

Arcs and Sectors

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • Foundation tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (2 marks)

The diagram shows a sector of a circle of radius 9 cm.

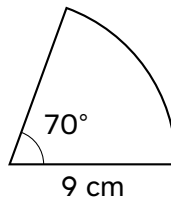


Diagram **NOT** accurately drawn

Work out the area of the sector.

Give your answer correct to 1 decimal place.

$$\text{Area of a sector} = \frac{\text{angle}}{360} \times \pi r^2$$

Here the angle is 70° and the radius is $r = 9$.

$$\text{Area} = \frac{70}{360} \times \pi \times 9^2$$

$$= 49.48 \dots$$

Round to 1 decimal place: 49.5

Answer: 49.5 cm²

Marks: 1 mark for $\frac{70}{360} \times \pi \times 9^2$. 1 mark for 49.5 (or 49.48...).

2 (2 marks)

A sector has radius 12 cm and angle 150°

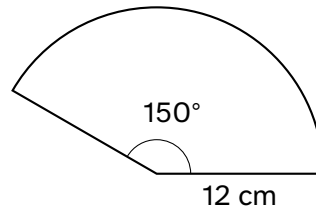


Diagram **NOT** accurately drawn

Work out the length of the arc.

Give your answer correct to 1 decimal place.

$$\text{Arc length} = \frac{\text{angle}}{360} \times 2\pi r$$

Here the angle is 150° and $r = 12$.

$$\text{Arc length} = \frac{150}{360} \times 2 \times \pi \times 12$$

$$= 31.41 \dots$$

Round to 1 decimal place: 31.4

Answer: 31.4 cm

Tip: Arc length comes from the circumference, $2\pi r$. Many students use πr^2 (area) or πr by mistake.

Marks: 1 mark for $\frac{150}{360} \times 2 \times \pi \times 12$. 1 mark for 31.4 (or 31.41...).

3 (3 marks)

A sector has radius 7 cm and angle 100°

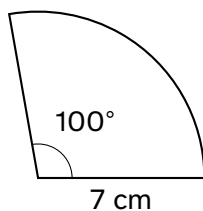


Diagram **NOT** accurately drawn

Work out the perimeter of the sector.

Give your answer correct to 1 decimal place.

The perimeter is the arc plus the two straight sides (two radii).

$$\text{Arc length} = \frac{100}{360} \times 2 \times \pi \times 7$$

$$= 12.21 \dots$$

The two radii add up to $7 + 7 = 14$.

$$\text{Perimeter} = 12.21 \dots + 14 = 26.21 \dots$$

Round to 1 decimal place: 26.2

Answer: 26.2 cm

Tip: Remember to add the two radii (2×7) to the arc length. Forgetting them is the most common mistake.

Marks: 1 mark for working out the arc length. 1 mark for adding 14 (the two radii). 1 mark for 26.2.

4 (2 marks)

A sector has radius 10 cm and angle 90°

Work out the area of the sector.

Give your answer in terms of π .

$$90^\circ \text{ is } \frac{90}{360} = \frac{1}{4} \text{ of a circle.}$$

$$\text{Area of the whole circle} = \pi \times 10^2 = 100\pi$$

$$\text{Sector area} = \frac{1}{4} \times 100\pi$$

$$= 25\pi$$

Answer: $25\pi \text{ cm}^2$

Tip: A 90° sector is a quarter circle. Do not forget to divide by 4.

Marks: 1 mark for $\frac{1}{4} \times \pi \times 10^2$. 1 mark for 25π .

5 (2 marks)

A sector has radius 6 cm and angle 40°

Show that the area of the sector is $4\pi \text{ cm}^2$

40° is $\frac{40}{360} = \frac{1}{9}$ of a circle.

Area of the whole circle = $\pi \times 6^2 = 36\pi$

Sector area = $\frac{1}{9} \times 36\pi$

= $4\pi \text{ cm}^2$, as required.

Answer: $\frac{40}{360} \times 36\pi = 4\pi$

Tip: In a “show that” question you must show every step. Writing 4π on its own gets no marks.

Marks: 1 mark for $\frac{40}{360} \times \pi \times 6^2$. 1 mark for showing clearly that this equals 4π .

6 (3 marks)

The diagram shows a sector OAB of a circle, centre O .

Angle $AOB = 150^\circ$

The length of the arc AB is 10π cm.

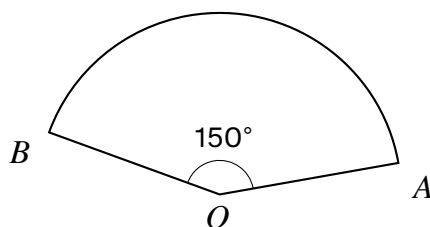


Diagram **NOT** accurately drawn

Work out the radius of the circle.

