

# **Year 10 Mathematics**

## **AOS 7 Revision [10.2] Mock CAT 1 - Version B**

**Total Marks:** 50 marks

**Time Allowed:** 90 minutes

**Instructions:** Answer all questions

Show all working

Calculators permitted for Tech-Active questions

<b>Section</b>	<b>Marks</b>	<b>Score</b>
Section A: Short Answer (Q4-Q16)	34	
Section B: Extended Response (Q17-Q18)	16	
<b>TOTAL</b>	<b>50</b>	

Student Name: \_\_\_\_\_

## Section A: Short Answer Questions

**< b > Question 4 </ b >****[1 mark]**

Two similar cones have heights in the ratio 2:5. What is the ratio of their volumes?

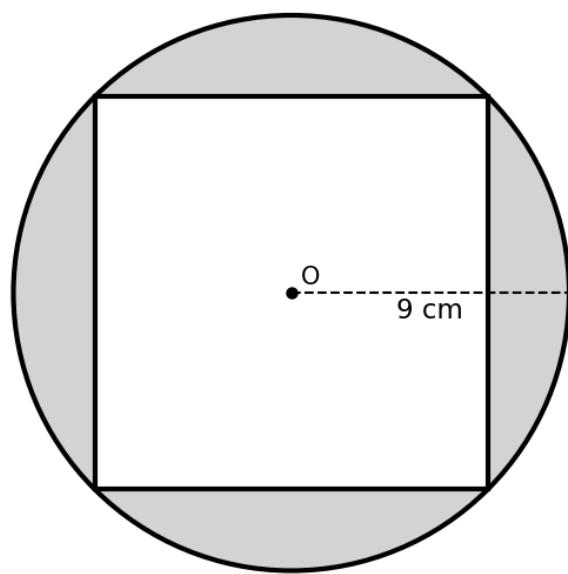
**< b > Question 5 </ b >****[1 mark]**

A cube has a surface area of  $150 \text{ cm}^2$ . Find the side length of the cube.

**< b > Question 6 </ b >****[2 marks]**

The diagram shows a circle with radius 9 cm and a square inscribed inside it. Find the shaded area. Leave your answer in terms of  $\pi$ .

Circle with inscribed square



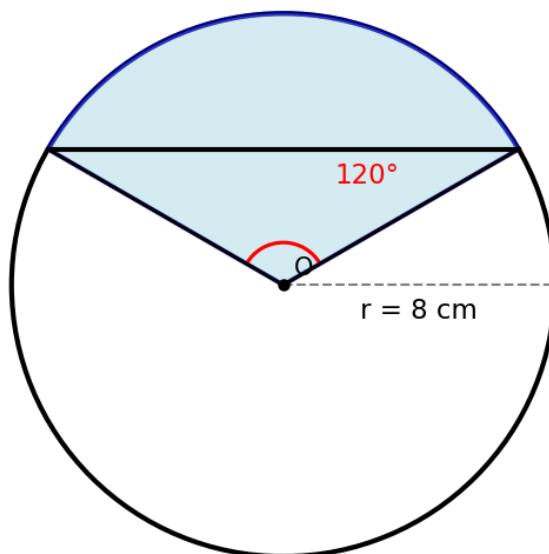
**<b>Question 7</b>****[2 marks]**

A cone has a base radius of 6 cm and a perpendicular height of 8 cm. Find the total surface area of the cone in terms of  $\pi$ .

