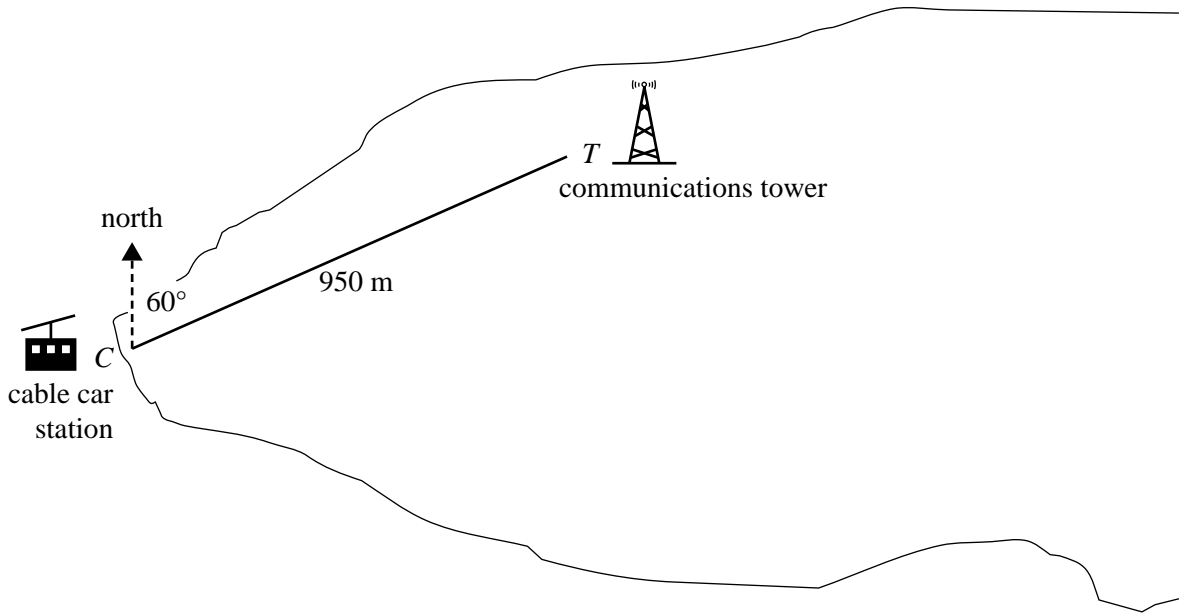


**Question 2** (4 marks)

There are plans to construct a series of straight paths on the flat top of the mountain.

A straight path will connect the cable car station at  $C$  to a communications tower at  $T$ , as shown in the diagram below.



The bearing of the communications tower from the cable car station is  $060^\circ$ .

The length of the straight path between the communications tower and the cable car station is 950 m.

- a. How far north of the cable car station is the communications tower? 1 mark

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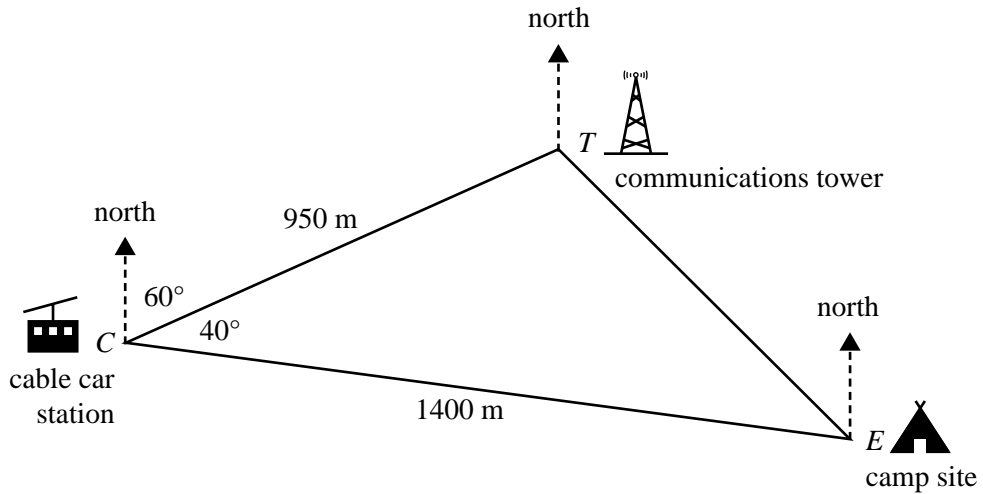
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Paths will also connect the cable car station and the communications tower to a camp site at  $E$ , as shown below.



The length of the straight path between the cable car station and the camp site is  $1400\text{ m}$ .

The angle  $TCE$  is  $40^\circ$ .

- b. i.** What will be the length of the straight path between the communications tower and the camp site?

Write your answer correct to the nearest metre.

1 mark

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- ii.** Use the cosine rule to find the bearing of the camp site from the communications tower. Write your answer correct to the nearest degree.

2 marks

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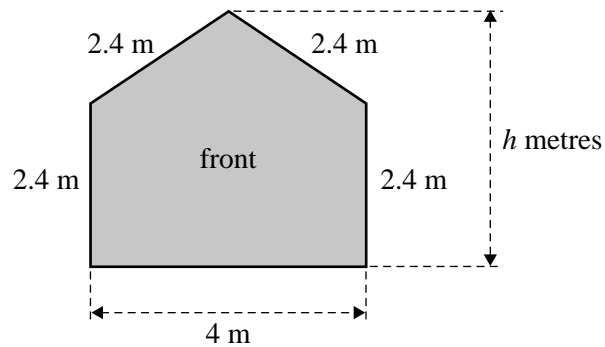
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## 3

**Question 3** (3 marks)

Cabins are being built at the camp site.

The dimensions of the front of each cabin are shown in the diagram below.



The walls of each cabin are 2.4 m high.

The sloping edges of the roof of each cabin are 2.4 m long.

The front of each cabin is 4 m wide.

The overall height of each cabin is  $h$  metres.

- a. Show that the value of  $h$  is 3.73, correct to two decimal places.

1 mark

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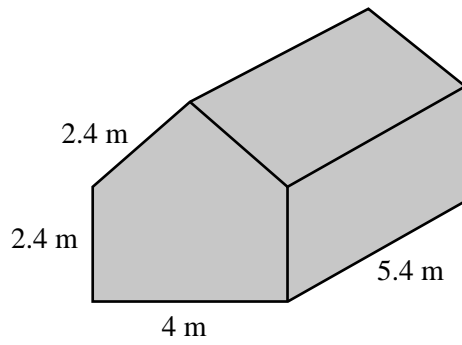


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Each cabin is in the shape of a prism, as shown in the diagram below.



- b. All external surfaces of one cabin are to be painted, excluding the base.

What is the total area of the surface to be painted?

Write your answer correct to the nearest square metre.

2 marks

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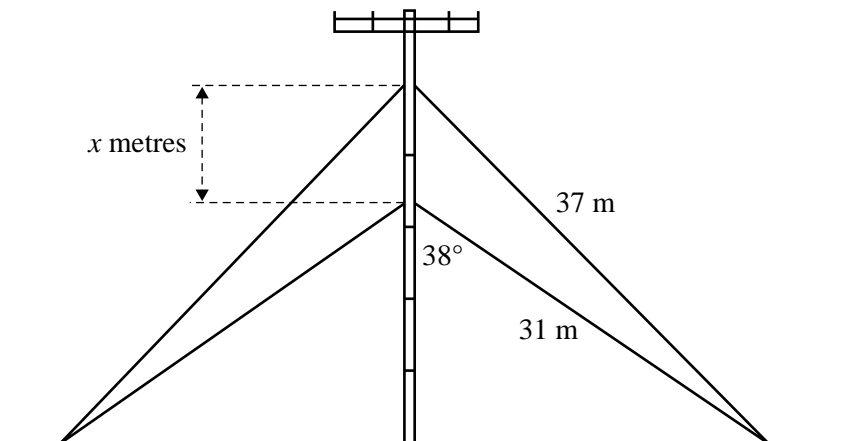
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**Question 4** (2 marks)

Wires support the communications tower, as shown in the diagram below.



