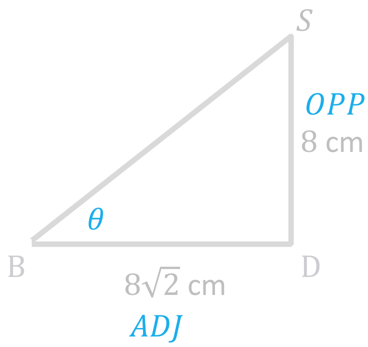
$$SB^2 = 128 + 8^2 = 192$$

$$\mathbf{SB = \sqrt{192} = 8\sqrt{3} = 13.9cm}$$

(b) Calculate angle SBD.

[2]

Use trigonometry (SOHCAHTOA) in triangle SBD:

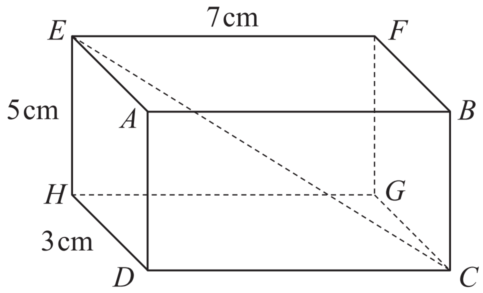


$$\tan\theta = \frac{OPP}{ADJ}$$

$$\tan(S\hat{B}D) = \frac{SD}{BD} = \frac{8}{8\sqrt{2}}$$

$$S\hat{B}D = \tan^{-1}\left(\frac{8}{8\sqrt{2}}\right)$$

$$\mathbf{S\hat{B}D = 35.3°}$$



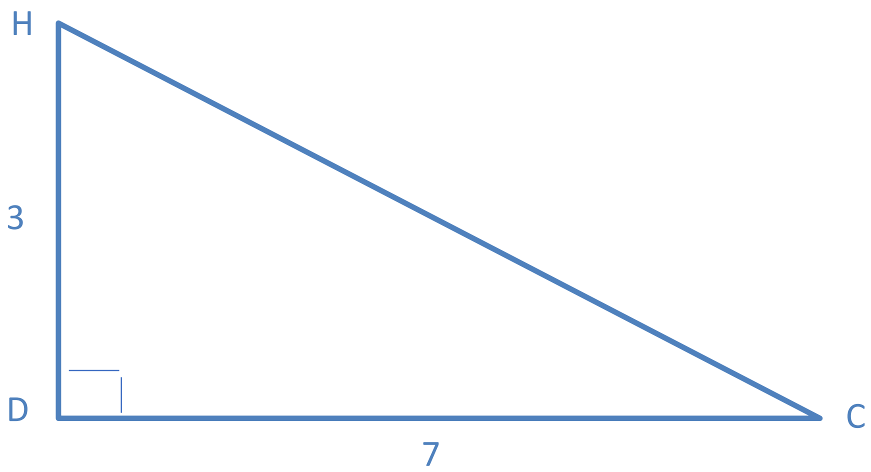
NOT TO SCALE

The diagram shows a cuboid.
$HD = 3$ cm, $EH = 5$ cm and $EF = 7$ cm.

Calculate

(a) the length CE, [4]

First consider triangle CHD



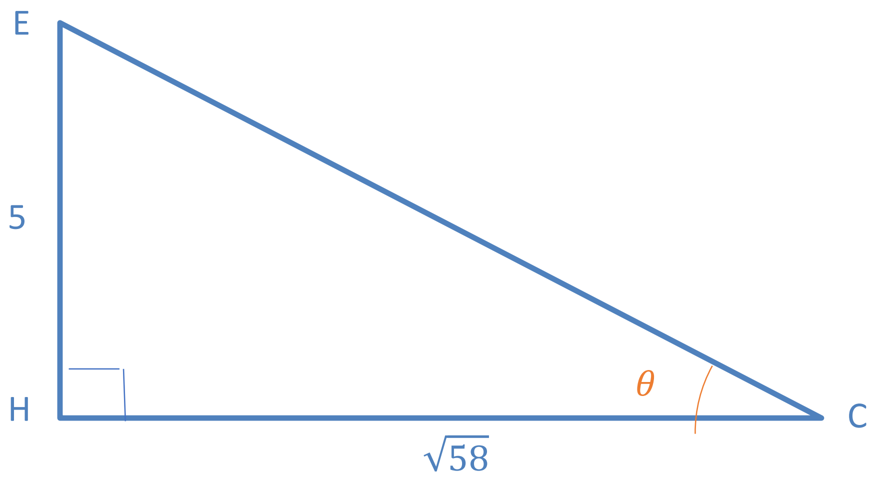
Calculate CH using Pythagoras'

