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National 5 Maths Pythagoras' Theorem

SQA past paper and specimen paper
questions and answers by topic

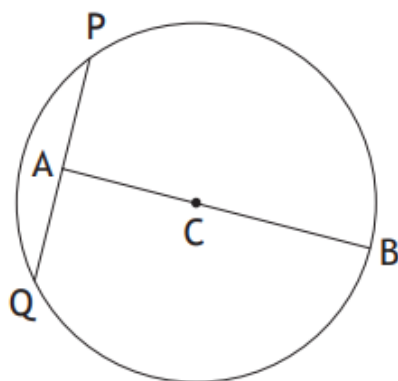
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The diagram below shows a circle, centre C.



The radius of the circle is 15 centimetres.

A is the mid-point of chord PQ.

The length of AB is 27 centimetres.

Calculate the length of PQ.

4

Answer:

18 cm

The diagram below shows the position of three towns.

Lowtown is due west of Midtown.

The distance from

- Lowtown to Midtown is 75 kilometres.
- Midtown to Hightown is 110 kilometres.
- Hightown to Lowtown is 85 kilometres.



Is Hightown directly north of Lowtown?

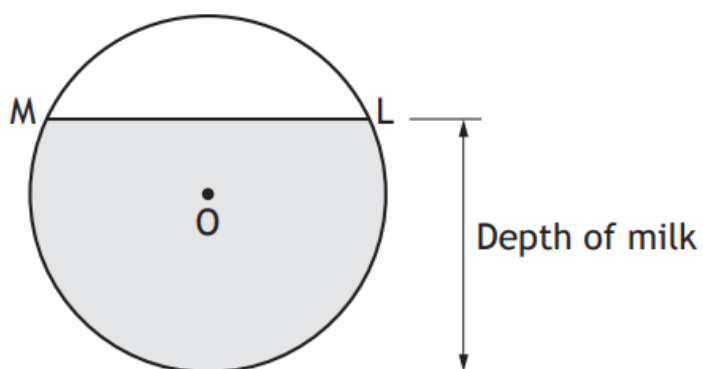
Justify your answer.

4

Answer:

$85^2 + 75^2 \neq 110^2$ so by the Converse of Pythagoras, the triangle is not right-angled.
Hightown is not therefore directly north of Lowtown.

The diagram below shows the circular cross-section of a milk tank.



The radius of the circle, centre O , is 1.2 metres.

The width of the surface of the milk in the tank, represented by ML in the diagram, is 1.8 metres.

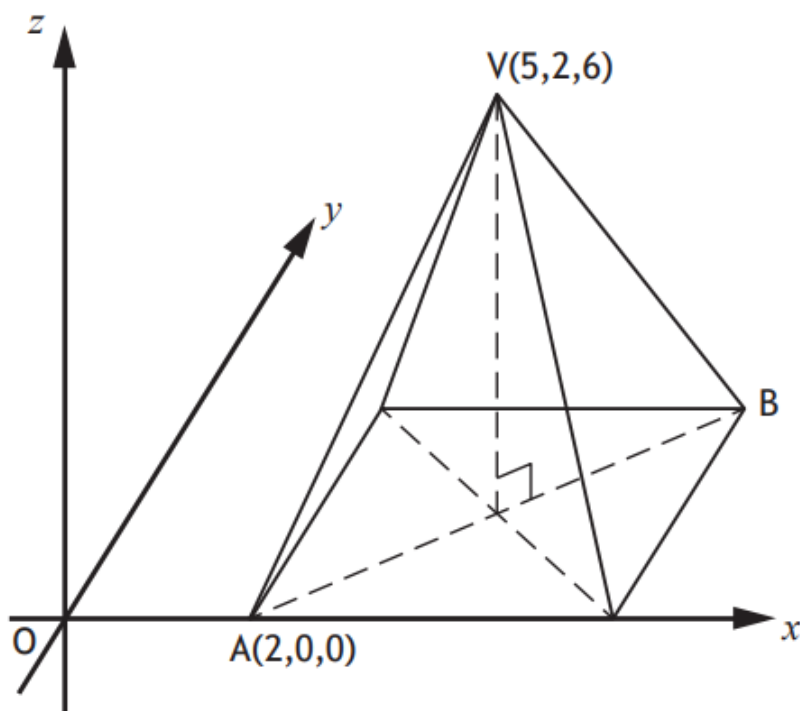
Calculate the depth of the milk in the tank.