The shortest wire is 31 m long.

The shortest wire makes an angle of  $38^\circ$  with the communications tower.

The longest wire is 37 m long.

The longest wire is attached to the communications tower  $x$  metres above the shortest wire.

What is the value of  $x$ ?

Write your answer in metres, correct to one decimal place.

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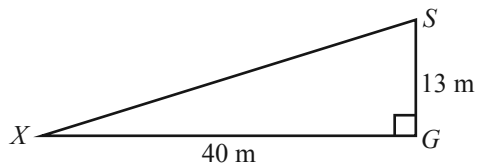


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Module 2: Geometry and trigonometry

Question 1 (4 marks)

A spectator,  $S$ , in the grandstand of an athletics ground is 13 m vertically above point  $G$ . Competitor  $X$ , on the athletics ground, is at a horizontal distance of 40 m from  $G$ .



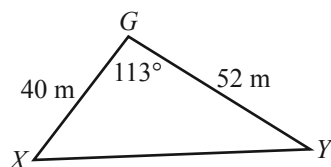
- a. Find the distance,  $SX$ , correct to the nearest metre. 1 mark

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Competitor  $X$  is 40 m from  $G$  and competitor  $Y$  is 52 m from  $G$ . The angle  $XGY$  is  $113^\circ$ .



- b. i. Calculate the distance,  $XY$ , correct to the nearest metre. 1 mark

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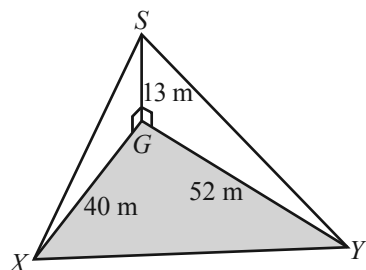
- ii. Find the area of triangle  $XGY$ , correct to the nearest square metre. 1 mark

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- c. Determine the angle of elevation of spectator  $S$  from competitor  $Y$ , correct to the nearest degree. Note that  $X$ ,  $G$  and  $Y$  are on the same horizontal level. 1 mark




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## 7

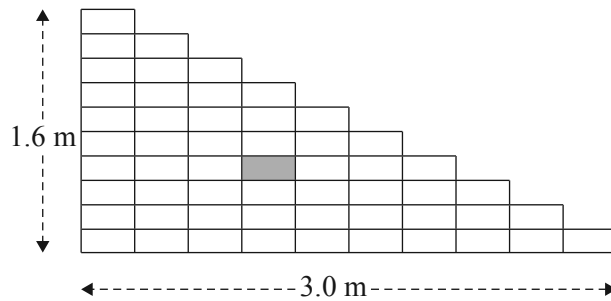
**Question 2** (3 marks)

A concrete staircase leading up to the grandstand has 10 steps.

The staircase is 1.6 m high and 3.0 m deep.

Its cross-section comprises identical rectangles.

One of these rectangles is shaded in the diagram below.



- a. Find the area of the shaded rectangle in square metres.

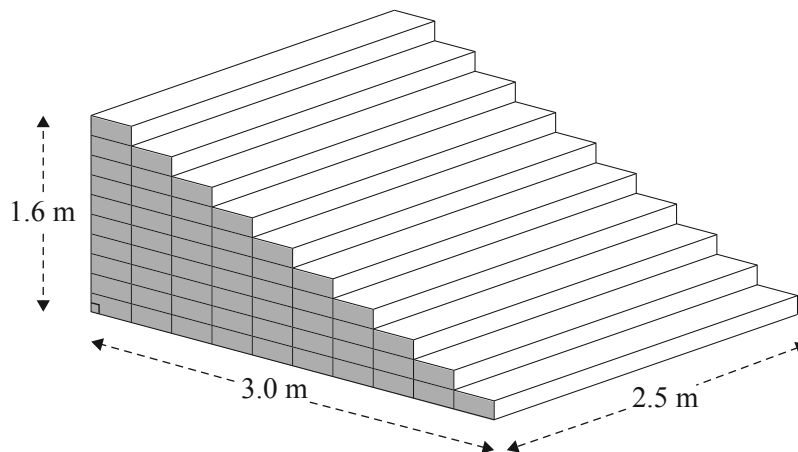
1 mark

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The concrete staircase is 2.5 m wide.



- b. Find the volume of the solid concrete staircase in cubic metres.

2 marks

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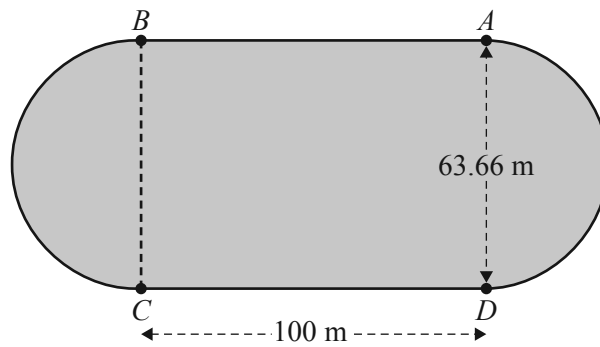
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**Question 3** (4 marks)

A grassed region in the athletics ground is shown shaded in the diagram below.



The perimeter of the grassed region comprises two parallel lines,  $BA$  and  $CD$ , each 100 m in length, and two semi-circles,  $BC$  and  $AD$ .

In total, the perimeter of the grassed region is 400 m.

- a. The diameter of the semi-circle  $AD$  is 63.66 m, correct to two decimal places.

Show how this value could be obtained.

1 mark

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- b. Determine the area of the grassed region, correct to the nearest square metre.

1 mark

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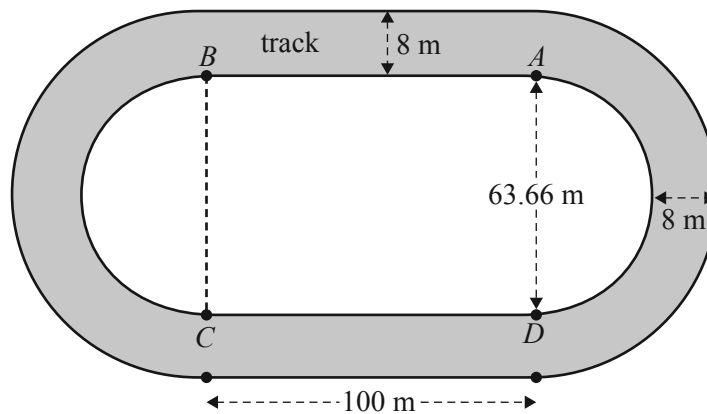
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A running track, shown shaded in the diagram below, surrounds the grassed region. This running track is 8 m wide at all points.



- c. The running track is to be resurfaced with special rubber material that is 0.1 m deep. Find the volume of rubber material that is needed to resurface the running track. Write your answer, correct to the nearest cubic metre.

2 marks

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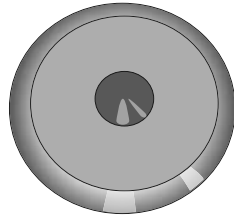


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**Question 4** (2 marks)

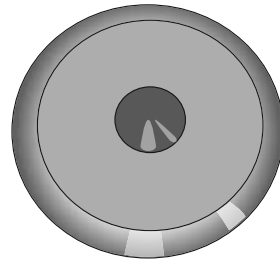
Competitors in the intermediate division of the discus use a smaller discus than the one used in the senior division, but of a similar shape. The total surface area of each discus is given below.

intermediate discus



total surface area  $500 \text{ cm}^2$

senior discus



total surface area  $720 \text{ cm}^2$

By what value can the volume of the intermediate discus be multiplied to give the volume of the senior discus?

