

# 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

Section	Marks	Score
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

### **Question 4**

**[1 mark]**

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

### **Question 5**

**[1 mark]**

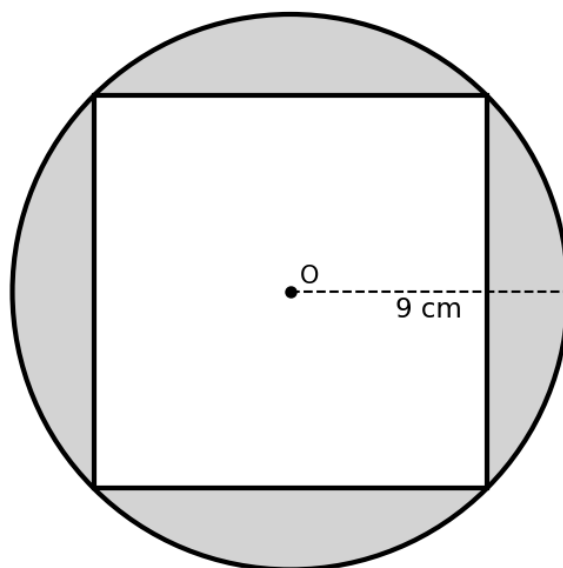
A cube has a surface area of  $150 \text{ cm}^2$ . Find the side length of the cube.

### **Question 6**

**[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



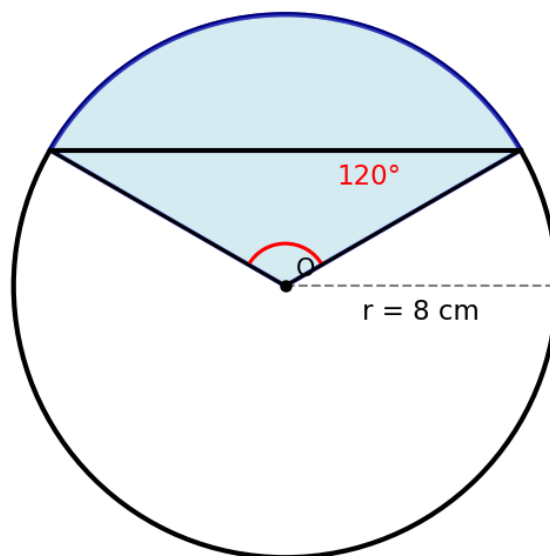
**Question 7****[2 marks]**

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  $\pi$ .

**Question 8****[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)

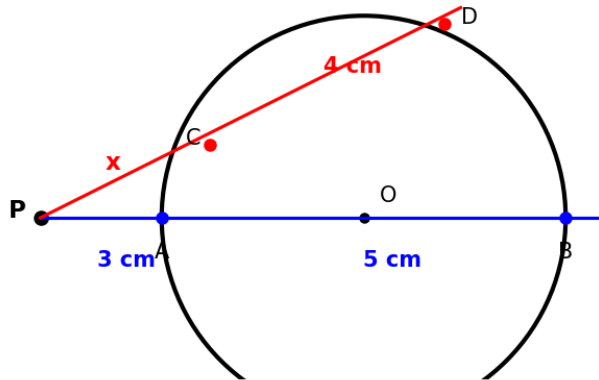


**Question 9****[2 marks]**

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

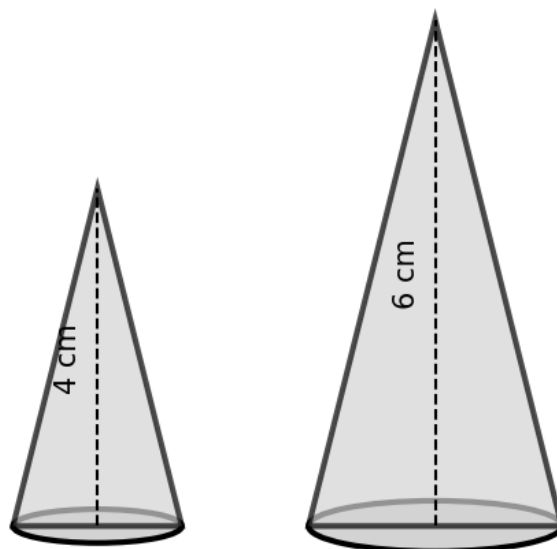
Given:  $PA = 3\text{ cm}$ ,  $AB = 5\text{ cm}$ ,  $PC = x\text{ cm}$ ,  $CD = 4\text{ cm}$ .

