

Past-paper walk-through

Circular measure ■ 1.4

eXercise

Questions in this set

- 9709/11 N25 Q7 ■ 8 marks
- 9709/12 N25 Q10 ■ 9 marks
- 9709/11 J25 Q9 ■ 8 marks

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- **//** separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = “or words to that effect” – the wording need not match.

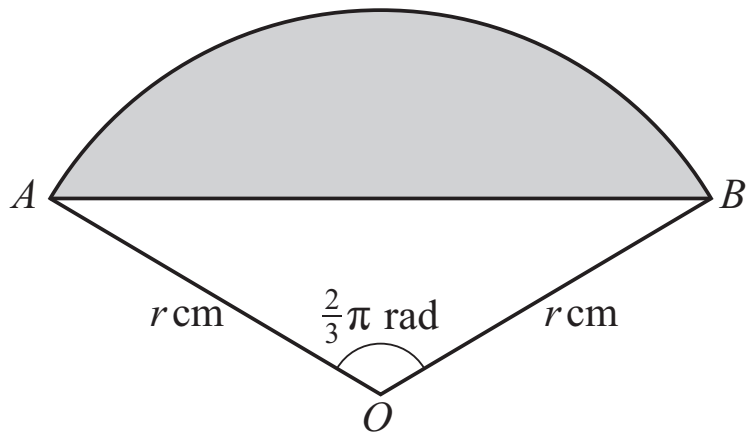
Question 7

9709/11 N25 ■ Q7 ■ 8 marks

The diagram shows a sector of a circle with centre O and radius r cm. The shaded region is bounded by the chord AB and the arc AB . The size of angle AOB is $\frac{2}{3}\pi$ radians.

- (a)** Show that the area of the shaded region is approximately $0.614r^2$ cm². [2]
- (b)(i)** Find the rate of increase of the area of the shaded region at the instant when $r = 20$. Give your answer correct to 2 significant figures. [3]
- (b)(ii)** Find the rate of increase of the length of the arc AB . Give your answer correct to 2 significant figures. [3]

Question 7



Solution 7

(a)

Mark scheme

■ Shaded area $= \frac{1}{2}r^2\left(\frac{2}{3}\pi\right) - \frac{1}{2}r^2 \sin \frac{2}{3}\pi = \left(\frac{\pi}{3} - \frac{\sqrt{3}}{4}\right)r^2 = 0.614r^2$ (AG).

Solution 7

(b)(i)

Mark scheme

$$\blacksquare \frac{dA}{dr} = 1.228r, \quad \frac{dA}{dt} = \frac{dA}{dr} \times 0.4 = 1.228(20)(0.4) = 9.8 \text{ cm}^2 \text{ s}^{-1} \text{ (2 s.f.)}.$$

Solution 7

(b)(ii)**Mark scheme**

■ Arc $AB = \frac{2}{3}\pi r$, so $\frac{dl}{dt} = \frac{2}{3}\pi \times 0.4 = 0.84 \text{ cm s}^{-1}$ (2 s.f.).

Question 10

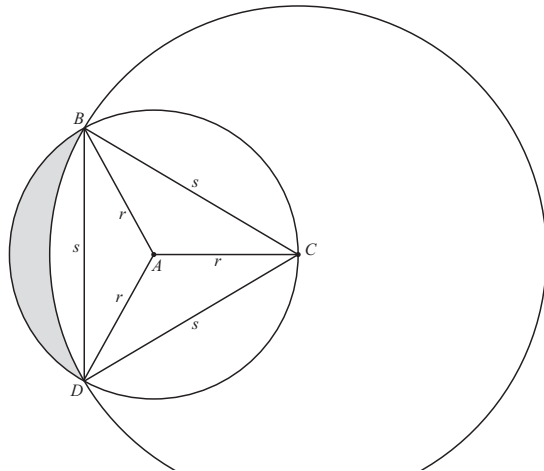
9709/12 N25 ■ Q10 ■ 9 marks

The diagram shows a circle with centre A and radius r passing through points B , C and D . A larger circle of radius s has centre C and passes through B and D . The length BD is also s .

(a) Show that $s = \sqrt{3}r$. [2]

(b) Find an expression for the area of the shaded region. Give your answer in the form $(a + b\pi)r^2$, where a and b are constants to be found. [7]

Question 10



Question 10



Solution 10

(a)

Mark scheme

$$\blacksquare s^2 = r^2 + r^2 - 2r^2 \cos \frac{2\pi}{3} = 2r^2 + r^2 = 3r^2 \Rightarrow s = \sqrt{3} r \text{ (AG).}$$

Solution 10

(b) Mark scheme

- Sector $BAD = \frac{\pi}{3}r^2$, sector $BCD = \frac{1}{2}s^2\left(\frac{\pi}{3}\right) = \frac{\pi}{2}r^2$; triangle terms $\frac{\sqrt{3}}{4}r^2$ and $\frac{3\sqrt{3}}{4}r^2$.
Shaded area = $\left(\frac{\sqrt{3}}{2} - \frac{\pi}{6}\right)r^2$ (so $a = \frac{\sqrt{3}}{2}$, $b = -\frac{1}{6}$).

Question 9

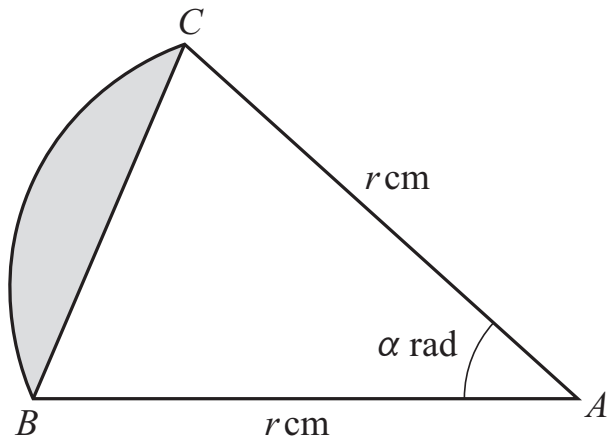
9709/11 J25 ■ Q9 ■ 8 marks

The diagram shows a sector ABC of a circle with centre A and radius r cm. The angle BAC is α radians, where $0 < \alpha < \frac{1}{2}\pi$.

(a) It is given that the area of the triangle ABC is 4 cm^2 and the area of the sector ABC is $8\alpha \text{ cm}^2$. Find the exact area of the shaded segment. [4]

(b) It is given instead that the length of the chord BC is $\frac{1}{\sqrt{2}}r$ cm but the area of the triangle ABC is still 4 cm^2 . Find the area of the shaded segment. Give your answer correct to 3 significant figures. [4]

Question 9



Solution 9

(a)

Mark scheme

- Sector $\frac{1}{2}r^2\alpha = 8\alpha \Rightarrow r^2 = 16$. Triangle $\frac{1}{2}r^2 \sin \alpha = 4 \Rightarrow \sin \alpha = \frac{1}{2} \Rightarrow \alpha = \frac{\pi}{6}$.
Segment $= 8\alpha - 4 = \frac{4\pi}{3} - 4$.

Solution 9

(b)

Mark scheme

■ $BC^2 = 2r^2(1 - \cos \alpha) = \frac{1}{2}r^2 \Rightarrow \cos \alpha = \frac{3}{4}, \alpha = 0.7227.$
 $\frac{1}{2}r^2 \sin \alpha = 4 \Rightarrow r^2 = \frac{32}{\sqrt{7}}.$ Segment $= \frac{1}{2}r^2\alpha - 4 = 0.371.$