$$CH^2 = 3^3 + 7^2$$

$$= 58$$

$$CH = \sqrt{58}$$

Now consider triangle CHE



Find CE using Pythagoras'

$$CE^2 = 58 + 5^2$$

$$= 83$$

$$CE = \sqrt{83}$$

$$= \mathbf{9.11}$$

(b) the angle between CE and the base $CDHG$. [3]

Considering triangle CHE again

We now ned to calculate angle θ. To do this we can use the tan relation

$$\tan\theta = \frac{opp}{adj}$$

Using our values

$$\tan\theta = \frac{5}{\sqrt{58}}$$

$$\theta = \tan^{-1}\frac{5}{\sqrt{58}}$$

$$= \mathbf{33.3}°$$

3D Pythagoras & SOHCAHTOA
Difficulty: Hard

Model Answers 2

Level	IGCSE
Subject	Maths (0580/0980)
Exam Board	CIE
Topic	Trigonometry
Sub-Topic	3D Pythagoras & SOHCAHTOA
Paper	Paper 2
Difficulty	Hard
Booklet	Model Answers 2

Time allowed: **28 minutes**

Score: **/22**

Percentage: **/100**

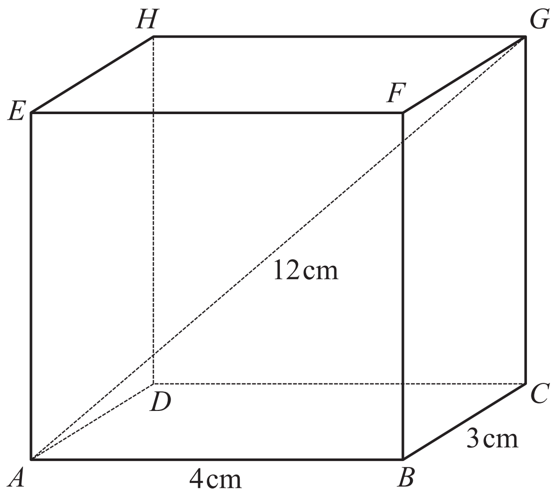
Grade Boundaries:

CIE IGCSE Maths (0580)

A*	A	B	C	D	E
>88%	76%	63%	51%	40%	30%

CIE IGCSE Maths (0980)

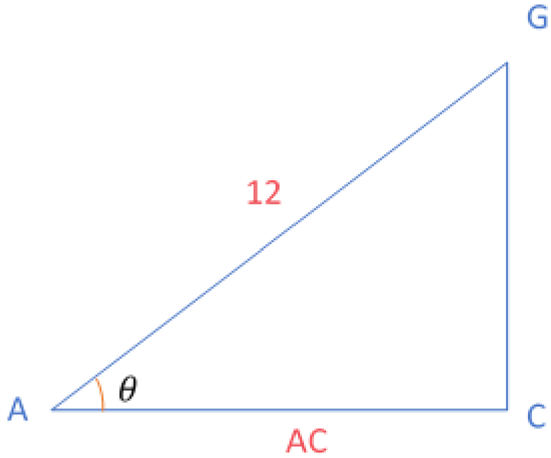
9	8	7	6	5	4	3
>94%	85%	77%	67%	57%	47%	35%



NOT TO SCALE

ABCDEFGH is a cuboid.
$AB = 4$ cm, $BC = 3$ cm and $AG = 12$ cm.