4

Answer:

1.99 m

The diagram shows a rectangular based pyramid, relative to the coordinate axes.



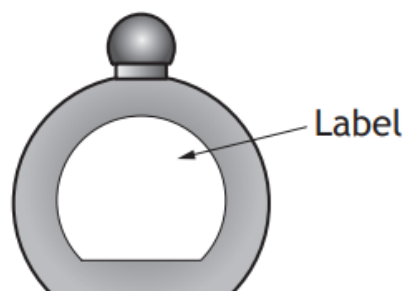
- A is the point $(2,0,0)$.
- V is the point $(5,2,6)$.

- (a) Write down the coordinates of B. 1
- (b) Calculate the length of edge AV of the pyramid. 3

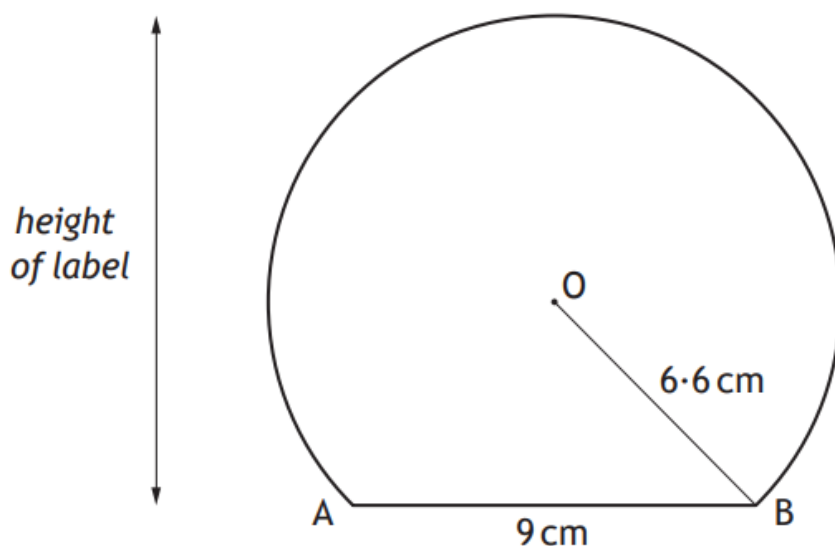
Answers:

- (a) $B(8, 4, 0)$
- (b) 7

This perfume bottle has a label in the shape of part of a circle.



A diagram of the label is shown below.



- The centre of the circle is O.
- The chord AB is 9 centimetres.
- The radius OB is 6.6 centimetres.

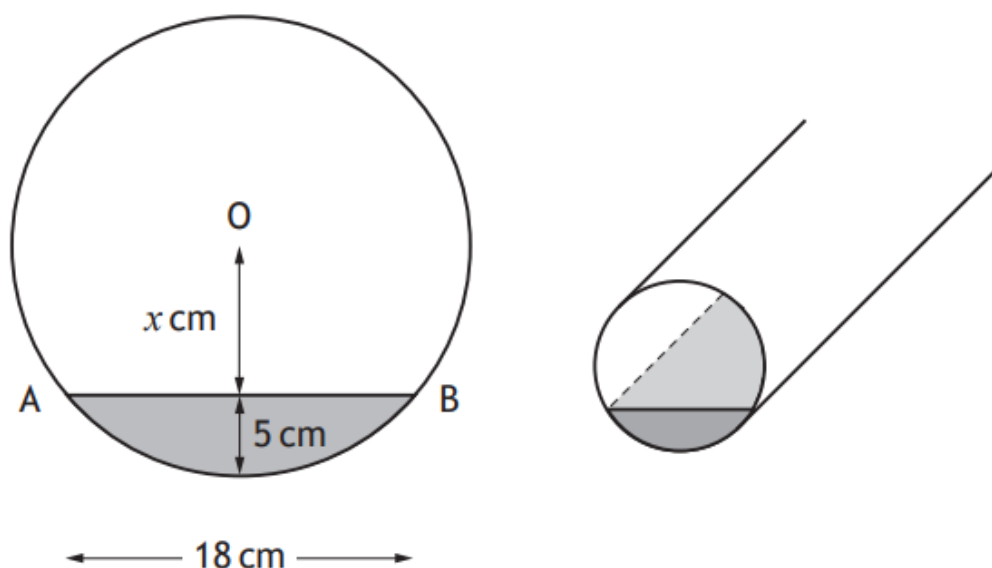
Find the height of the label.

