

Circles - Circumference and Area

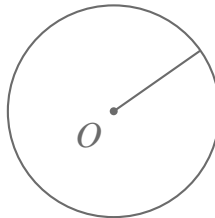
Solutions

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)

- (a) Here is a circle, centre O . On the diagram, draw a radius of the circle.



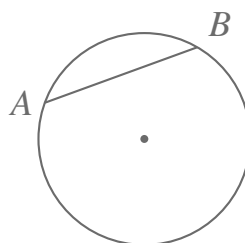
A radius is a straight line from the centre to the circumference (the edge of the circle).

Use a ruler to draw a line from O to any point on the circle.

Answer: A line from O to the circle

Tip: Draw just one line, from the centre to the edge. A line right across the circle through O is a diameter, not a radius.

- (b) Here is another circle.



Write down the mathematical name of the line AB .

AB is a straight line joining two points on the circumference.

It does not go through the centre, so it is not a diameter.

This is called a chord.

Answer: Chord

2 (2 marks)

A circle has radius 6 cm.

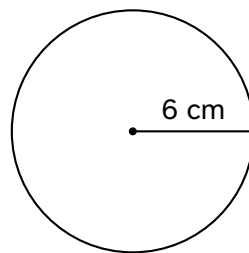


Diagram **NOT** accurately drawn

Work out the area of the circle.

Give your answer correct to 1 decimal place.

$$\text{Area} = \pi r^2$$

$$r = 6, \text{ so } r^2 = 6 \times 6 = 36$$

$$A = \pi \times 36 = 113.097 \dots$$

To 1 decimal place: 113.1 cm^2

Answer: 113.1 cm^2

Tip: Square the radius first: $6^2 = 36$, not 12. Then multiply by π .

Marks: 1 mark for $\pi \times 6^2$. 1 mark for 113.1.

3 (2 marks)

A circle has a diameter of 14 cm.

Work out the area of the circle.

Give your answer in terms of π .

The area formula uses the radius.

$$\text{Radius} = 14 \div 2 = 7 \text{ cm}$$

$$\text{Area} = \pi r^2 = \pi \times 7^2 = 49\pi$$

Answer: $49\pi \text{ cm}^2$

Tip: You are given the diameter, so halve it first. Using 14 in πr^2 gives 196π , which is wrong.

Marks: 1 mark for $\pi \times 7^2$. 1 mark for 49π .

4 (2 marks)

The circumference of a circle is 40 cm.

Work out the diameter of the circle.

Give your answer correct to 1 decimal place.

$$\text{Circumference} = \pi \times \text{diameter}$$

$$\pi d = 40$$

$$\text{Divide both sides by } \pi: d = 40 \div \pi = 12.73 \dots$$

To 1 decimal place: 12.7 cm

Answer: 12.7 cm

Marks: 1 mark for $40 \div \pi$. 1 mark for 12.7.

5 (3 marks)

Here is a shape.

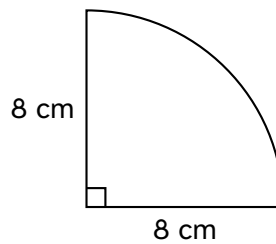


Diagram **NOT** accurately drawn

The diagram shows a quarter of a circle of radius 8 cm.

Work out the perimeter of the shape.

Give your answer correct to 1 decimal place.

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

Circumference of the full circle: $2 \times \pi \times 8 = 50.265 \dots \text{ cm}$

Arc (a quarter of it): $50.265 \dots \div 4 = 12.566 \dots \text{ cm}$

Two radii: $8 + 8 = 16 \text{ cm}$

Perimeter: $12.566 \dots + 16 = 28.566 \dots$

To 1 decimal place: 28.6 cm

Answer: 28.6 cm

Tip: Don't forget the two straight edges. Each one is a radius, 8 cm.

Marks: 1 mark for $\frac{1}{4} \times 2 \times \pi \times 8$. 1 mark for adding 16. 1 mark for 28.6.

6 (3 marks)

A circular sandpit has an area of 7 m^2 .

Kai is going to put wooden edging all the way round the sandpit.

Work out the length of edging Kai needs.

Give your answer correct to 1 decimal place.

$$\text{Area} = \pi r^2, \text{ so } \pi r^2 = 7$$

$$r^2 = 7 \div \pi = 2.228 \dots$$

$$r = \sqrt{2.228 \dots} = 1.492 \dots \text{ m}$$

The edging goes round the edge, so find the circumference.

$$\text{Circumference} = 2 \times \pi \times 1.492 \dots = 9.378 \dots \text{ m}$$

To 1 decimal place: 9.4 m

Answer: 9.4 m

Tip: You are given the area, so work backwards to find the radius first. Keep the full value of r on your calculator before finding the circumference.