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**Question 5** (2 marks)

Daniel threw a javelin a distance of 68.32 m on a bearing of  $057^\circ$  on his first throw.

On his second throw from the same point, he threw the javelin a distance of 72.51 m.

The second throw landed at a point on a bearing of  $125^\circ$ , measured from the point where the first throw landed.

Determine the distance between the point where Daniel's first throw landed and the point where his second throw landed.

Write your answer in metres, correct to one decimal place.

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Module 2: Geometry and trigonometry

Question 1

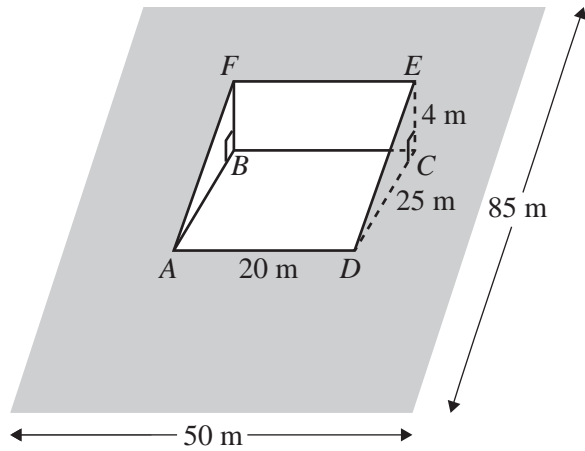
A rectangular block of land has width 50 metres and length 85 metres.

- a. Calculate the area of this block of land.  
Write your answer in  $m^2$ .

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1 mark

In order to build a house, the builders dig a hole in the block of land.  
The hole has the shape of a right-triangular prism,  $ABCDEF$ .  
The width  $AD = 20$  m, length  $DC = 25$  m and height  $EC = 4$  m are shown in the diagram below.



- b. Calculate the volume of the right-triangular prism,  $ABCDEF$ .  
Write your answer in  $m^3$ .

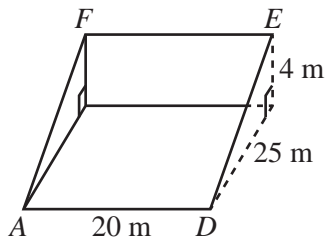
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1 mark

Once the right-triangular prism shape has been dug, a fence will be placed along the two sloping edges,  $AF$  and  $DE$ , and along the edges  $AD$  and  $FE$ .



- c. Calculate the total length of fencing that will be required.  
Write your answer, in metres, correct to one decimal place.

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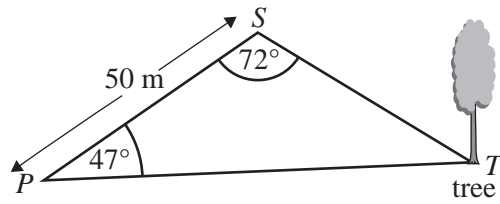
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1 mark

**Question 3**

A tree is growing near the block of land.

The base of the tree,  $T$ , is at the same level as the corners,  $P$  and  $S$ , of the block of land.



- a. Show that, correct to two decimal places, distance  $ST$  is 41.81 metres.

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1 mark

- b. From point  $S$ , the angle of elevation to the top of the tree is  $22^\circ$ .  
Calculate the height of the tree.  
Write your answer, in metres, correct to one decimal place.

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1 mark

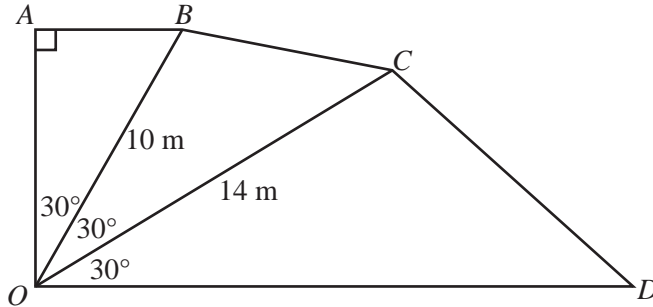
**Question 4**

$OABCD$  has three triangular sections, as shown in the diagram below.

Triangle  $OAB$  is a right-angled triangle.

Length  $OB$  is 10 m and length  $OC$  is 14 m.

Angle  $AOB = \text{angle } BOC = \text{angle } COD = 30^\circ$



- a. Calculate the length,  $OA$ .  
Write your answer, in metres, correct to two decimal places.

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1 mark

- b. Determine the area of triangle  $OAB$ .  
Write your answer, in  $\text{m}^2$ , correct to one decimal place.

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1 mark

- c. Triangles  $OBC$  and  $OCD$  are similar.  
The area of triangle  $OBC$  is  $35 \text{ m}^2$ .  
Find the area of triangle  $OCD$ , in  $\text{m}^2$ .

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2 marks

- d. Determine angle  $CDO$ .  
Write your answer, correct to the nearest degree.

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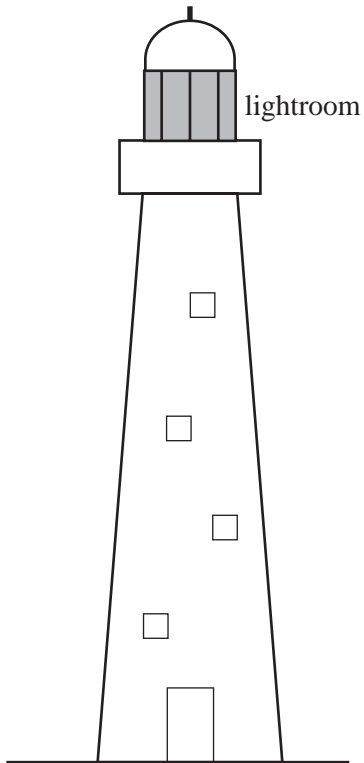
**Question 3**

The lighthouse has a lightroom, shown shaded in Figure 2 below.

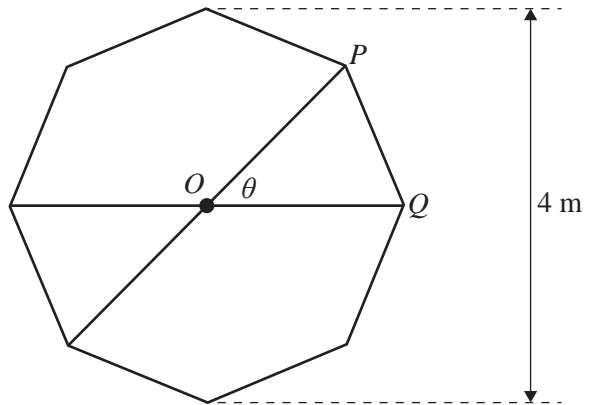
The floor of the lightroom is in the shape of a regular octagon.

The longest distance across the floor is 4 metres.

The lightroom floor and  $\angle POQ = \theta^\circ$  are shown in Figure 3 below.



**Figure 2**



**Figure 3**

- a. Show that the size of the angle  $\theta$  is  $45^\circ$ .

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1 mark

- b. Determine the area of triangle  $POQ$ .  
Write your answer in square metres correct to one decimal place.

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1 mark

The lighthouse is surrounded by a walkway of diameter 6.4 metres.  
 An outer circular wall surrounds the walkway.  
 The walkway is shown shaded in Figure 4 below.