4

Answer:

11.4 cm

A cylindrical pipe has water in it as shown.



The depth of the water at the deepest point is 5 centimetres.

The width of the water surface, AB, is 18 centimetres.

The radius of the pipe is r centimetres.

The distance from the centre, O, of the pipe to the water surface is x centimetres.

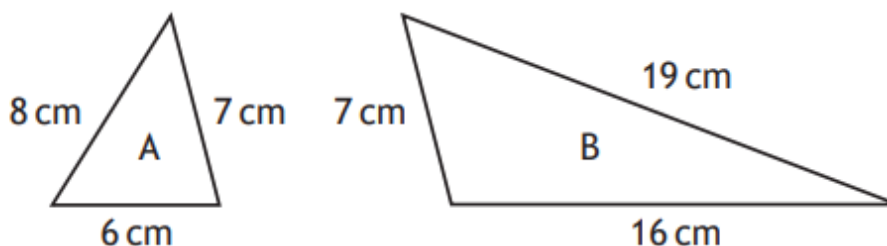
- (a) Write down an expression for x in terms of r . 1
- (b) Calculate r , the radius of the pipe. 3

Answers:

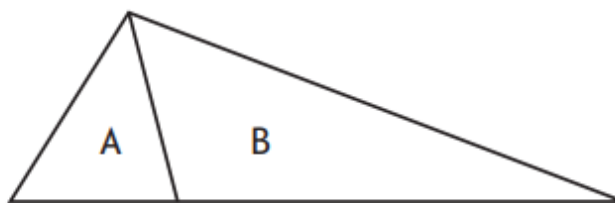
- (a) $x = r - 5$
- (b) 10.6 cm



Triangles A and B are shown below.



The triangles are placed together to form the larger triangle shown below.



Is this larger triangle right-angled?

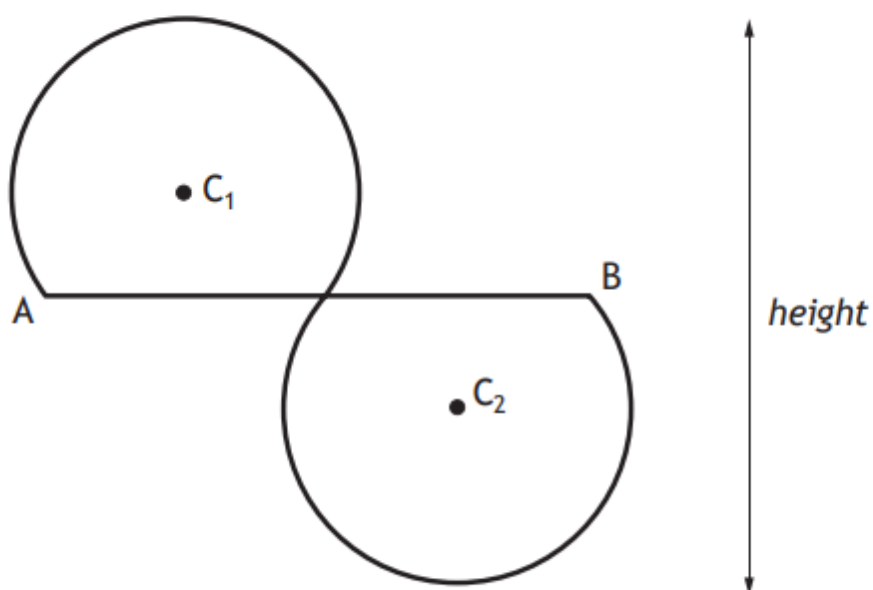
3

Justify your answer.