Calculate the angle that AG makes with the base $ABCD$. [4]



The length AC is found using Pythagoras'

$$AC^2 = 3^2 + 4^2$$

$$= 25$$

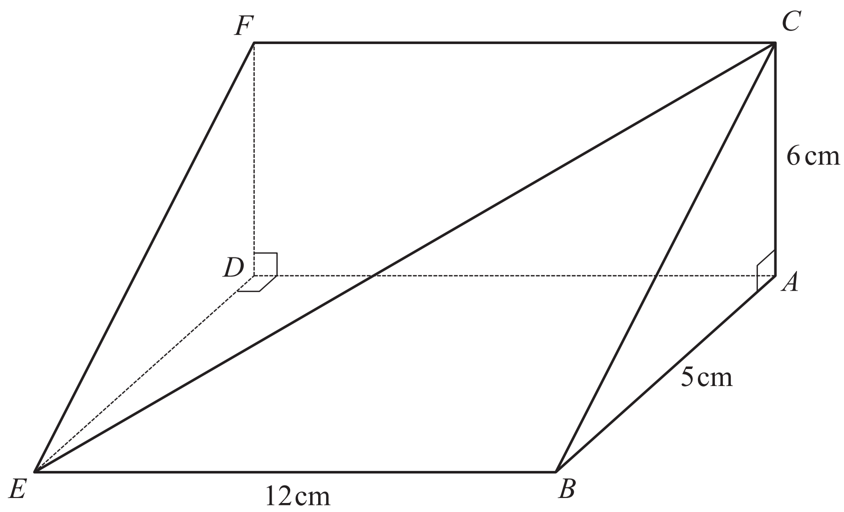
$$\rightarrow AC = 5$$

We then find the angle using the trigonometric relation

$$\boldsymbol{\cos\theta = \frac{adj}{hyp}}$$

$$\rightarrow \cos\theta = \frac{5}{12}$$

$$\boldsymbol{\rightarrow \theta = 65.4}$$

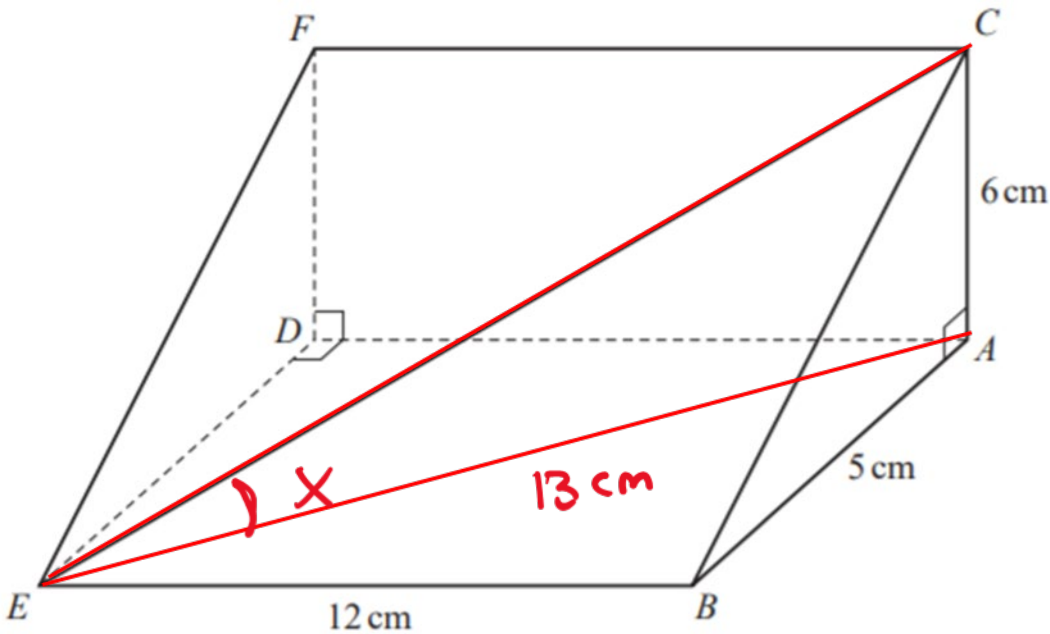


NOT TO SCALE

The diagram shows a triangular prism of length 12 cm.
Triangle ABC is a cross section of the prism.
Angle $BAC = 90°$, $AC = 6$ cm and $AB = 5$ cm.