**<b>Question 8</b>****[2 marks]**

Find the area of the shaded minor segment shown in the diagram. The circle has a radius of 8 cm and the central angle is  $120^\circ$ . Give your answer to one decimal place. [Tech-Active]

Minor segment (shaded)

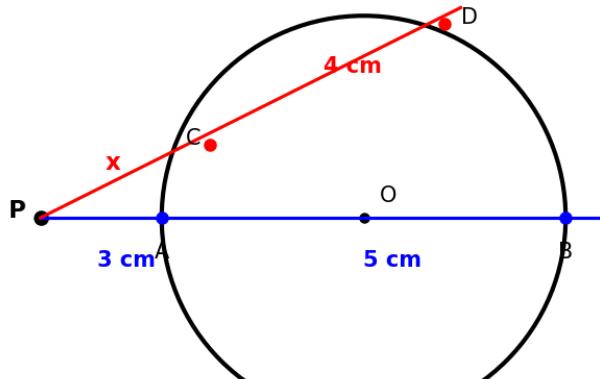


**<b>Question 9</b>****[2 marks]**

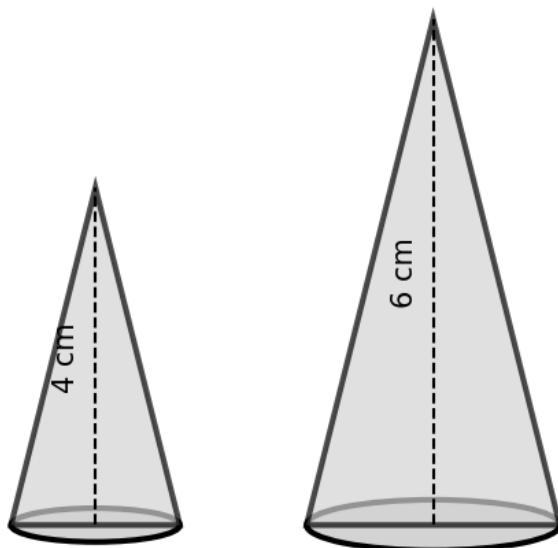
In the diagram, two secants are drawn from external point P to a circle. Find the value of  $x$ .

Given:  $PA = 3 \text{ cm}$ ,  $AB = 5 \text{ cm}$ ,  $PC = x \text{ cm}$ ,  $CD = 4 \text{ cm}$ .

Two secants from external point P

**<b>Question 10</b>****[2 marks]**

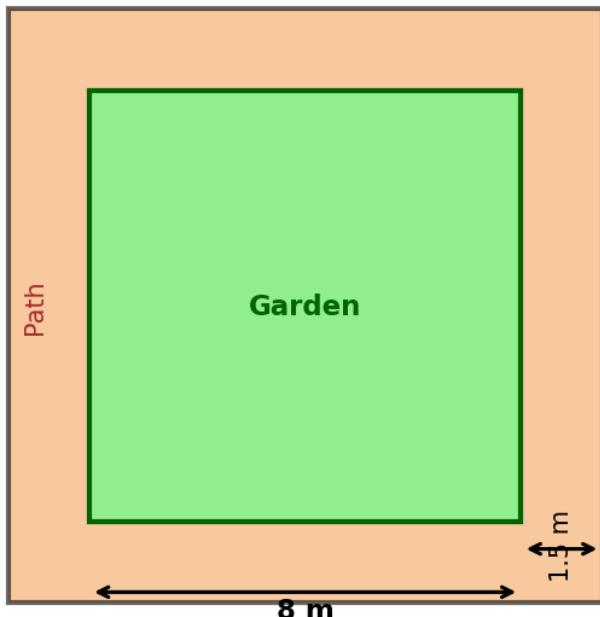
Two similar cones have heights of 4 cm and 6 cm. If the curved surface area of the smaller cone is  $60 \text{ cm}^2$ , what is the curved surface area of the larger cone? [Tech-Active]

**Two similar cones**



**<b>Question 11</b>****[2 marks]**

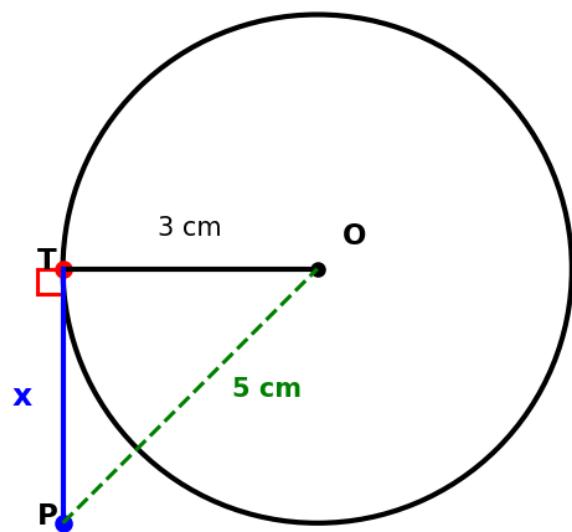
A square garden has sides of length 8 m. A path 1.5 m wide surrounds the garden. Find the area of the path.

