

## Length of Arc

### Starter

1. **(Review of last lesson)** An isosceles triangle has two sides of length 4 cm and its one distinct angle is  $54^\circ$ . Find its area.

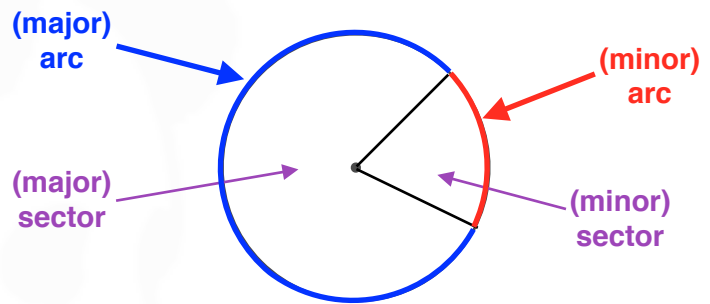
**Working:** Area of triangle =  $\frac{1}{2} \times 4 \times 4 \times \sin 54 = 6.47 \text{ cm}^2$  (3 s.f.)

### Key language

**Arcs** form part of the **circumference**.

**Sectors** form part of the **area**.

**N.B.** A **sector** is like a **pizza slice**



2. A circle has a radius of 18 cm. Express the following in terms of  $\pi$ . Find:
- the **circumference** of the circle
  - the **length of arc** when we have only half the circle (angle is  $180^\circ$ ).
  - the **length of arc** when we have one quarter of a circle (angle is  $90^\circ$ ).
  - the **length of arc** when the angle at the centre is  $60^\circ$ .
  - the **length of arc** when the angle at the centre is  $\theta$  (give your answer in terms of  $\theta$ ).

**Working:**

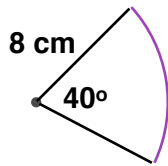
- $36\pi$
- $18\pi$
- $9\pi$
- $6\pi$
- $\frac{\theta}{360} \times 36\pi$

3. Based on your answer to (e), write down a formula for the **length of arc** of a when the radius of the sector is  $r$  and the angle at the centre is  $\theta$ .  
Give your answer in terms of  $r$  and  $\theta$ .

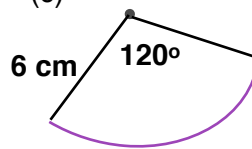
**Working:** Length of arc =  $\frac{\theta}{360} \times 2\pi r$

**E.g. 1** Find the length of the **arc**, giving your answers to 3 s.f.

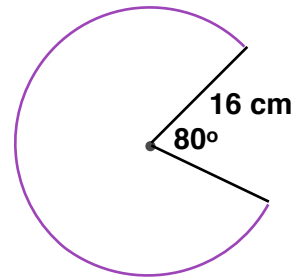
(a)



(b)



(c)



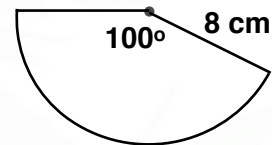
**Working:** (a) Length of arc =  $\frac{40}{360} \times 2\pi \times 8 = \frac{16\pi}{9} = 5.59 \text{ cm (3 s.f.)}$

(b) Length of arc =  $\frac{120}{360} \times 2\pi \times 6 = 4\pi = 12.6 \text{ cm (3 s.f.)}$

(c) The angle of the required arc is  $360^\circ - 80^\circ = 280^\circ$   
 Length of arc =  $\frac{280}{360} \times 2\pi \times 16 = \frac{224\pi}{9} = 78.2 \text{ cm (3 s.f.)}$

**E.g. 2** The length of an arc is 20 cm when the angle subtended at the centre is  $50^\circ$ . Find the radius of the sector.

**E.g. 3** Find the perimeter of the sector.



**E.g. 2 Working:**  $\frac{50}{360} \times 2\pi \times r = 20$   
 $\frac{5}{36} \times 2\pi r = 20$   
 $r = \frac{20 \times 36}{2\pi \times 5}$   
 $r = 22.9 \text{ cm (3 s.f.)}$

**E.g. 3 Working:** Length of arc =  $\frac{100}{360} \times 2\pi \times 8 = \frac{40\pi}{9}$   
 Perimeter =  $\frac{40\pi}{9} + 16 = 30.0 \text{ cm (3 s.f.)}$

**Video:** [Arc length](#)

[Solutions to Starter and E.g.s](#)

**Exercise**

- 9-1 class textbook: p429 M13.2 Qu 1, 3, 5, 7-9, 12-15
- A\*-G class textbook: p384 E13.2 Qu 1, 3, 5, 7-9, 12-15
- 9-1 homework book: p146 M13.2 Qu 1-9
- A\*-G homework book: p107 E13.2 Qu 1-8

**[Homework book answers \(only available during a lockdown\)](#)**