Answer:

$8^2 + 19^2 \neq 22^2$ so by the Converse of Pythagoras, the larger triangle is not right-angled.

Two identical shapes are used to form a logo.
Each shape is part of a circle.



- The circles have centres C_1 and C_2 .
- The radius of each circle is 14 centimetres.
- The logo has half-turn symmetry about the mid-point of AB .
- AB is 48 centimetres long.

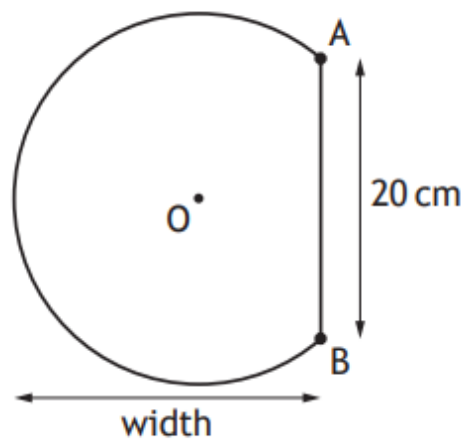
Calculate the height of the logo.

4

Answer:

42.4 cm

The shape below is part of a circle, centre O.



The circle has radius 13 centimetres.

AB is a chord of length 20 centimetres.

Calculate the width of the shape.

4

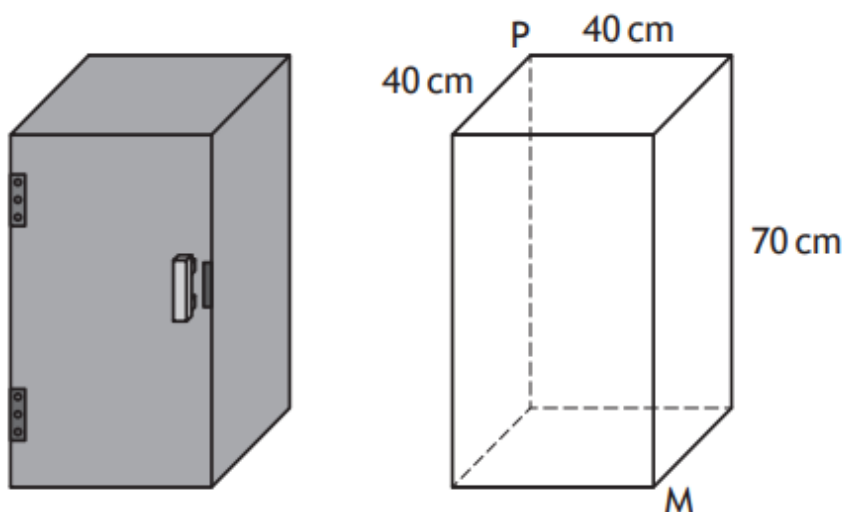
Answer:

21.3 cm



Chris wants to store his umbrella in a locker.

The locker is a cuboid with internal dimensions of length 40 centimetres, breadth 40 centimetres and height 70 centimetres.



The umbrella is 85 centimetres long.

He thinks it will fit into the locker from corner P to corner M.

Is he correct?

Justify your answer.

4

Answer:

Space diagonal = 90 cm

The SQA's marking instructions say: "Yes, since $85 < 90$."

However, we think that this question was flawed. It wasn't simply asking whether or not the umbrella will fit into the locker. It was asking whether the umbrella will fit "from corner P to corner M", which it will not, because it is too short to reach all the way from P to M. So we would have answered: "No, because the umbrella is shorter than the space diagonal, so it will not reach from corner P to corner M."