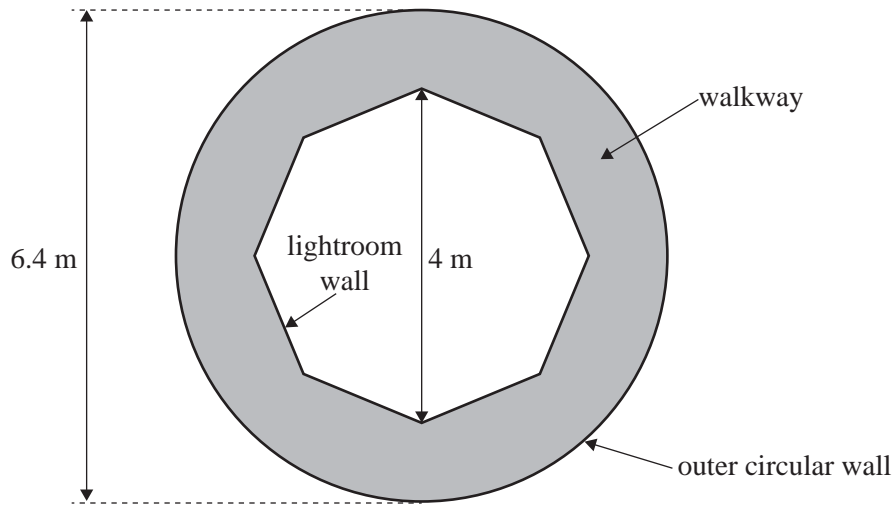


Figure 4

- c. Determine the minimum distance between the lightroom wall and the outer circular wall.

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1 mark

- d. The walkway is the shaded area in Figure 4. Determine its area correct to the nearest square metre.

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2 marks

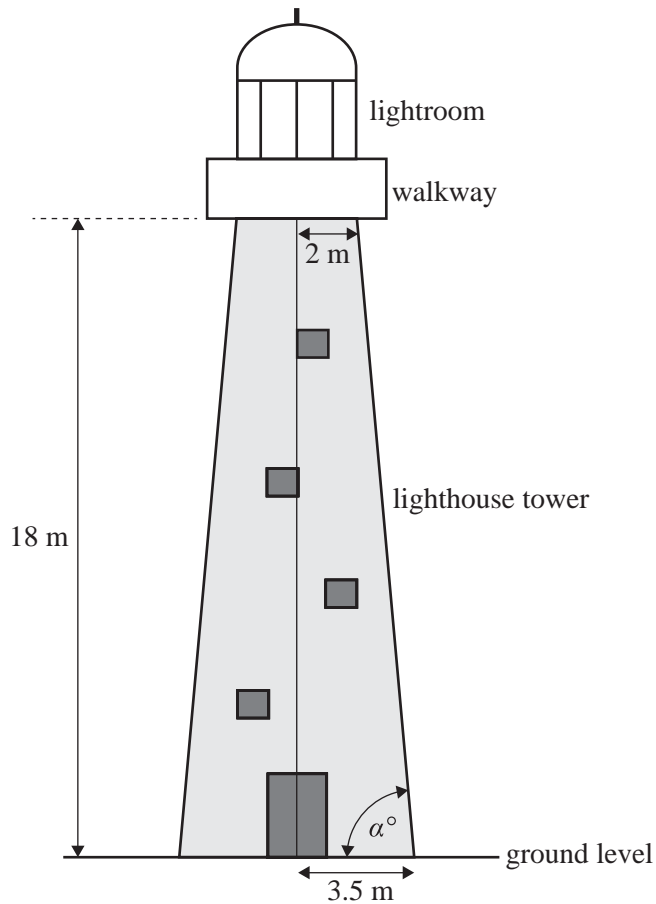
**Question 4**

The lighthouse tower, shaded on Figure 5 below, is in the shape of a truncated cone.

It has circular cross-sections that decrease uniformly from a radius of 3.5 metres at ground level to a radius of 2 metres at the walkway.

The height of the lighthouse tower is 18 metres.

The angle marked  $\alpha$  is the angle that the outer wall of the lighthouse tower makes with the horizontal at ground level.



**Figure 5**

- a. Determine the size of the angle  $\alpha$ .  
Write your answer in degrees correct to one decimal place.

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1 mark



The lighthouse tower is part of a cone. The height of this cone is  $h$  metres and the base radius is 3.5 metres, as shown in Figure 6.

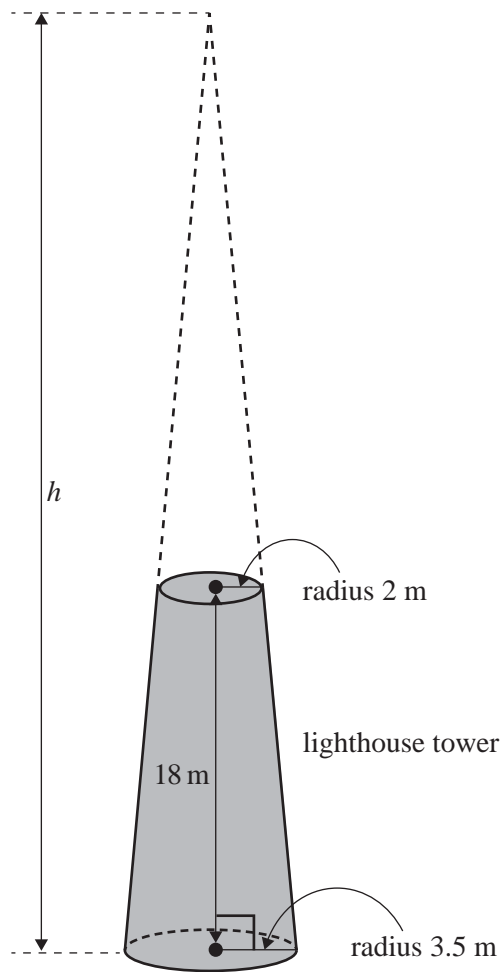


Figure 6

- b. i. Determine  $h$ , the height of this cone, in metres.

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- ii. Determine the volume of the lighthouse tower.  
Write your answer to the nearest cubic metre.

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2 + 1 = 3 marks

Total 15 marks

Module 2: Geometry and trigonometry

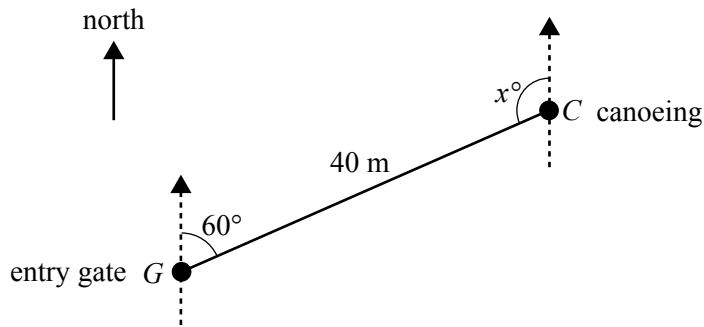
Question 1

In the plan below, the entry gate of an adventure park is located at point  $G$ .

A canoeing activity is located at point  $C$ .

The straight path  $GC$  is 40 metres long.

The bearing of  $C$  from  $G$  is  $060^\circ$ .



- a. Write down the size of the angle that is marked  $x^\circ$  in the plan above.

\_\_\_\_\_ 1 mark

- b. What is the bearing of the entry gate from the canoeing activity?

