

1.4 Circular measure

Name: _____ Class: _____ Date: _____

Total: 13 marks

Objective

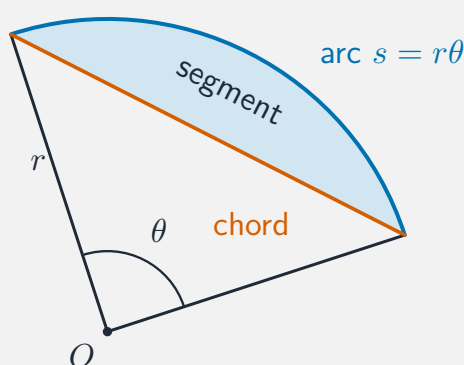
Build the skills to answer exam questions on **circular measure** 弧度制—**radians** 弧度, **arc length** 弧长, **sector area** 扇形面积 and the area of a **segment** 弓形.

You must be able to:

- convert between degrees and radians
- use $s = r\theta$ and $A = \frac{1}{2}r^2\theta$ (with θ in radians)
- find a segment area as sector minus triangle

1 Worked examples

■ Sector and segment



The shaded segment is the part of the sector between the chord and the arc

For a sector (angle θ in radians): $s = r\theta$, $A = \frac{1}{2}r^2\theta$. Segment = $\frac{1}{2}r^2\theta - \frac{1}{2}r^2 \sin \theta = \frac{1}{2}r^2(\theta - \sin \theta)$.

A sector has $r = 6$, $\theta = \frac{2}{3}\pi$. Arc = $6 \cdot \frac{2}{3}\pi = 4\pi$; area = $\frac{1}{2}(36)\frac{2}{3}\pi = 12\pi$.

2 Practice

2.1 Convert 120° to radians (exact). [1]

2.2 A sector has $r = 5$ cm and $\theta = 0.8$ rad. Find its arc length. [1]

3 Exam-style questions

3.1 The area of a sector with $r = 4$ and $\theta = \frac{\pi}{6}$ is: [1]

- A $\frac{2\pi}{3}$
 - B $\frac{4\pi}{3}$
 - C $\frac{\pi}{3}$
 - D 2π
-

3.2 A sector OAB has centre O , radius 10 cm and angle $AOB = 1.2$ radians.

(a) Find the perimeter of the sector. [3]

(b) Find the area of the **segment** between the chord AB and the arc. [3]

3.3 A sector has perimeter 20 cm and area 16 cm^2 . Show that the radius r satisfies $r^2 - 10r + 16 = 0$, and hence find the two possible radii. [4]

4 Go further

You are now ready for the real exam questions on this subtopic. Open the **1.4 Circular measure** past-paper sheet in the Library, or try these in **Practice mode**:

- 9709/11 N25 —Q7 (arc and sector)
- 9709/12 N25 —Q10 (circular measure)
- 9709/11 J25 —Q9 (segment area)

Solutions

2.1 $120 \times \frac{\pi}{180} = \frac{2\pi}{3}$.

2.2 $s = r\theta = 5 \times 0.8 = 4$ cm.

3.1 B. $A = \frac{1}{2}(16)\frac{\pi}{6} = \frac{4\pi}{3}$.

3.2 (a) arc = $10 \times 1.2 = 12$; perimeter = $12 + 10 + 10 = 32$ cm.

(b) segment = $\frac{1}{2}(10^2)(1.2 - \sin 1.2) = 50(1.2 - 0.9320) = 50(0.2680) = 13.4$ cm².

3.3 perimeter: $2r + r\theta = 20$; area: $\frac{1}{2}r^2\theta = 16 \Rightarrow r\theta = \frac{32}{r}$. Substitute: $2r + \frac{32}{r} = 20 \Rightarrow 2r^2 - 20r + 32 = 0 \Rightarrow r^2 - 10r + 16 = 0$. Factorise $(r - 2)(r - 8) = 0 \Rightarrow r = 2$ or $r = 8$.