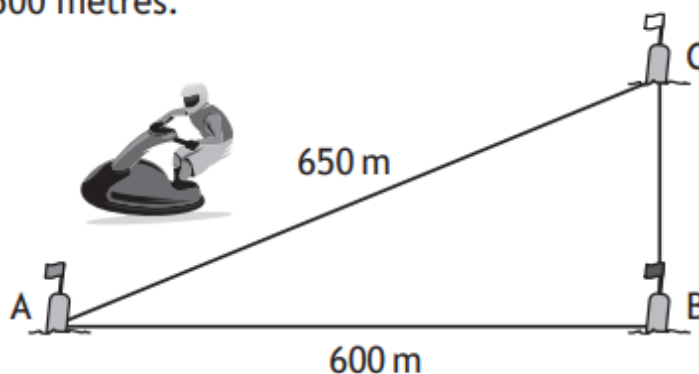


The diagram shows the course for a jet-ski race.

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

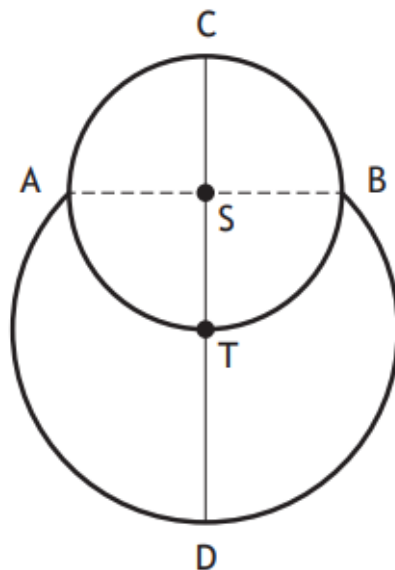
Answer:

$250^2 + 600^2 = 650^2$, so by the Converse of Pythagoras' Theorem, B is due east of A.

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

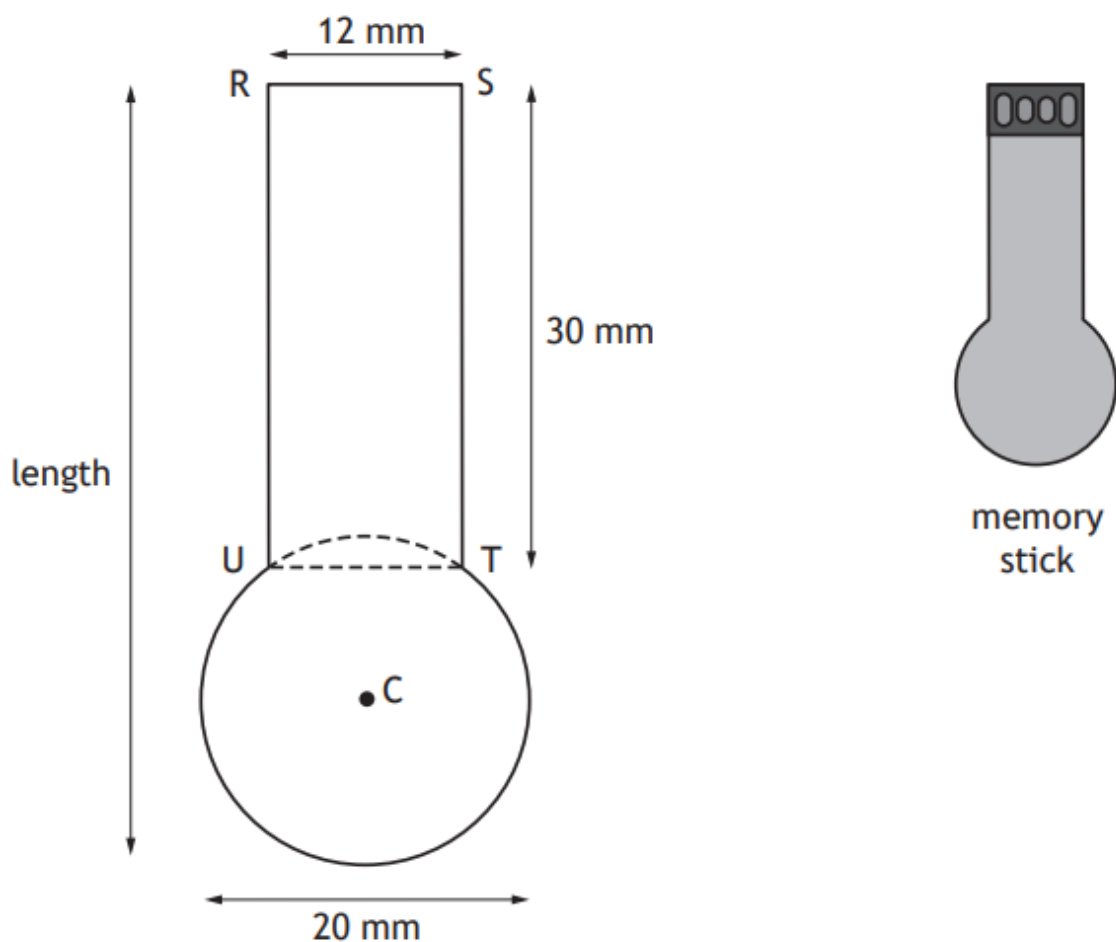
Calculate CD , the height of the snowman.