\_\_\_\_\_  
 \_\_\_\_\_ 1 mark

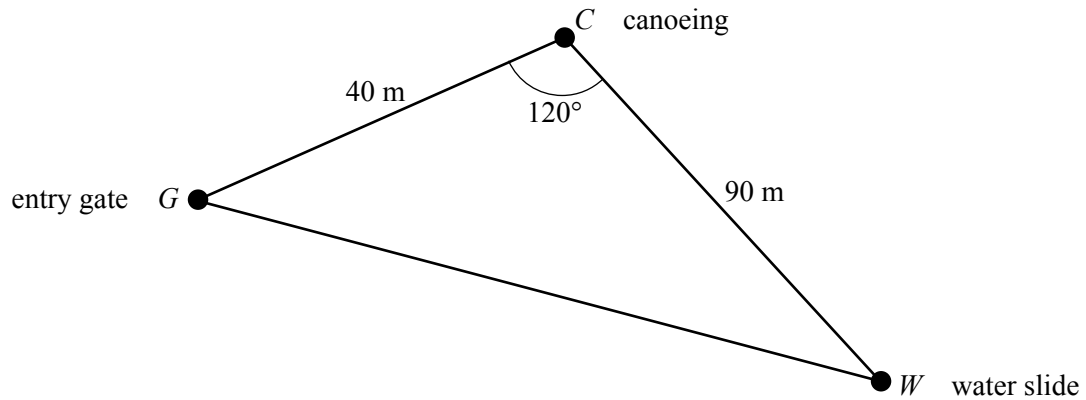
- c. How many metres **north** of the entry gate is the canoeing activity?

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ 1 mark

$CW$  is a 90 metre straight path between the canoeing activity and a water slide located at point  $W$ .

$GW$  is a straight path between the entry gate and the water slide.

The angle  $GCW$  is  $120^\circ$ .



- d. i. Find the area that is enclosed by the three paths,  $GC$ ,  $CW$  and  $GW$ .  
Write your answer in square metres, correct to one decimal place.

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- ii. Show that the length of path  $GW$  is 115.3 metres, correct to one decimal place.

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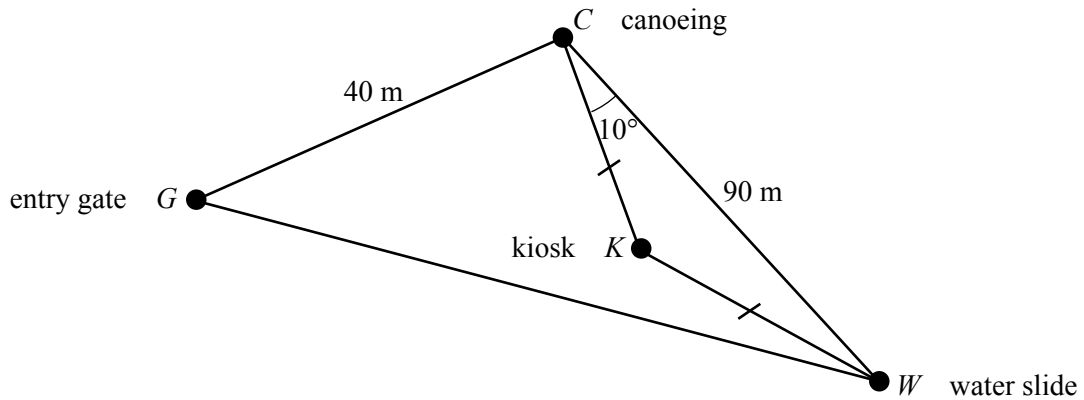
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1 + 1 = 2 marks

Straight paths  $CK$  and  $WK$  lead to the kiosk located at point  $K$ .  
 These two paths are of equal length.  
 The angle  $KCW$  is  $10^\circ$ .



- e. i. Find the size of the angle  $CKW$ .

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- ii. Find the length of path  $CK$ , in metres, correct to one decimal place.

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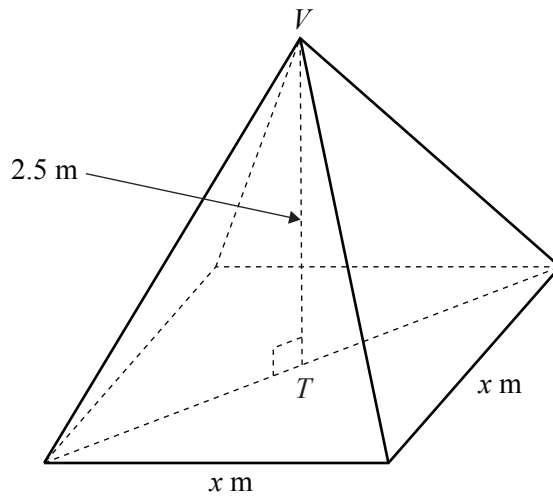
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1 + 1 = 2 marks

**Question 3**

A concrete square pyramid with volume  $1.8 \text{ m}^3$  sits on the flat top of the hill.

The length of the square base of the pyramid is  $x$  metres. The height of the pyramid,  $VT$ , is 2.5 metres.



Find the value of  $x$ , correct to two decimal places.

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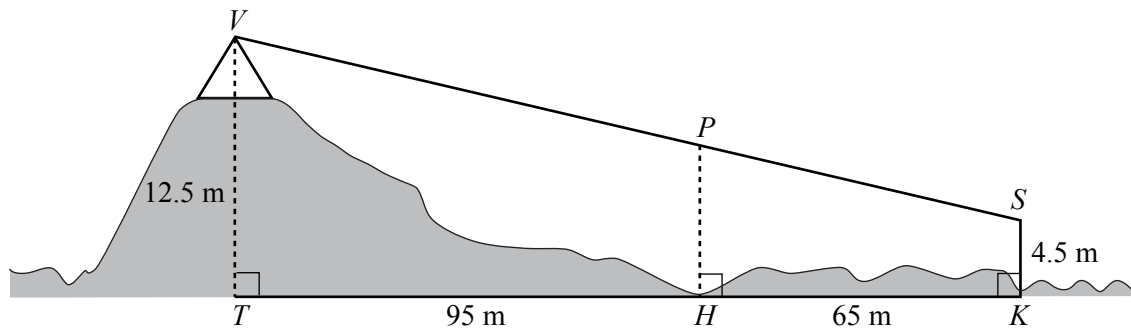
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2 marks

**Question 4**

A flying fox suspension wire begins at  $V$ , 12.5 metres above  $T$  as shown in the diagram below. It ends at  $S$ , 4.5 metres above  $K$ .



At  $P$ , the flying fox wire passes over  $H$ .

The horizontal distances  $TH$  and  $HK$  are 95 metres and 65 metres respectively.

Calculate the vertical distance,  $PH$ , in metres.

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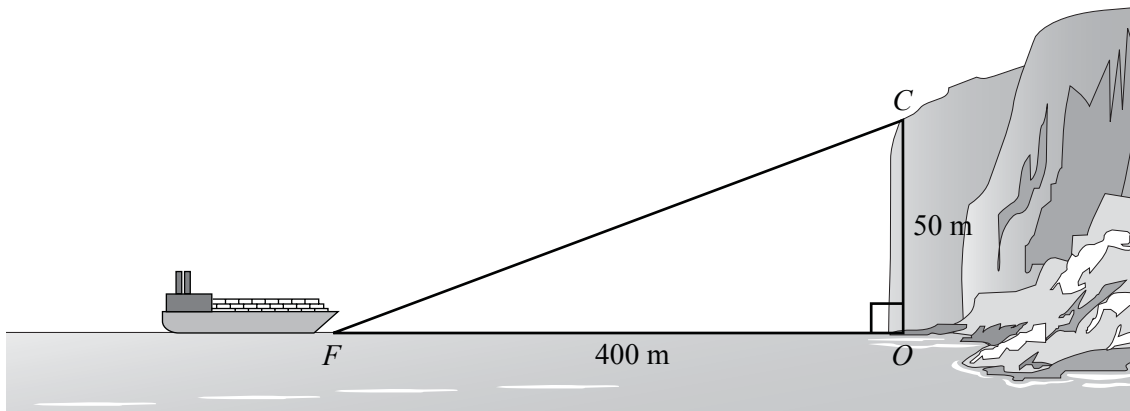
2 marks

Total 15 marks

## Module 2: Geometry and trigonometry

## Question 1

A ferry,  $F$ , is 400 metres from point  $O$  at the base of a 50 metre high cliff,  $OC$ .



