

Cambridge International AS & A Level

Mathematics

9709

Paper 1 Pure Mathematics 1

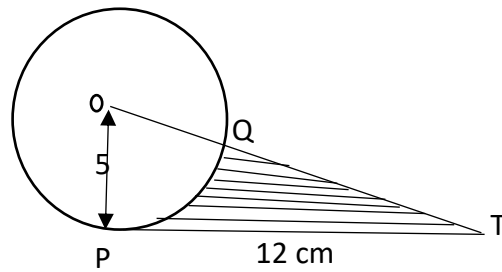
Topic 4-Circular Measure

Question No (5)

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Question No (5)

The diagram shows a circle with center O and radius 5 cm. The point P lies on the circle; PT is a tangent to the circle and $PT = 12$ cm. The line OT cuts the circle at the point Q.

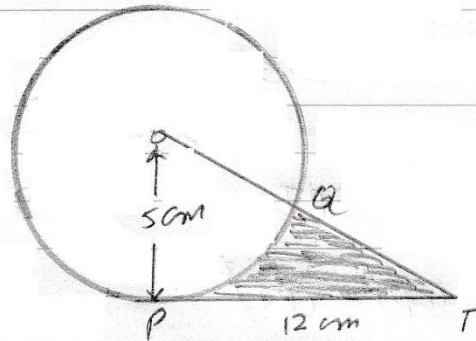
- (i) Find the perimeter of the shaded region.
- (ii) Find the area of the shaded region.

Solution

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DATE :-

②



As tangent to circle makes an angle of 90° to the radius of the circle i.e. $\angle OPT = 90^\circ$

So $OP \perp PT$

From triangle OPT

$$\tan \angle POT = \frac{\text{vertical}}{\text{base}}$$

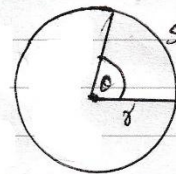
$$\tan \angle POT = \frac{12}{5}$$

$$\angle POT = \tan^{-1}\left(\frac{12}{5}\right)$$

$$\angle POT = 1.176 \text{ radians}$$

Arc length formula

$$s = r\theta$$



ARC length

$$\widehat{PQ} = r\theta$$

$$= (5)(1.176)$$

$$= 5.88 \text{ cm}$$

$$= r = 5, \theta = 1.176$$

From triangle OPT

$$(OT)^2 = (OP)^2 + (PT)^2$$

$$= (5)^2 + (12)^2$$

$$= 25 + 144$$

$$(OT)^2 = 169$$

$$OT = 13 \text{ cm}$$

By Pythagoras
Theorem

From Fig

$$OT = OQ + QT$$

$$13 = 5 + QT$$

$$QT = 13 - 5$$

$$QT = 8$$

$\therefore$ perimeter of the shaded region =

$$\text{arc length } \widehat{PQ} + QT + PT$$

$$= 5.88 + 8 + 12$$

$$= 25.9 \text{ cm}$$

(ii) Now we shall find area of shaded region

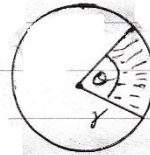
$$\text{Area of } \triangle OPT = \frac{1}{2} \text{ base} \times \text{height}$$

$$= \frac{1}{2} (5)(12)$$

$$= 30 \text{ cm}^2$$

Formula for area of sector

$$A = \frac{1}{2} r^2 \theta$$



$$\text{Area of sector } OPQ = \frac{1}{2} r^2 \theta$$

$$= \frac{1}{2} (5)^2 (1.176)$$

$$= 14.7 \text{ cm}^2$$

$$\therefore \text{Area of shaded region} = \text{area of } \triangle OPT - \text{area of sector } OPQ$$

$$= 30 - 14.7$$

$$= 15.3 \text{ cm}^2$$