Two secants from external point P

**Question 10****[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**

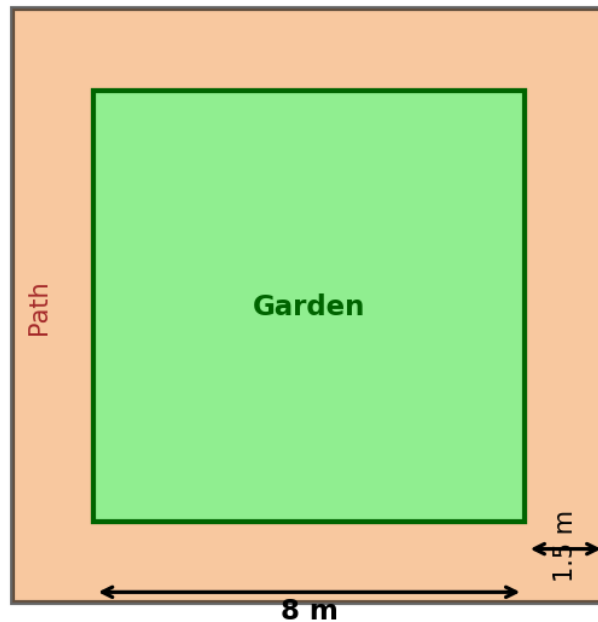




**Question 11****[2 marks]**

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

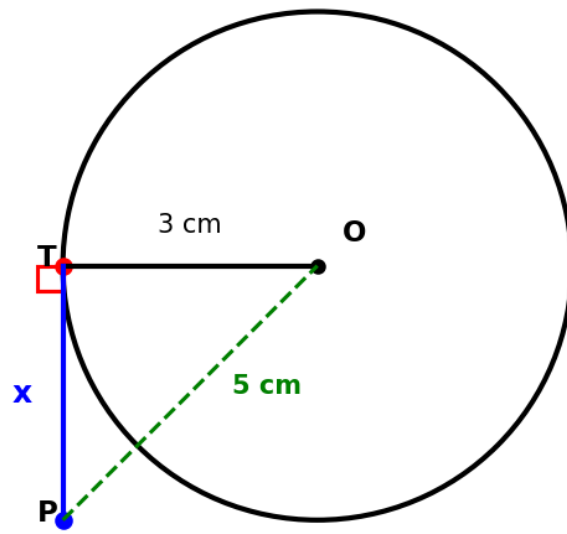
**Square garden with path**

**Question 12****[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]*

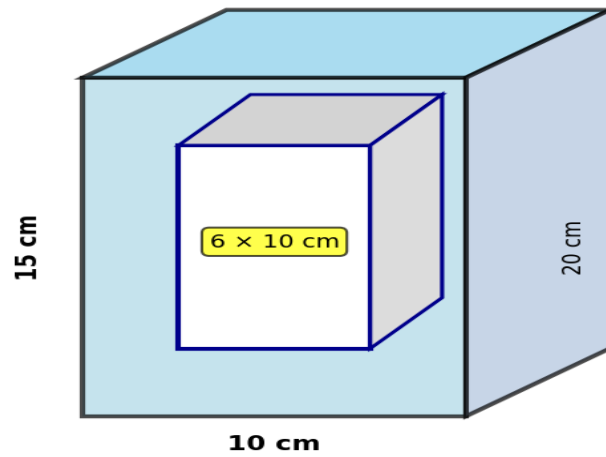
### Tangent from external point



**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**



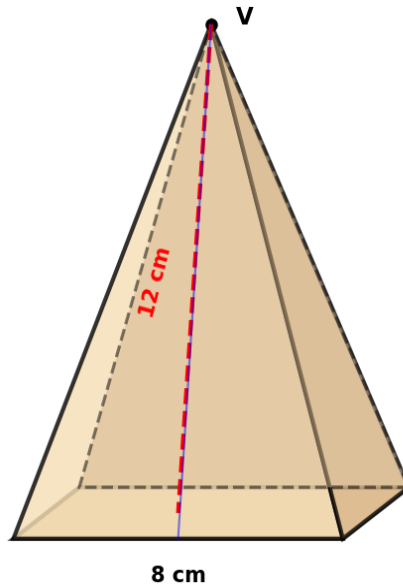
**(a)** What is the volume of material in the prism? Leave your answer in exact form. [2 marks]

**(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]

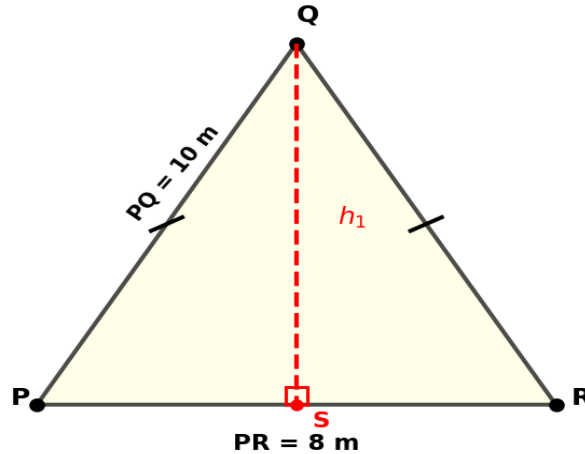
**(b)** Find the lateral surface area (area of the four triangular faces only). Give your answer to the nearest  $\text{cm}^2$ . [1 mark]

**(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  $\triangle PQR$ . A vertical support beam  $QS$  connects the peak  $Q$  to the midpoint  $S$  of the base  $PR$ .