- a. Show that the gradient of the line  $FC$  in the diagram is 0.125.

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1 mark

- b. Calculate the angle of elevation of point  $C$  from  $F$ .  
Write your answer in degrees, correct to one decimal place.

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1 mark

- c. Calculate the distance  $FC$ , in metres, correct to one decimal place.

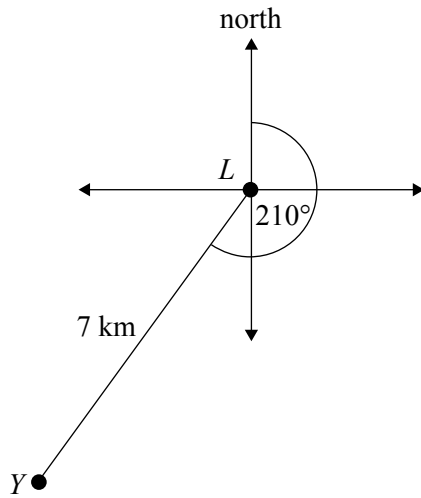
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1 mark

**Question 2**

A yacht,  $Y$ , is 7 km from a lighthouse,  $L$ , on a bearing of  $210^\circ$  as shown in the diagram below.



- a. A ferry can also be seen from the lighthouse. The ferry is 3 km from  $L$  on a bearing of  $135^\circ$ . On the diagram above, label the position of the ferry,  $F$ , and show an angle to indicate its bearing.

1 mark

- b. Determine the angle between  $LY$  and  $LF$ .

\_\_\_\_\_

1 mark

- c. Calculate the distance, in km, between the ferry and the yacht correct to two decimal places.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

1 mark

- d. Determine the bearing of the lighthouse from the ferry.

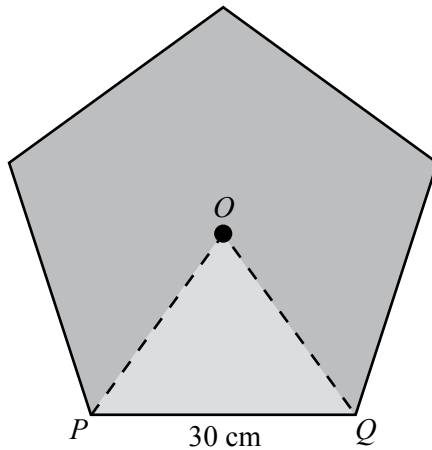
\_\_\_\_\_  
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1 mark



**Question 3**

The ferry has a logo painted on its side. The logo is a regular pentagon with centre  $O$  and side length 30 cm. It is shown in the diagram below.



- a. Show that angle  $POQ$  is equal to  $72^\circ$ .

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1 mark

- b. Show that, correct to two decimal places, the length  $OP$  is 25.52 cm.

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1 mark

- c. Find the area of the pentagon. Write your answer correct to the nearest  $\text{cm}^2$ .

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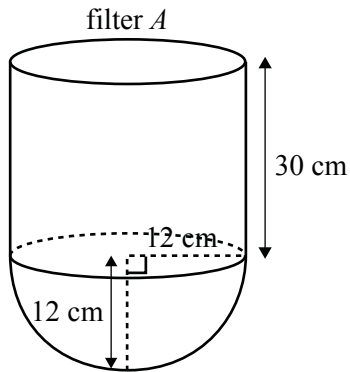
2 marks

**Question 4**

The ferry has two fuel filters,  $A$  and  $B$ .

Filter  $A$  has a hemispherical base with radius 12 cm.

A cylinder of height 30 cm sits on top of this base.



- a. Calculate the volume of filter  $A$ . Write your answer correct to the nearest  $\text{cm}^3$ .

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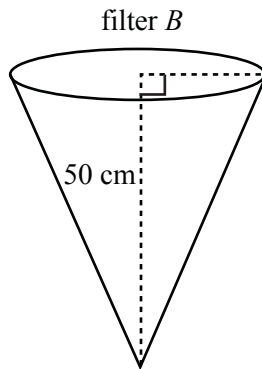
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2 marks

Filter  $B$  is a right cone with height 50 cm.



- b. Originally filter  $B$  was full of oil, but some was removed.  
If the height of the oil in the cone is now 20 cm, what percentage of the original volume of oil was removed?

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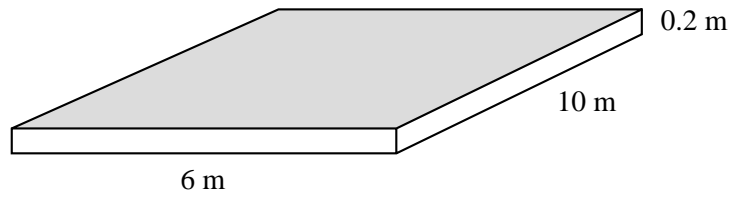
2 marks

Total 15 marks

**END OF MODULE 2  
TURN OVER**

**Module 2: Geometry and trigonometry****Question 1**

A shed is built on a concrete slab. The concrete slab is a rectangular prism 6 m wide, 10 m long and 0.2 m deep.



- a. Determine the volume of the concrete slab in  $\text{m}^3$ .

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1 mark

- b. On a plan of the concrete slab, a 3 cm line is used to represent a length of 6 m.
- i. What scale factor is used to draw this plan?

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The top surface of the concrete slab shaded in the diagram above has an area of  $60 \text{ m}^2$ .

- ii. What is the area of this surface on the plan?

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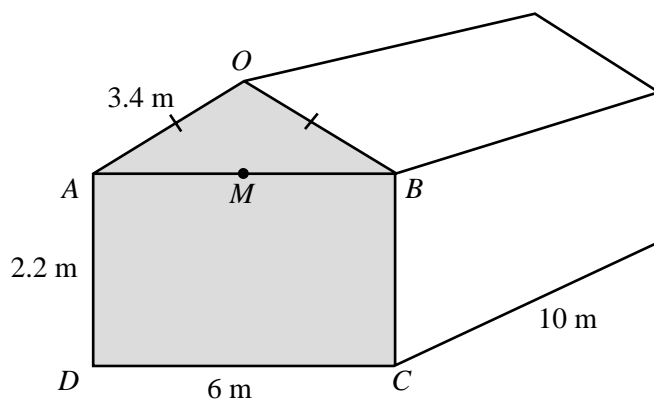
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1 + 1 = 2 marks

**Question 2**

The shed has the shape of a prism. Its front face,  $AOBCD$ , is shaded in the diagram below.  $ABCD$  is a rectangle and  $M$  is the mid point of  $AB$ .



- a. Show that the length of  $OM$  is  $1.6\text{ m}$ .

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1 mark

- b. Show that the area of the front face of the shed,  $AOBCD$ , is  $18\text{ m}^2$ .

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1 mark

- c. Find the volume of the shed in  $\text{m}^3$ .

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1 mark

- d. All inside surfaces of the shed, including the floor, will be painted.

- i. Find the total area that will be painted in  $\text{m}^2$ .

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One litre of paint will cover an area of  $16\text{ m}^2$ .

- ii. Determine the number of litres of paint that is required.