**Square garden with path****<b>Question 12</b>****[2 marks]**

In the diagram, PT is a tangent to the circle with centre O and radius 3 cm. If PO = 5 cm, find the length of the tangent PT (marked as  $x$ ). Give your answer correct to two decimal places.

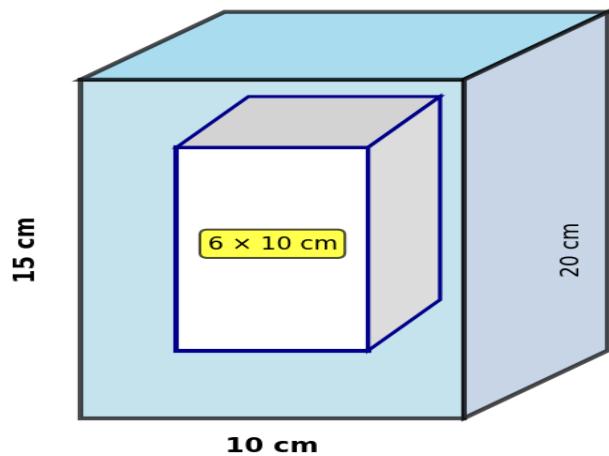
[Tech-Active]

### Tangent from external point



**Question 13 [4 marks]**

A hollow rectangular prism has outer dimensions  $10 \text{ cm} \times 15 \text{ cm} \times 20 \text{ cm}$  (width  $\times$  height  $\times$  length). A rectangular hole  $6 \text{ cm} \times 10 \text{ cm}$  passes through the entire length of the prism.

**Hollow rectangular prism**

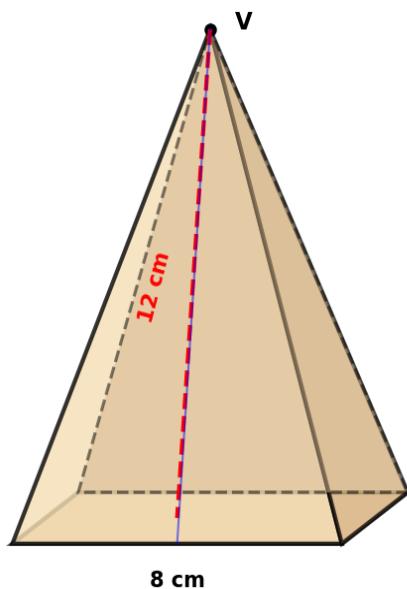
(a) What is the volume of material in the prism? Leave your answer in exact form. [2 marks]

(b) Find the total surface area of the prism (including all interior and exterior surfaces). [2 marks]

**Question 14 [4 marks] [Tech-Active]**

A camping tent has the shape of a square-based pyramid. The base is a square with side length 8 cm and the perpendicular height from the apex to the base is 12 cm.

