

Circles - Circumference and Area

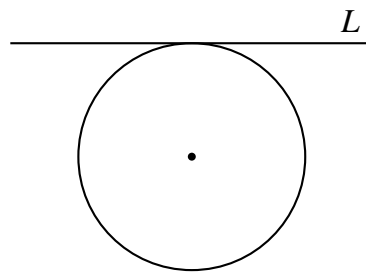
Solutions

For AQA GCSE Mathematics (8300) • 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 (1 mark)

Here is a circle.



Not drawn accurately

The line L touches the circle at one point.

Circle the word that describes line L .

Options: radius, diameter, chord, tangent

A straight line that touches a circle at exactly one point, without going inside it, is a tangent.

(A chord goes across the circle, joining two points on it.)

Answer: tangent

Tip: Learn the names: radius, diameter, chord, tangent, arc, sector and segment. Questions on these are often answered wrongly.

2 (1 mark)

Which of these is **always** a chord of the circle?

Tick one box.

A chord is a straight line joining two points on the circle.

A diameter joins two points on the circle (passing through the centre), so it is always a chord.

A radius has one end at the centre, not on the circle.

A tangent only touches the circle at one point, and an arc is curved.

Answer: a diameter

Tip: A diameter is a special chord: the longest chord, which passes through the centre.

3 (1 mark)

A circle has radius r .

Circle the expression for the circumference of the circle.

Options: πr , $2\pi r$, πr^2 , $2\pi r^2$

Circumference = $\pi \times$ diameter

The diameter is $2r$.

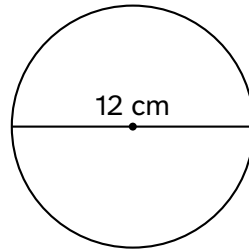
So circumference = $\pi \times 2r = 2\pi r$.

Answer: $2\pi r$

Tip: πr^2 is the **area**. Anything with r^2 gives an area, not a length.

4 (2 marks)

A circle has diameter 12 cm.



Not drawn accurately

Work out the circumference of the circle.

Give your answer to 1 decimal place.

Circumference = $\pi \times$ diameter

$$C = \pi \times 12$$

$$C = 37.699 \dots$$

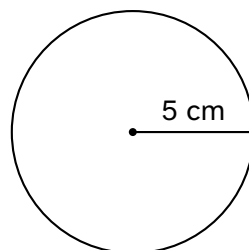
To 1 decimal place: 37.7 cm

Answer: 37.7 cm

Marks: 1 mark for $\pi \times 12$. 1 mark for 37.7.

5 (2 marks)

A circle has radius 5 cm.



Not drawn accurately

Work out the area of the circle.

Give your answer in terms of π .

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

$$r = 5, \text{ so } r^2 = 5 \times 5 = 25$$

$$A = \pi \times 25 = 25\pi$$

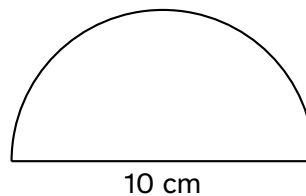
Answer: $25\pi \text{ cm}^2$

Tip: “In terms of π ” means leave π in your answer. Don’t change it to a decimal.

Marks: 1 mark for $\pi \times 5^2$. 1 mark for 25π .

6 (3 marks)

Here is a semicircle.



Not drawn accurately

Work out the perimeter of the semicircle.

Give your answer to 1 decimal place.

The perimeter has two parts: the curved edge and the straight edge (the diameter).

Curved edge: half of the circumference

$$\frac{1}{2} \times \pi \times 10 = 15.707 \dots \text{ cm}$$

Straight edge: 10 cm

$$\text{Perimeter: } 15.707 \dots + 10 = 25.707 \dots$$

To 1 decimal place: 25.7 cm

Answer: 25.7 cm

Tip: Don’t forget the straight edge. The perimeter goes all the way round, including the diameter.

Marks: 1 mark for $\frac{1}{2} \times \pi \times 10$. 1 mark for adding 10. 1 mark for 25.7.

7 (2 marks)

A circle has an area of 50 cm^2

Work out the radius of the circle.

Give your answer to 3 significant figures.

$$\text{Area} = \pi r^2, \text{ so } \pi r^2 = 50$$

$$\text{Divide both sides by } \pi: r^2 = 50 \div \pi = 15.915 \dots$$

$$\text{Square root: } r = \sqrt{15.915 \dots} = 3.989 \dots$$

To 3 significant figures: 3.99 cm

Answer: 3.99 cm

Marks: 1 mark for $50 \div \pi$. 1 mark for 3.99.

8 (4 marks)

Zara is decorating 5 round cakes. Each cake has diameter 20 cm.

She puts one strip of ribbon all the way round the side of each cake.

She also uses an extra 12 cm of ribbon on each cake for a bow.

Ribbon is sold in whole metres.

How many metres of ribbon must Zara buy?

You must show your working.