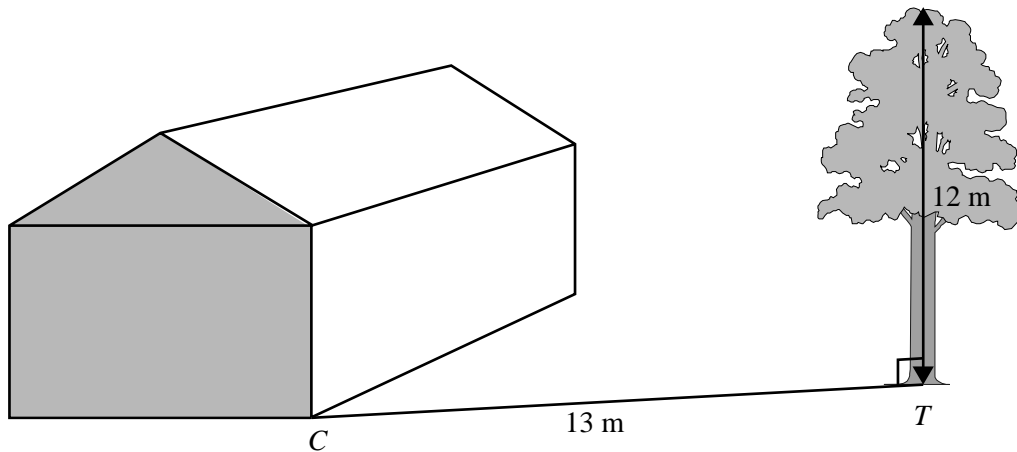
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2 + 1 = 3 marks

**Question 3**

A tree, 12 m tall, is growing at point  $T$  near the shed.

The distance,  $CT$ , from corner  $C$  of the shed to the centre base of the tree is 13 m.



- a. Calculate the angle of elevation of the top of the tree from point  $C$ .  
Write your answer, in degrees, correct to one decimal place.

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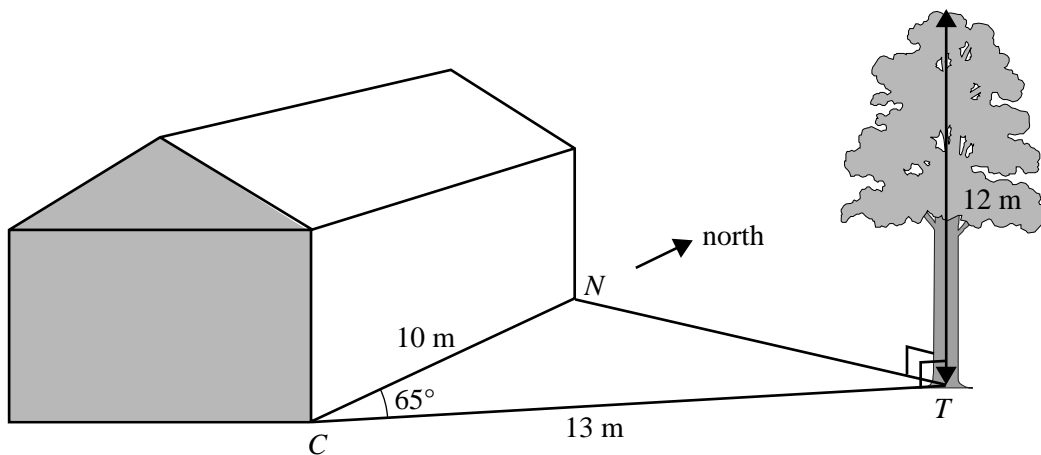


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1 mark



$N$  and  $C$  are two corners at the base of the shed.  $N$  is due north of  $C$ .

The angle,  $TCN$ , is  $65^\circ$ .

- b. Show that, correct to one decimal place, the distance,  $NT$ , is 12.6 m.

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1 mark

- c. Calculate the angle,  $CNT$ , correct to the nearest degree.

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1 mark

- d. Determine the bearing of  $T$  from  $N$ . Write your answer correct to the nearest degree.

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1 mark

- e. Is it possible for the tree to hit the shed if it falls?  
Explain your answer showing appropriate calculations.

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2 marks

Total 15 marks

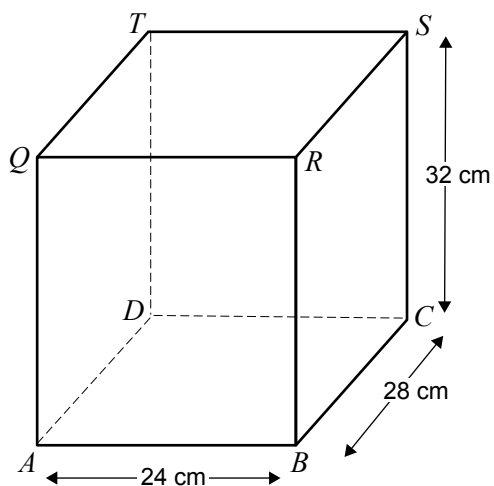
**Module 2: Geometry and trigonometry**

Tessa is a student in a woodwork class.

The class will construct geometrical solids from a block of wood.

Tessa has a piece of wood in the shape of a rectangular prism.

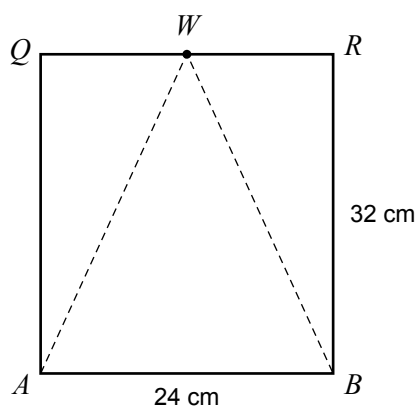
This prism,  $ABCDQRST$ , shown in Figure 1, has base length 24 cm, base width 28 cm and height 32 cm.



**Figure 1**

**Question 1**

On the front face of Figure 1,  $ABRQ$ , Tessa marks point  $W$  halfway between  $Q$  and  $R$  as shown in Figure 2 below. She then draws line segments  $AW$  and  $BW$  as shown.



**Figure 2**

- a. Determine the length, in cm, of  $QW$ .

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1 mark

- b. Calculate the angle  $WAQ$ . Write your answer in degrees, correct to one decimal place.

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1 mark

- c. Calculate the angle  $AWB$  correct to one decimal place.

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1 mark

- d. What fraction of the area of the rectangle  $ABRQ$  does the area of the triangle  $AWB$  represent?

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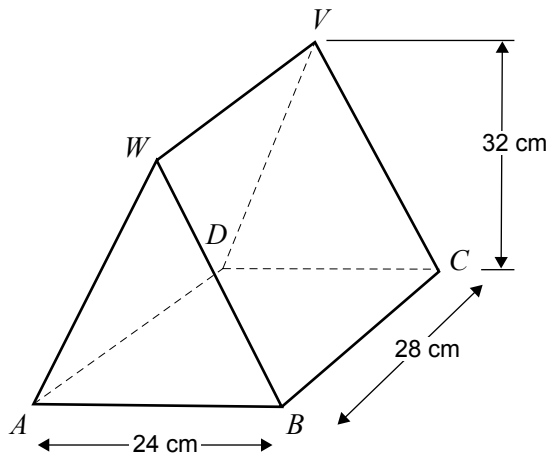
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1 mark

**Question 2**

Tessa carves a triangular prism from her block of wood.

Using point  $V$ , halfway between  $T$  and  $S$  on the back face,  $DCST$ , of Figure 1, she constructs the triangular prism shown in Figure 3.



**Figure 3**

- a. Show that, correct to the nearest centimetre, length  $AW$  is 34 cm.

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1 mark

- b. Using length  $AW$  as 34 cm, find the total surface area, in  $\text{cm}^2$ , of the triangular prism  $ABCDWW$  in Figure 3.