**Square pyramid tent**



(a) Find the slant height of one triangular face of the pyramid. [2 marks]

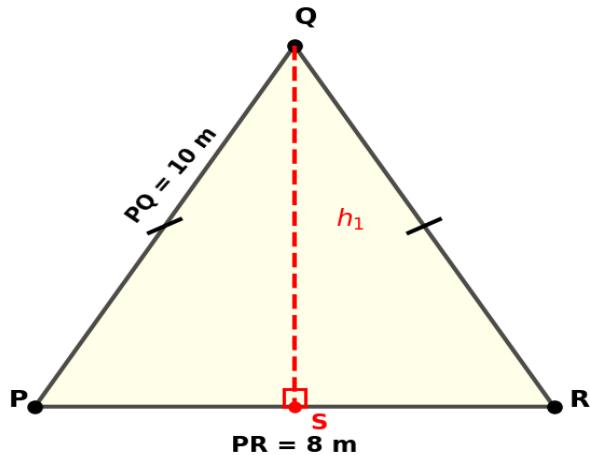
(b) Find the lateral surface area (area of the four triangular faces only). Give your answer to the nearest  $\text{cm}^2$ . [1 mark]

(c) Rope is attached around the perimeter of the base. What is the minimum length of rope needed? [1 mark]

**Question 15 [3 marks]**

An architect is designing a symmetrical A-frame support structure for a building, as shown by ▲PQR. A vertical support beam QS connects the peak Q to the midpoint S of the base PR.

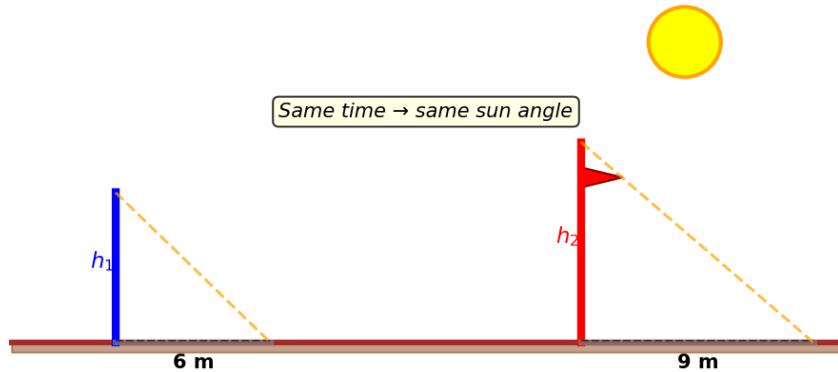
**A-frame support structure**



- (a) Calculate the height  $h_1$  of the support beam QS.

Given:  $PQ = 10 \text{ m}$ ,  $PR = 8 \text{ m}$  [2 marks]

The support beam (with height  $h_1$ ) casts a shadow that is 6 metres long. At the exact same time, a flag pole (with height  $h_2$ ) casts a shadow that is 9 metres long.

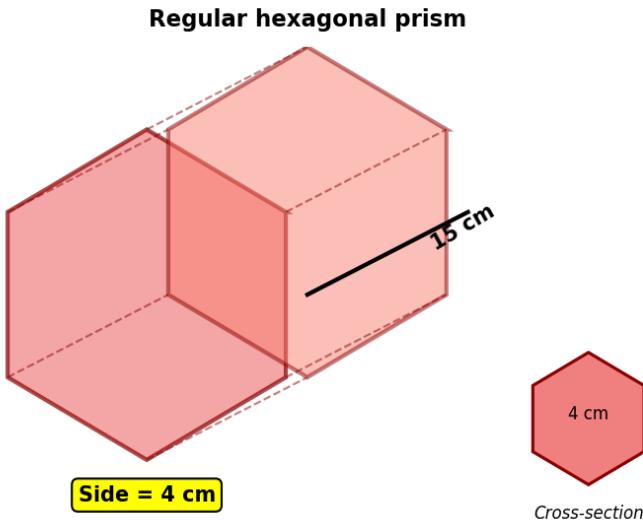


- (b) Calculate the height  $h_2$  of the flag pole. [1 mark]



**Question 16 [4 marks]**

A prism has a regular hexagonal cross-section with side length 4 cm. The length of the prism is 15 cm.