The ribbon goes round the circumference of each cake.

$$\text{Circumference} = \pi \times 20 = 62.83 \dots \text{ cm}$$

$$\text{Ribbon for one cake: } 62.83 \dots + 12 = 74.83 \dots \text{ cm}$$

$$\text{Ribbon for 5 cakes: } 5 \times 74.83 \dots = 374.15 \dots \text{ cm}$$

$$\text{Change to metres: } 374.15 \dots \div 100 = 3.74 \dots \text{ m}$$

Ribbon is sold in whole metres, so she must round **up**: 4 m

Answer: 4 m

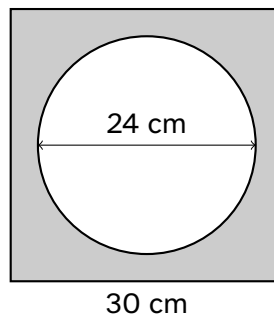
Tip: 3.74 rounds to 4 here because she needs **enough** ribbon. Buying 3 m would not be enough.

Marks: 1 mark for $\pi \times 20$. 1 mark for adding 12 and multiplying by 5. 1 mark for 374 cm or 3.74 m. 1 mark for 4.

9 (3 marks)

A circular clock face of diameter 24 cm is fixed to a square wooden board of side 30 cm.

The shaded part of the board is not covered.



Not drawn accurately

Work out the area of the board that is **not** covered by the clock face.
Give your answer to 1 decimal place.

Area of the square board: $30 \times 30 = 900 \text{ cm}^2$

The diameter of the clock face is 24 cm, so its radius is 12 cm.

Area of the clock face: $\pi \times 12^2 = 452.38 \dots \text{ cm}^2$

Area not covered: $900 - 452.38 \dots = 447.61 \dots$

To 1 decimal place: 447.6 cm^2

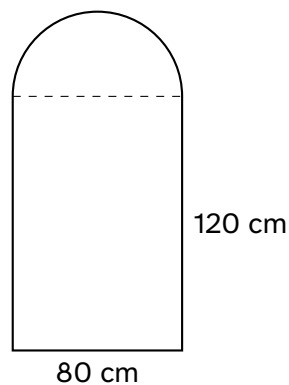
Answer: 447.6 cm^2

Tip: Use the radius, 12 cm, in πr^2 . Using 24 gives an area four times too big.

Marks: 1 mark for $\pi \times 12^2$. 1 mark for $900 -$ your circle area. 1 mark for 447.6.

10 (4 marks)

A window is made from a rectangle and a semicircle.



Not drawn accurately

Work out the area of the window.

Give your answer in m^2 to 2 decimal places.

The window is a rectangle with a semicircle on top.

Area of the rectangle: $80 \times 120 = 9600 \text{ cm}^2$

The semicircle has diameter 80 cm, so its radius is 40 cm.

Area of the semicircle: $\frac{1}{2} \times \pi \times 40^2 = 2513.27 \dots \text{ cm}^2$

Total area: $9600 + 2513.27 \dots = 12\,113.27 \dots \text{ cm}^2$

$1 \text{ m}^2 = 100 \times 100 = 10\,000 \text{ cm}^2$

$12\,113.27 \dots \div 10\,000 = 1.211 \dots \text{ m}^2$

To 2 decimal places: 1.21 m^2

Answer: 1.21 m^2

Tip: To change cm^2 to m^2 , divide by 10 000, not by 100.

Marks: 1 mark for 80×120 . 1 mark for $\frac{1}{2} \times \pi \times 40^2$. 1 mark for $12\,113 \text{ cm}^2$ (or the total in m^2). 1 mark for 1.21.

11 (4 marks)

A café sells round pizzas in two sizes.

Small: diameter 20 cm, cost £5.50

Large: diameter 30 cm, cost £11.00

Which size of pizza gives more pizza for each £1?

You must show your working.

Small pizza: radius = $20 \div 2 = 10 \text{ cm}$

Area = $\pi \times 10^2 = 314.15 \dots \text{cm}^2$

Area for each £1: $314.15 \dots \div 5.50 = 57.12 \text{ cm}^2$ (to 2 d.p.)

Large pizza: radius = $30 \div 2 = 15 \text{ cm}$

Area = $\pi \times 15^2 = 706.85 \dots \text{cm}^2$

Area for each £1: $706.85 \dots \div 11 = 64.26 \text{ cm}^2$ (to 2 d.p.)

64.26 is more than 57.12, so the large pizza gives more pizza for each £1.

Answer: Large: 64.26 cm^2 per £1, compared with 57.12 cm^2 per £1

Tip: Use the radius, not the diameter, in πr^2 . The large pizza costs twice as much, but its area is more than twice as big.

Marks: 1 mark for the area of one pizza. 1 mark for both areas. 1 mark for a correct comparison, e.g. area per £1 or cost per cm^2 . 1 mark for Large with correct values.
