

# Circles, Arcs & Sectors (H)

A collection of 9-1 Maths GCSE Sample and Specimen questions from AQA, OCR, Pearson-Edexcel and WJEC Eduqas

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Total Marks:	

1. The diagram shows a circle split into two regions: A and B.

$$C = \pi D$$

$$A = \pi r^2$$

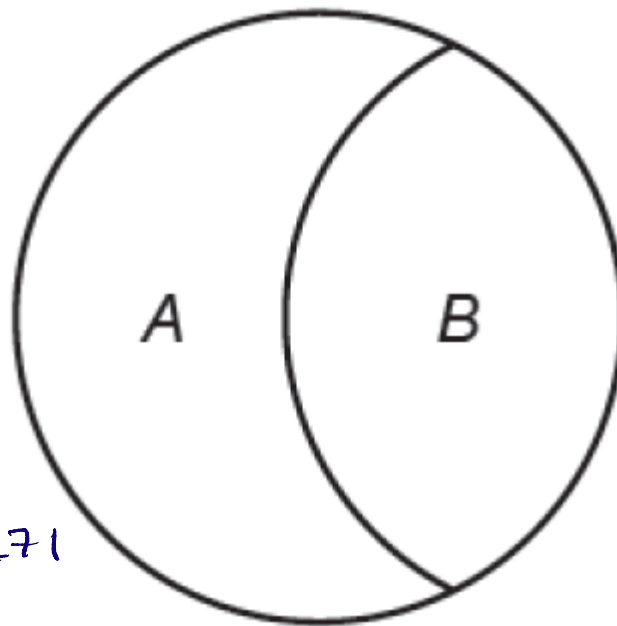
①

Total area

$$= \pi \times 1.5^2$$

$$= 2.25\pi \text{ cm}^2$$

$$\text{OR } 7.068583471 \text{ cm}^2$$



②

$$A : B$$

$$2 : 3$$

$$\frac{2.25\pi}{5} = 0.45\pi$$

*Diagram not drawn to scale*

The ratio of the areas of the regions A and B is 2 : 3.

The radius of the circle is 1.5cm.

Calculate the area of region A.

$$A = 0.45\pi \times 2 = 0.9\pi = 2.82743$$

$$B = 0.45\pi \times 3 = 1.35\pi$$

$$\text{Area of A} = 2.83 \text{ (2dp)} \text{ cm}^2 \quad [4]$$

2. A circular table top has radius 70 cm.

Calculate the area of the table top in cm<sup>2</sup>, giving your answer as a multiple of  $\pi$ .



$$A = \pi \times 70^2$$

$$= 4900\pi$$

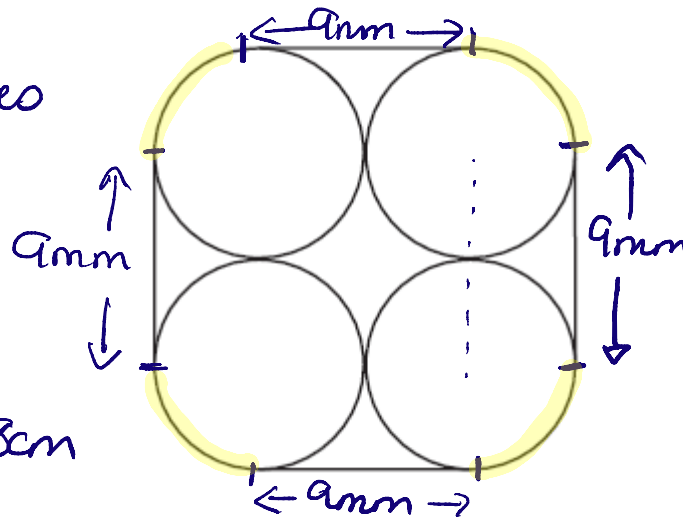
$$4900\pi \text{ cm}^2 \quad [2]$$

3. Four pencils are held together with a band.

The figure below shows the bottom end of the pencils and the band.