4

Answer: 25.6 cm

The diagram below shows a design for a memory stick.

The design consists of a rectangle, RSTU and part of a circle, centre C.



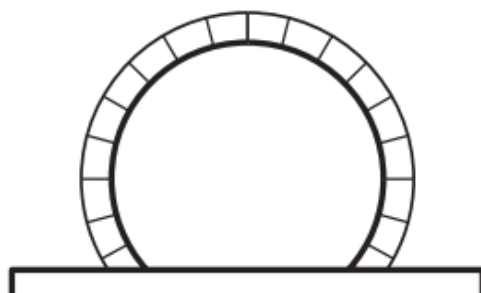
- $RS = UT = 12$ millimetres
- $RU = ST = 30$ millimetres
- The diameter of the circle is 20 millimetres
- UT is a chord of the circle

Calculate the length of the memory stick.

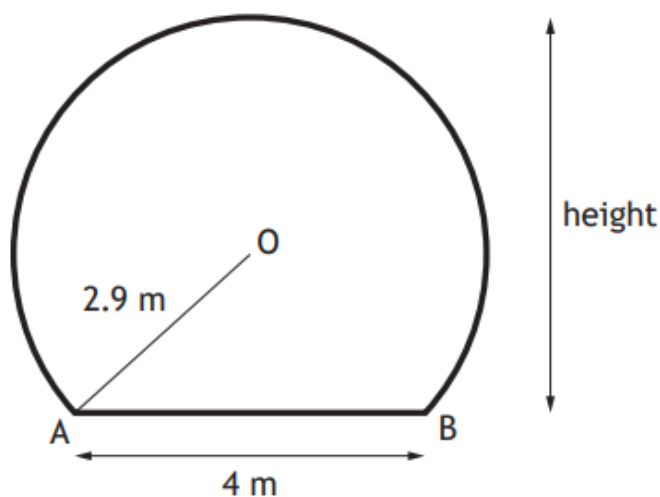
4

Answer: 48 mm

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.

