

Section 2: Circular measure

Solutions to Exercise level 1

1. (i) Arc length = $r\theta = 10 \times 2 = 20$ cm

(ii) Arc length = $r\theta = 8 \times \frac{7\pi}{12} = \frac{14\pi}{3} = 14.7$ cm (3 s.f.)

(iii) $105^\circ = \frac{105}{180} \times \pi$ radians

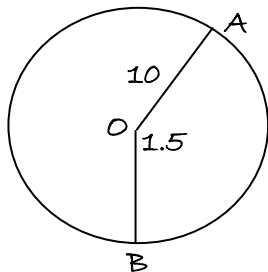
Arc length = $r\theta = 15 \times \frac{105}{180} \pi = \frac{35\pi}{4} = 27.5$ cm (3 s.f.)

2. (i) Area of sector = $\frac{1}{2}r^2\theta = \frac{1}{2} \times 10^2 \times 2 = 100$ cm²

(ii) Area of sector = $\frac{1}{2}r^2\theta = \frac{1}{2} \times 8^2 \times \frac{7\pi}{12} = \frac{56\pi}{3} = 58.6$ cm² (3 s.f.)

(iii) Area of sector = $\frac{1}{2}r^2\theta = \frac{1}{2} \times 15^2 \times \frac{105\pi}{180} = \frac{525\pi}{8} = 206$ cm² (3 s.f.)

3.



Arc length = $r\theta = 10 \times 1.5 = 15$ cm

Area of sector = $\frac{1}{2}r^2\theta = \frac{1}{2} \times 10^2 \times 1.5 = 75$ cm²

4. Using the small angle approximations $\sin x \approx x$, $\cos x \approx 1 - \frac{1}{2}x^2$, $\tan x \approx x$

(i) $\sin 2\theta \approx 2\theta$

(ii) $\tan 3\theta \approx 3\theta$

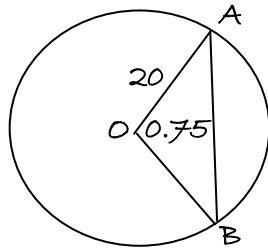
(iii) $\sin \theta \cos \theta \approx \theta(1 - \frac{1}{2}\theta^2) = \theta - \frac{1}{2}\theta^3$

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$$(iv) \quad \tan \theta \cos 2\theta \approx \theta \left(1 - \frac{1}{2}(2\theta)^2\right) = \theta - 2\theta^3$$

$$(v) \quad 1 - \cos 2\theta \approx 1 - \left(1 - \frac{1}{2}(2\theta)^2\right) \\ = 1 - 1 + \frac{1}{2} \times 4\theta^2 \\ = 2\theta^2$$

5.



$$\text{Area of triangle } AOB = \frac{1}{2} \times 20 \times 20 \sin 0.75 = 136.33$$

$$\text{Area of sector } AOB = \frac{1}{2} r^2 \theta = \frac{1}{2} \times 20^2 \times 0.75 = 150$$

$$\text{Area of segment} = 150 - 136.33 = 13.7 \text{ cm}^2$$