Radians, arcs and sectors

Skills sheet · SL AA 3.4

KEY FACTS

π rad $= 180°$ D1 P1

Arc $l = r\theta$; sector $A = \frac{1}{2}r^2\theta$ P2

Segment $\frac{1}{2}r^2(\theta - \sin\theta)$ D2

θ in radians in both formulas W2.

Perimeter: two radii and the arc.

No degree sign: radians W1.

WHAT UNLOCKS

- degrees → radians $\times \frac{\pi}{180}$, then simplify.
- an arc or a sector → the formula, θ in radians.
- a shaded segment → sector minus triangle.
- θ and $\sin\theta$ in one equation → the GDC.

WORKED EXAMPLE ①

Convert $135°$ to radians. no GDC

$135 \times \frac{\pi}{180}$ M1

$= \frac{3\pi}{4}$ A1

Method

Converting

① Multiply by $\frac{\pi}{180}$.
② Simplify the fraction.
③ Keep π.

WORKED EXAMPLE ②

A sector has radius 5 and angle 0.8. Find its arc. no GDC

5×0.8 M1

$= 4$ A1

Method

An arc

① Check θ is in radians.
② $l = r\theta$.
③ Units.

Never $r\theta$ with θ in degrees.

FLUENCY

1. $60°$ in radians no GDC

2. $\frac{\pi}{5}$ in degrees no GDC

3. $\frac{3\pi}{2}$ in degrees no GDC

4. Arc: $r = 4$, $\theta = \frac{\pi}{2}$ no GDC

5. Sector area: $r = 6$, $\theta = \frac{\pi}{3}$ no GDC

6. One radian in degrees with GDC

REASONING

●●● **Question 1.** A sector of radius 6 has an arc of length 15. [no GDC]

(a) Find its angle. [1]

(b) Find its area. [2]

●●● **Question 2.** A circle has radius 5; a chord subtends 1 radian at the centre. [with GDC]

(a) Find the area of the minor segment. [3]

●●● **Question 3.** A sector has radius 9 and angle $\frac{2\pi}{3}$. [no GDC]

(a) Find its exact perimeter. [2]

PROBLEMS

●●● **Question 4.** A sector has perimeter 28 cm and area 48 cm^2. [no GDC]

(a) Find the two possible pairs of radius and angle. [5]

●●● **Question 5.** A sector has area 25 and perimeter 20. [no GDC]

(a) Find its radius and its angle. [4]

ANSWERS

1 $\frac{\pi}{3}$

2 $36°$

3 $270°$

4 2π

5 6π

6 $57.3°$

Q1 (a) 2.5 (b) 45

Q2 $\frac{1}{2} \times 25(1 - \sin 1) = 1.98$

Q3 $18 + 6\pi$

Q4 $r^2 - 14r + 48 = 0$: $r = 6, \theta = \frac{8}{3}$ or $r = 8, \theta = 1.5$

Q5 $r^2 - 10r + 25 = 0$: $r = 5, \theta = 2$

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