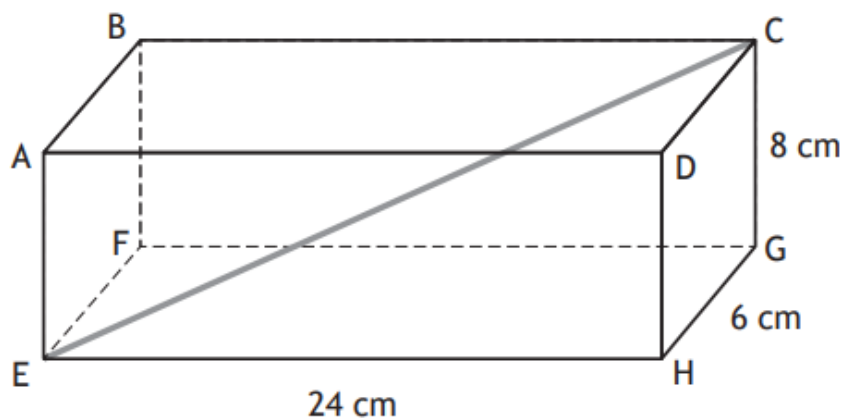
Calculate the height of the tunnel.

4

Answer:

5 m

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.

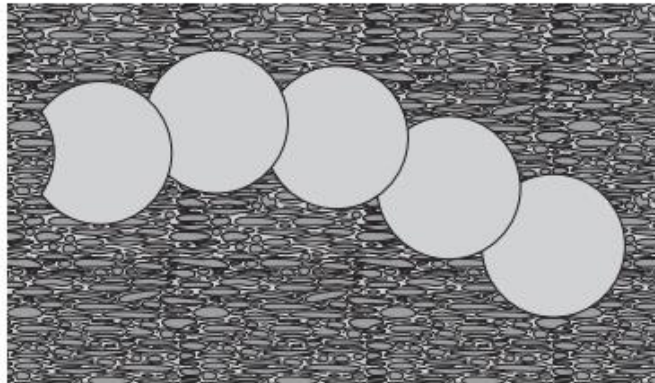
Calculate the length of EC, the space diagonal of the cuboid.

3

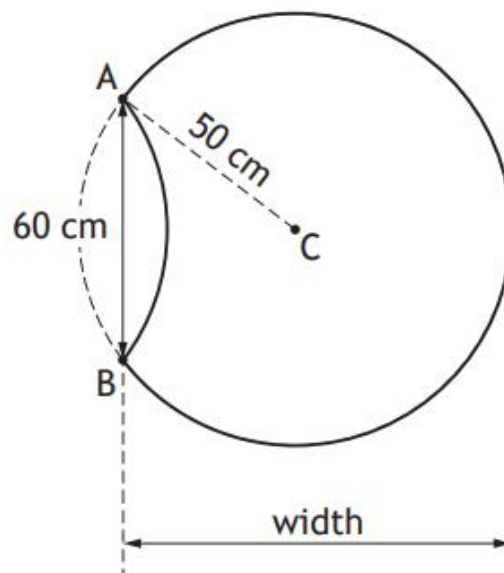
Answer:

26 cm

Alan buys some identical paving slabs to make a path.
Each slab is part of a circle.



The diagram below shows a single slab.

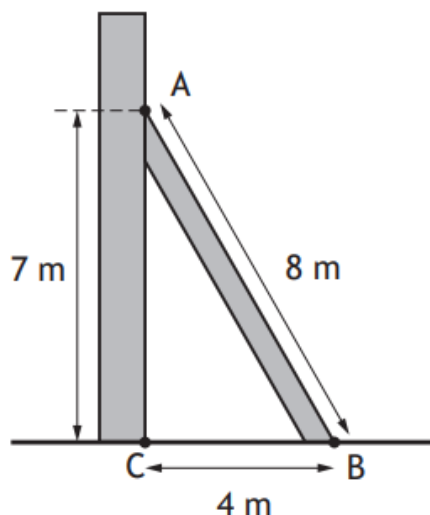


The circle, centre C , has a radius of 50 centimetres.
Length AB is 60 centimetres.
Calculate the width of the paving slab.

4

Answer: 90 cm

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

Answer:

$4^2 + 7^2 \neq 8^2$, so by the Converse of Pythagoras' Theorem, the angle is not right-angled, so the wall is not perpendicular to the ground.

Note:

It is also possible to answer this question using the cosine rule.