Calculate the angle between the line CE and the base $ABED$. [4]

Here we want to find the angle between the base and the line CE – this is easiest represented by the angle AEC. We will call this angle x.



We can see that the red line at the base (AE) creates a right angle triangle with the lines EB and BA. We can find the length of the line AE using Pythagoras' theorem:

$a^2 = b^2 + c^2$

$$AE^2 = 12^2 + 5^2 = 169$$

$$AE = \sqrt{169} = 13$$

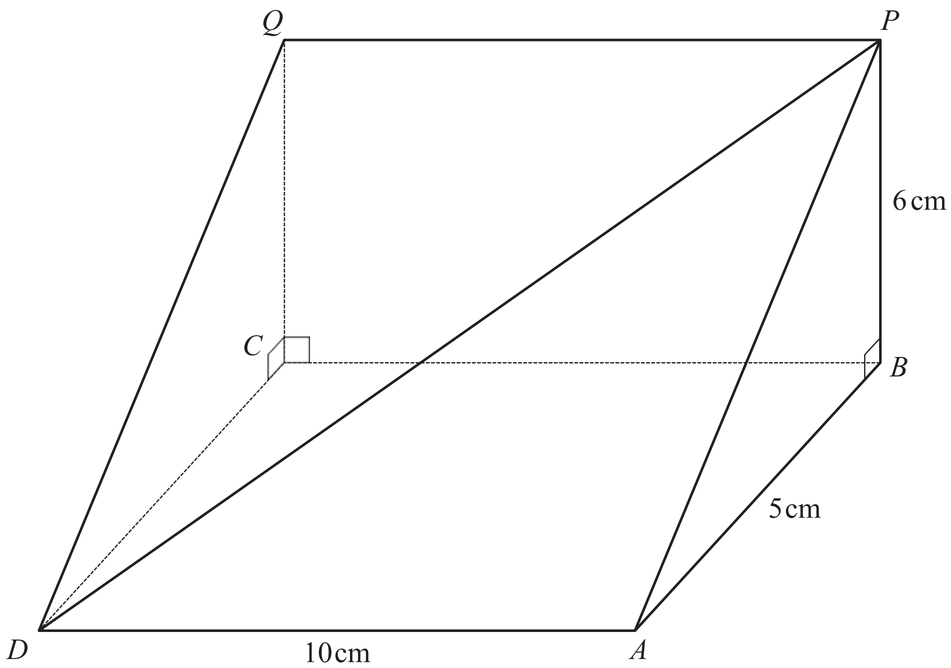
We can then use trigonometry to find x. We have the adjacent line, AE, and the opposite, AC. Hence, we use $\tan x = \frac{opposite}{adjacent}$ to solve this problem.

$$\tan x = \frac{opposite}{adjacent} = \frac{6}{13}$$

Rearranging for x we find

$$\mathbf{arctan}\left(\frac{\mathbf{6}}{\mathbf{13}}\right) = \boldsymbol{x} = \mathbf{24.8°}$$

$$\boldsymbol{x} = \mathbf{24.8°}$$



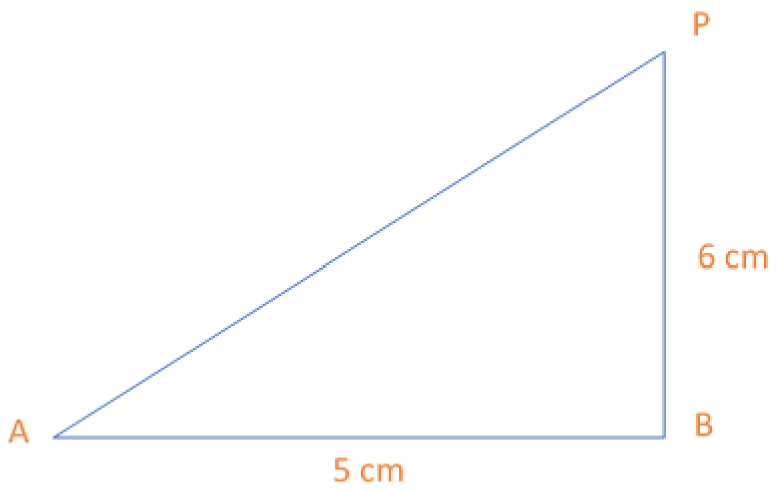
NOT TO SCALE

The diagram shows a triangular prism.
ABCD is a horizontal rectangle with *DA* = 10 cm and *AB* = 5 cm.
BCQP is a vertical rectangle and *BP* = 6 cm.