Marks: 1 mark for $7 \div \pi$. 1 mark for $r = 1.49 \dots$ 1 mark for 9.4.

7 (4 marks)

Ella wants to put a strip of lights all the way round the edge of a circular mirror.

The mirror has a diameter of 90 cm.

Strips of lights are sold in packs.

Each pack has 1 m of lights and costs £4.75

Work out the total cost of the packs Ella needs to buy.

The lights go round the edge, so find the circumference.

$$\text{Circumference} = \pi \times 90 = 282.74 \dots \text{ cm}$$

$$\text{Change to metres: } 282.74 \dots \div 100 = 2.827 \dots \text{ m}$$

Each pack has 1 m of lights, so 2 packs are not enough.

Ella needs 3 packs.

$$\text{Cost: } 3 \times 4.75 = \text{£}14.25$$

Answer: £14.25

Tip: Round the number of packs **up**: 2 packs only give 2 m of lights, which is not enough to go all the way round.

Marks: 1 mark for $\pi \times 90$. 1 mark for 2.83 m (or 283 cm compared with 100 cm packs). 1 mark for 3 packs. 1 mark for £14.25.

8 (3 marks)

The diagram shows a semicircle with centre O and diameter AB .
 $AB = 10$ cm.
 C is the point on the semicircle with OC perpendicular to AB .

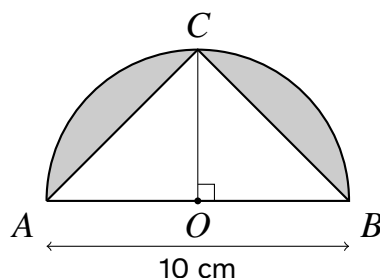


Diagram **NOT** accurately drawn

Work out the area of the shaded region.
Give your answer correct to 1 decimal place.

The shaded region is the semicircle take away triangle ABC .

$AB = 10$ cm, so the radius is 5 cm.

Area of the semicircle: $\frac{1}{2} \times \pi \times 5^2 = 39.26 \dots \text{cm}^2$

OC is a radius, so the height of the triangle is 5 cm.

Area of the triangle: $\frac{1}{2} \times 10 \times 5 = 25 \text{ cm}^2$

Shaded area: $39.26 \dots - 25 = 14.26 \dots$

To 1 decimal place: 14.3 cm^2

Answer: 14.3 cm^2

Tip: The height of the triangle is OC , which is a radius of the semicircle. Use the radius (5 cm), not the diameter, in πr^2 .

Marks: 1 mark for $\frac{1}{2} \times \pi \times 5^2$. 1 mark for the triangle area 25. 1 mark for 14.3.

9 (4 marks)

A park has a semicircular path and a straight path between points A and B .
 $AB = 150$ m.

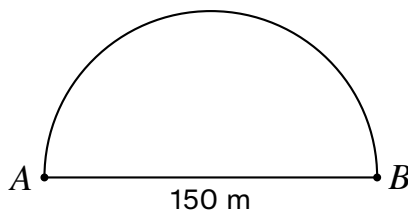


Diagram **NOT** accurately drawn

- (a) Ade walks from A to B along the semicircular path.
Bea walks from A to B along the straight path.
How much further does Ade walk than Bea?
Give your answer correct to the nearest metre.

The semicircular path is half the circumference of a circle with diameter 150 m.

$$\frac{1}{2} \times \pi \times 150 = 235.61 \dots \text{ m}$$

$$\text{Difference: } 235.61 \dots - 150 = 85.61 \dots$$

To the nearest metre: 86 m

Answer: 86 m

Marks: 1 mark for $\frac{1}{2} \times \pi \times 150$. 1 mark for 86.

- (b) Ade walks at a constant speed of 1.2 m/s.
How long does it take Ade to walk along the semicircular path?
Give your answer in minutes and seconds, to the nearest second.

$$\text{Time} = \text{distance} \div \text{speed}$$

$$235.61 \dots \div 1.2 = 196.34 \dots \text{ seconds}$$

196 seconds = 3 minutes and $196 - 180 = 16$ seconds

Answer: 3 minutes 16 seconds

Tip: 196 seconds is not 1.96 minutes. Take away 60 seconds for each whole minute:
 $3 \times 60 = 180$.

Marks: 1 mark for $235.6 \dots \div 1.2$. 1 mark for 3 minutes 16 seconds.