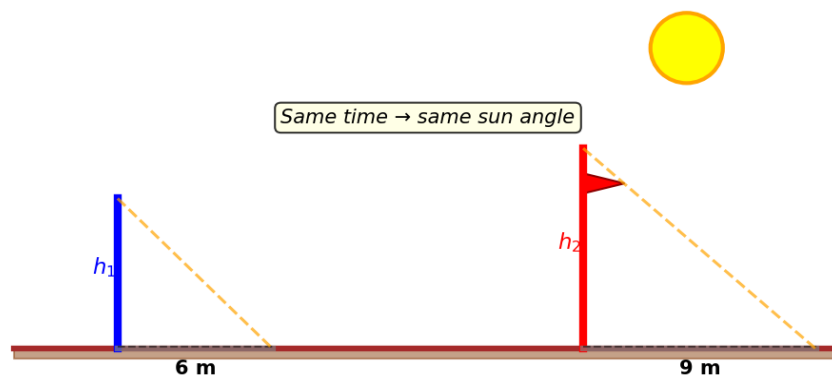
**A-frame support structure**



(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.

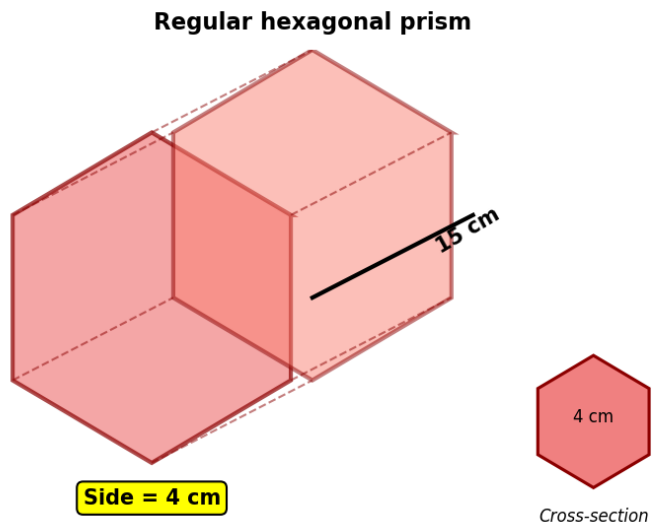


(b) Calculate the height  $h_2$  of the flag pole. [1 mark]



**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]

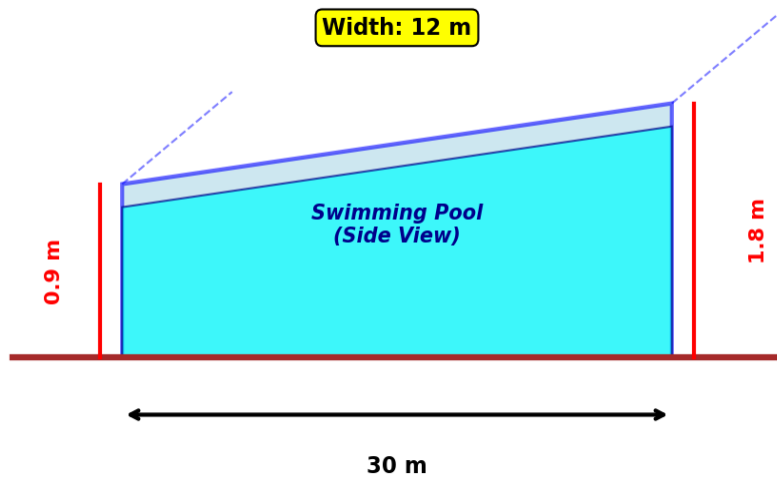
**(b)** Hence, find the area of the hexagonal cross-section. [1 mark]

**(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]

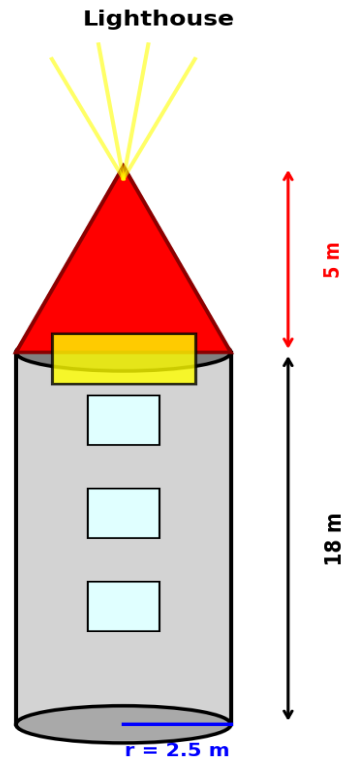
**(e)** The four interior walls will be tiled using square tiles measuring  $20\text{ cm} \times 20\text{ cm}$ . Allow 15% extra for wastage. How many tiles are needed? [2 marks]

**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**