Calculate

(a) the length of *DP*, [3]

Firstly, we need to find AP by considering triangle ABP

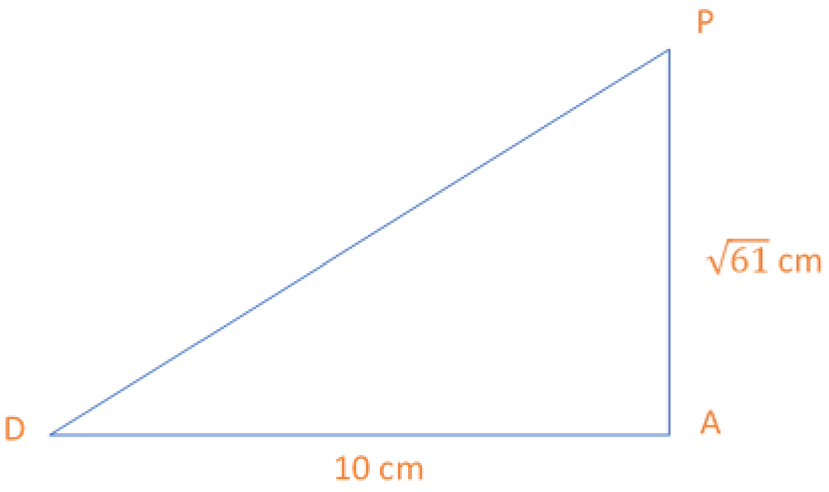


Use Pythagoras' Theorem to get

$$AP^2 = 5^2 + 6^2$$

$$\rightarrow AP^2 = 61$$

Now consider triangle DAP



Again, using Pythagoras' Theorem, we have

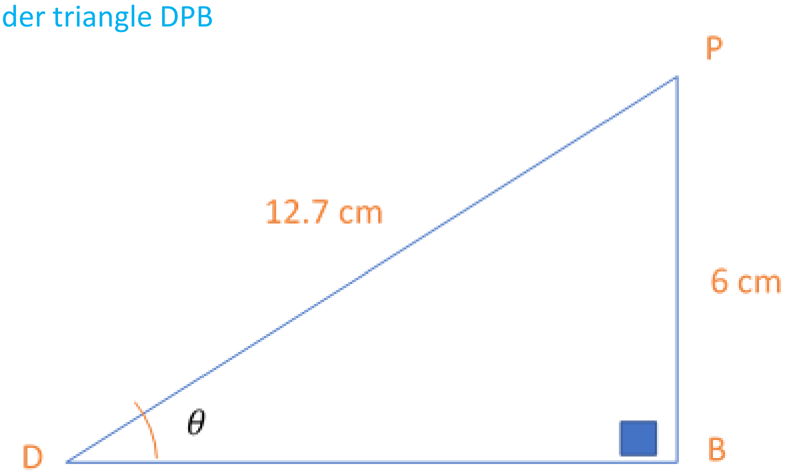
$$DP^2 = 10^2 + 61$$

$$= 161$$

$$\rightarrow \boldsymbol{DP = 12.7}$$

(b) the angle between DP and the horizontal rectangle $ABCD$. [3]