(a) A regular hexagon can be divided into 6 equilateral triangles. Find the height of one of these triangles. [2 marks]

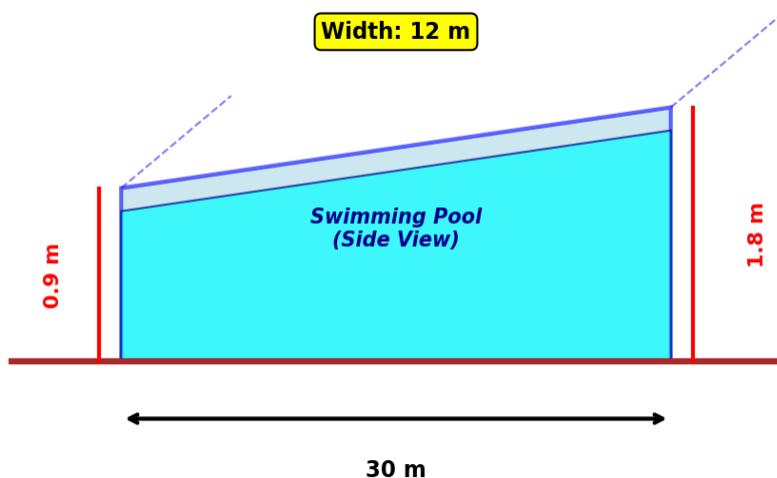
(b) Hence, find the area of the hexagonal cross-section. [1 mark]

(c) Find the volume of the prism. [1 mark]

## Section B: Extended Response Questions

### Question 17 [7 marks] [Tech-Active]

A swimming pool is a prism with a trapezoidal cross-section. The parallel sides of the trapezium are 0.9 m (shallow end) and 1.8 m (deep end). The pool is 30 m long and 12 m wide.



(a) Calculate the area of the trapezoidal cross-section. [1 mark]

(b) Find the volume of the pool in cubic metres. [1 mark]

(c) How many litres of water are needed to fill the pool? ( $1 \text{ m}^3 = 1000 \text{ L}$ ). [1 mark]

**Question 17 (continued)**

(d) The four interior walls of the pool need tiling:

- Two long rectangular walls ( $30\text{ m} \times 0.9\text{ m}$  and  $30\text{ m} \times 1.8\text{ m}$ )
- Two short trapezoidal end walls (already calculated in part a)

Find the total area of the four walls to be tiled. [2 marks]

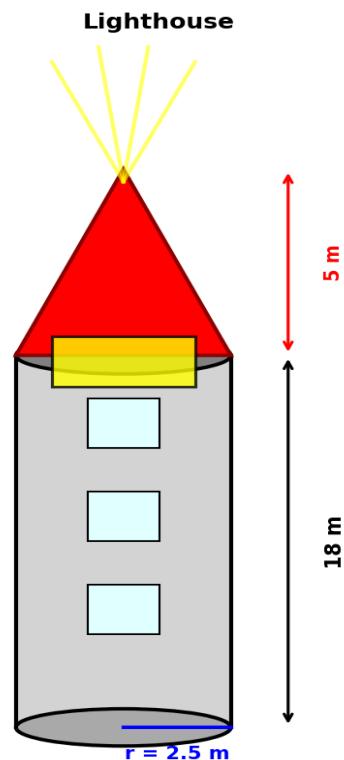
(e) The four interior walls will be tiled using square tiles measuring  $20\text{ cm} \times 20\text{ cm}$ . Allow 15% extra for wastage. How many tiles are needed? [2 marks]

**Question 18 [9 marks]**

A lighthouse consists of two parts: a cylindrical body and a conical roof.

The cylinder has a radius of 2.5 m and a height of 18 m.

The cone has the same base radius and a height of 5 m.



(a) Find the volume of the cylindrical body and the conical roof. [2 marks]

(b) Find the total volume of the lighthouse. [1 mark]

**Question 18 (continued)**

(c) To paint the exterior, the painter needs to know the lateral surface areas. Find:

- The curved surface area of the cylinder (excluding top and bottom)
- The slant height of the cone
- The curved surface area of the cone (excluding the base)

[4 marks]

(d) Find the total external surface area to be painted (cylindrical curved surface + conical curved surface, but NOT the base of the lighthouse). [2 marks]

**END OF EXAMINATION**