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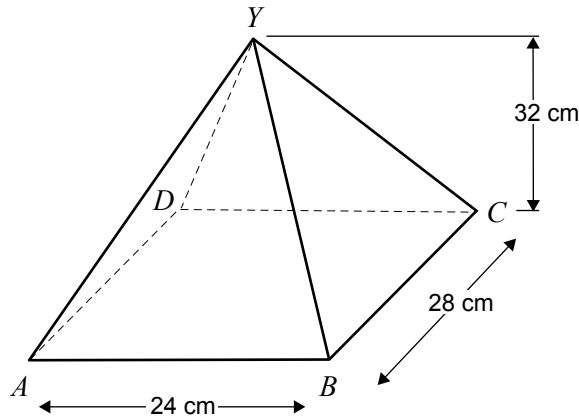
2 marks



**Question 3**

Tessa’s next task is to carve the right rectangular pyramid  $ABCDY$  shown in Figure 4 below.

She marks a new point,  $Y$ , halfway between points  $W$  and  $V$  in Figure 3. She uses point  $Y$  to construct this pyramid.



**Figure 4**

- a. Calculate the volume, in  $\text{cm}^3$ , of the pyramid  $ABCDY$  in Figure 4.

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1 mark

- b. Show that, correct to the nearest cm, length  $AY$  is 37 cm.

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2 marks

- c. Using  $AY$  as 37 cm, demonstrate the use of **Heron’s formula** to calculate the area, in  $\text{cm}^2$ , of the triangular face  $YAB$ .

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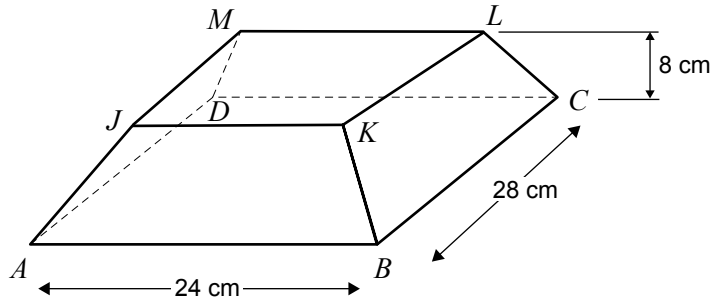
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2 marks

**Question 4**

Tessa's final task involves removing the top 24 cm of the height of her pyramid (Figure 4).

The shape remaining is shown in Figure 5 below. The top surface,  $JKLM$ , is parallel to the base,  $ABCD$ .



**Figure 5**

- a. What fraction of the height of the pyramid in Figure 4 has Tessa removed to produce Figure 5?

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1 mark

- b. What fraction of the volume of the pyramid in Figure 4 remains in Figure 5?

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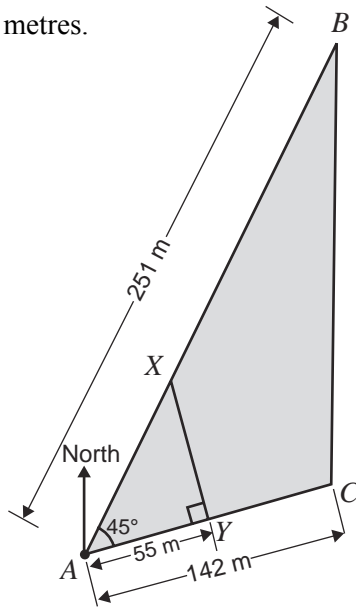
2 marks

Total 15 marks

Module 2: Geometry and trigonometry

Question 1

A farmer owns a flat allotment of land in the shape of triangle  $ABC$  shown below.  
 Boundary  $AB$  is 251 metres.  
 Boundary  $AC$  is 142 metres.  
 Angle  $BAC$  is  $45^\circ$ .



A straight track,  $XY$ , runs perpendicular to the boundary  $AC$ .  
 Point  $Y$  is 55 m from  $A$  along the boundary  $AC$ .

- a. Determine the size of angle  $AXY$ .

\_\_\_\_\_ 1 mark

- b. Determine the length of  $AX$ .  
 Write your answer, in metres, correct to one decimal place.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ 1 mark

- c. The bearing of  $C$  from  $A$  is  $078^\circ$ .  
 Determine the bearing of  $B$  from  $A$ .

\_\_\_\_\_  
 \_\_\_\_\_ 1 mark

- d. Determine the shortest distance from  $X$  to  $C$ .  
 Write your answer, in metres, correct to one decimal place.

\_\_\_\_\_  
 \_\_\_\_\_  
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- e. Determine the area of triangle  $ABC$  correct to the nearest square metre.

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1 mark

The length of the boundary  $BC$  is 181 metres (correct to the nearest metre).

- f. i. Use the cosine rule to show how this length can be found.

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- ii. Determine the size of angle  $ABC$ .  
Write your answer, in degrees, correct to one decimal place.

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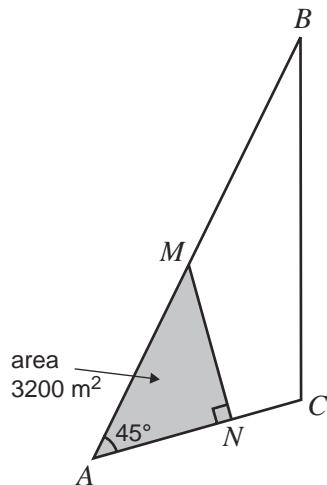
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1 + 1 = 2 marks

A farmer plans to build a fence,  $MN$ , perpendicular to the boundary  $AC$ .  
The land enclosed by triangle  $AMN$  will have an area of  $3200 \text{ m}^2$ .



- g. Determine the length of the fence  $MN$ .

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2 marks

Module 2: Geometry and trigonometry – continued

**TURN OVER**

**Question 2**

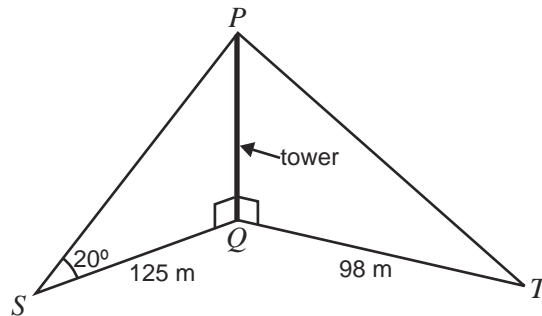
The allotment of land contains a communications tower,  $PQ$ .

Points  $S$ ,  $Q$  and  $T$  are situated on level ground.

From  $S$  the angle of elevation of  $P$  is  $20^\circ$ .

Distance  $SQ$  is 125 metres.

Distance  $TQ$  is 98 metres.



- a. Determine the height,  $PQ$ , of the communications tower.  
Write your answer, in metres, correct to one decimal place.

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1 mark

- b. Determine the angle of depression of  $T$  from  $P$ .  
Write your answer, in degrees, correct to one decimal place.

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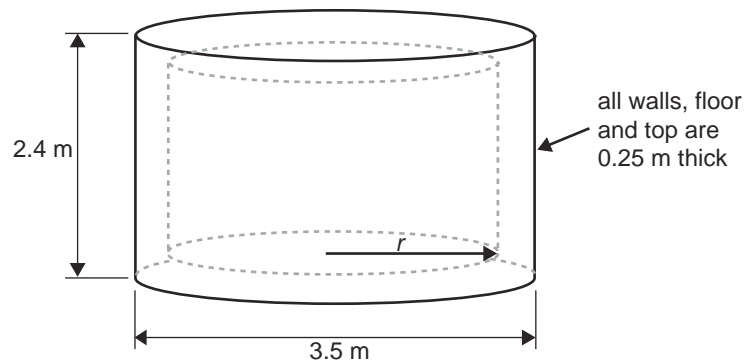
1 mark

**Question 3**

A **closed** cylindrical water tank has external diameter 3.5 metres.

The external height of the tank is 2.4 metres.

The walls, floor and top of the tank are made of concrete 0.25 m thick.



- a. What is the internal radius,  $r$ , of the tank?

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1 mark

- b. Determine the maximum amount of water this tank can hold.

Write your answer correct to the nearest cubic metre.

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2 marks

Total 15 marks