Consider triangle DPB



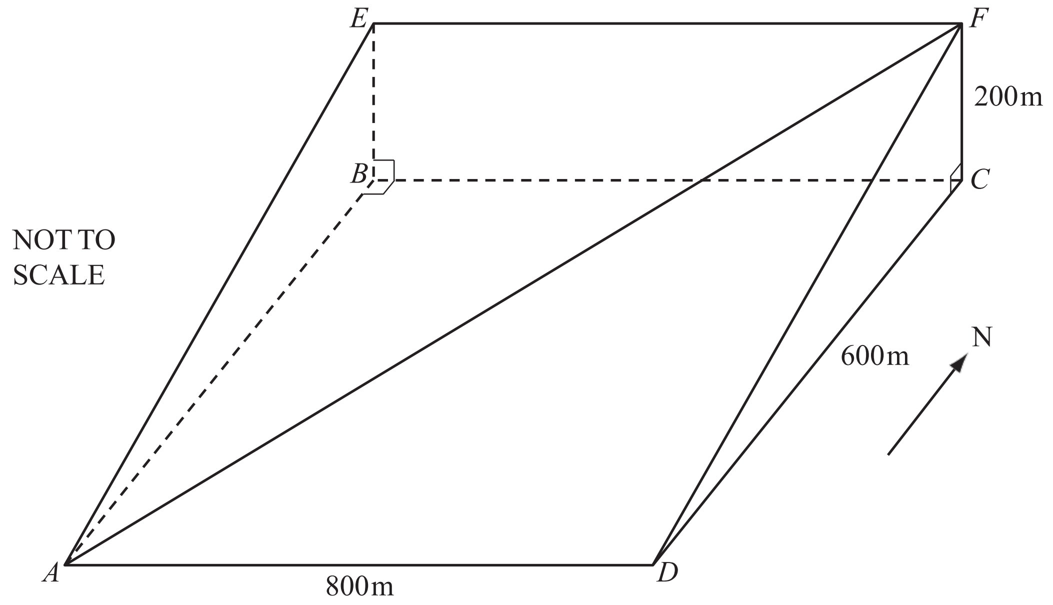
We wish to find angle θ using the trigonometric relation

$$\sin\theta = \frac{opp}{hyp}$$

$$\rightarrow \sin\theta = \frac{6}{12.7}$$

$$\rightarrow \theta = \sin^{-1}\frac{6}{12.7}$$

$$= 28.2$$



$ABCD$, $BEFC$ and $AEFD$ are all rectangles.
$ABCD$ is horizontal, $BEFC$ is vertical and $AEFD$ represents a hillside.
AF is a path on the hillside.
$AD = 800$ m, $DC = 600$ m and $CF = 200$ m.

(a) Calculate the angle that the path AF makes with $ABCD$. [5]

We find length AC using Pythagoras' Theorem

$$AC^2 = 800^2 + 600^2$$

$$= 1\,000\,000$$

$$\rightarrow AC = 1000$$

Now use the trig ratio

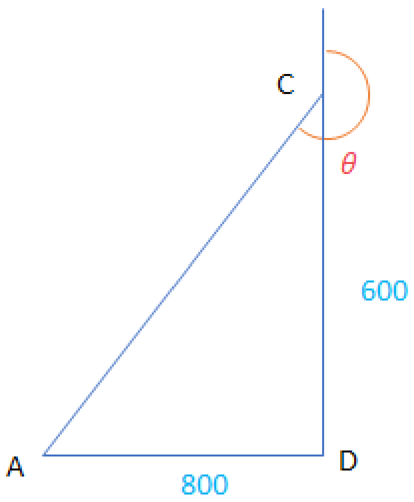
$$\tan\theta = \frac{opp}{adj}$$

$$\rightarrow \tan FAC = \frac{200}{1000}$$

$$\rightarrow FAC = \tan^{-1}(0.2)$$

$$= \mathbf{11.3}$$

(b) In the diagram D is due south of C.
Jasmine walks down the path from F to A in bad weather. She cannot see the path ahead.
The compass bearing she must use is the bearing of A from C.
Calculate this bearing. [3]



We need to calculate θ.

First use the relationship

$$\tan \alpha = \frac{opp}{adj}$$

to find ACD

$$\tan ACD = \frac{800}{600}$$

$$\rightarrow ACD = \tan^{-1}\frac{4}{3}$$

$$= 53$$

Hence

$$\theta = 180 + 53$$

$$= \mathbf{233}$$