Let the radius be r cm.

$$\text{Arc length} = \frac{150}{360} \times 2 \times \pi \times r$$

$$\text{So } \frac{150}{360} \times 2\pi r = 10\pi$$

$$\frac{150}{360} \times 2 = \frac{5}{6}, \text{ so } \frac{5}{6}\pi r = 10\pi$$

$$\text{Divide both sides by } \pi: \frac{5}{6}r = 10$$

$$r = 10 \div \frac{5}{6} = 12$$

Answer: 12 cm

Tip: The arc length uses $2\pi r$, not πr^2 . Put the formula equal to 10π and then solve for r .

Marks: 1 mark for $\frac{150}{360} \times 2 \times \pi \times r$. 1 mark for putting it equal to 10π and rearranging. 1 mark for 12.

7 (3 marks)

A flower bed is in the shape of a sector of a circle.

The radius is 4 m and the angle is 135°

Ali puts fertiliser on the flower bed.

One box of fertiliser covers 5 m^2

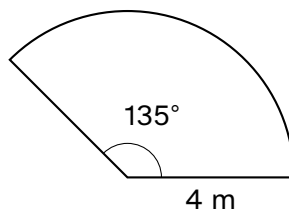


Diagram **NOT** accurately drawn

How many boxes of fertiliser does Ali need?

First find the area of the flower bed.

$$\text{Area} = \frac{135}{360} \times \pi \times 4^2$$

$$= 18.84 \dots \text{ m}^2$$

Each box covers 5 m^2 , so divide by 5:

$$18.84 \dots \div 5 = 3.76 \dots$$

3 boxes would not be enough, so Ali needs 4 boxes.

Answer: 4

Marks: 1 mark for the area of the sector. 1 mark for dividing the area by 5. 1 mark for 4.

8 (4 marks)

The diagram shows a quarter circle OAB , centre O and radius 12 cm.
A semicircle is drawn with OA as its diameter.

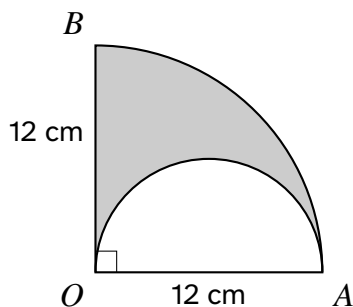


Diagram **NOT** accurately drawn

Work out the area of the shaded region.
Give your answer correct to 3 significant figures.

Shaded region = quarter circle – semicircle.

$$\text{Area of quarter circle} = \frac{90}{360} \times \pi \times 12^2$$

$$= 113.09 \dots \text{ cm}^2$$

The semicircle has diameter $OA = 12$ cm, so its radius is 6 cm.

$$\text{Area of semicircle} = \frac{1}{2} \times \pi \times 6^2 = 56.54 \dots \text{ cm}^2$$

$$\text{Shaded area} = 113.09 \dots - 56.54 \dots = 56.54 \dots$$

Round to 3 significant figures: 56.5

Answer: 56.5 cm²

Tip: The semicircle's radius is half of OA , so it is 6 cm, not 12 cm.

Marks: 1 mark for the area of the quarter circle. 1 mark for the area of the semicircle. 1 mark for subtracting. 1 mark for 56.5.

9 (4 marks)

A badge is cut from card in the shape of a sector OAB of a circle, centre O .

Angle $AOB = 72^\circ$

The badge has an area of $20\pi \text{ cm}^2$

Yusra sews braid all the way round the edge of the badge.

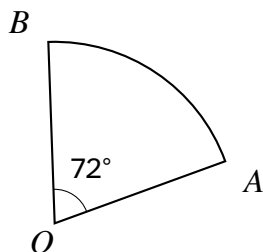


Diagram **NOT** accurately drawn

Work out the length of braid Yusra needs.

Give your answer correct to 3 significant figures.

The braid goes all the way round the edge, so we need the perimeter of the sector.

Let the radius be r cm.

Use the **area** to find r :

$$\frac{72}{360} \times \pi \times r^2 = 20\pi$$

$$\frac{72}{360} = \frac{1}{5}, \text{ so } \frac{1}{5}r^2 = 20$$

$$r^2 = 100, \text{ so } r = 10$$

Now find the arc length AB :

$$\frac{72}{360} \times 2 \times \pi \times 10 = 4\pi = 12.56 \dots \text{ cm}$$

Perimeter = arc + two radii

$$= 12.56 \dots + 10 + 10 = 32.56 \dots$$

Round to 3 significant figures: 32.6

Answer: 32.6 cm

Tip: $20\pi \text{ cm}^2$ is the **area**, so put it equal to the area formula. Then remember the edge includes the two straight sides (radii) as well as the arc.

Marks: 1 mark for $\frac{72}{360} \times \pi \times r^2 = 20\pi$. 1 mark for $r = 10$. 1 mark for the arc length, 4π or 12.5....
1 mark for 32.6.