The 4 curved edges make 1 circle

$$\begin{aligned} C &= \pi \times D \\ &= \pi \times 9 \\ &= 28.27433388 \text{ cm} \end{aligned}$$



Each of the pencils has diameter 9 mm.

Find the length of the band in this position.

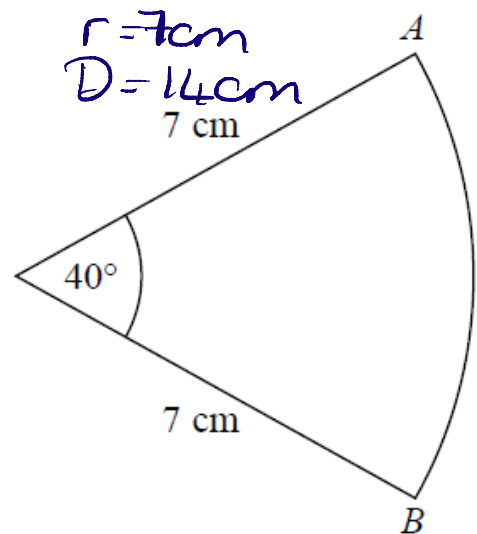
$$\begin{aligned} \text{Total} &= 9 + 9 + 9 + 9 + 28.27 \\ &= 64.27433388 \end{aligned}$$

$$64.27 \dots \text{ mm [4]}$$

4. The diagram shows a sector of a circle of radius 7 cm.

Total circumference of circle with radius 7cm

$$\begin{aligned} C &= \pi \times 14 \\ &= 43.98229715 \end{aligned}$$



Work out the length of arc AB.

Give your answer correct to 3 significant figures.

$$\begin{aligned} \text{arc AB} &= \frac{40}{360} \times 43.98229715 \\ &= 4.886921906 = 4.89 \text{ cm (3s.f.)} \end{aligned} \quad [2]$$

5. The distance from the Earth to the Sun is 93 million miles.

Assume

93,000,000 miles

it takes 365 days for the Earth to travel once around the Sun

the Earth travels in a circle with the Sun at the centre.

(a) Work out the average speed of the Earth in miles per hour.

$$\text{time} = 365 \text{ days} = 365 \times 24 \text{ hours} = 8760 \text{ hours}$$

$$\text{distance} = \pi \times 93,000,000 \times 2$$



$$\text{speed} = \frac{186,000,000\pi}{8760} = 66,671.2329$$

$$= 66,671 \text{ miles per hour.}^{[4]}$$

(b) It actually takes  $365 \frac{1}{4}$  days for the Earth to travel once around the Sun.

How does this affect your answer to part (a)?

it means the actual speed is slightly slower.

[1]

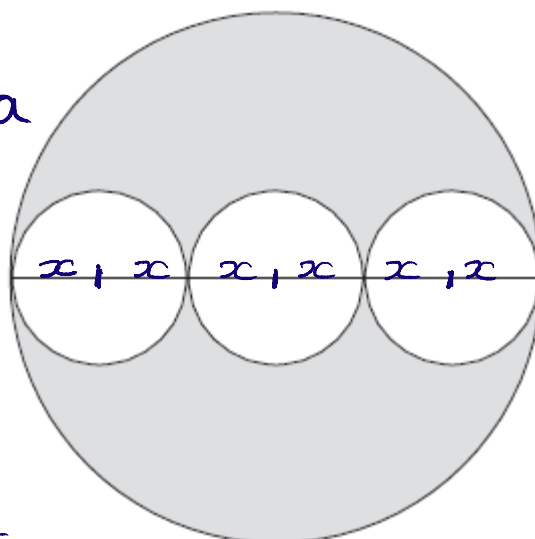
6. Three identical small circles are drawn inside one large circle, as shown in the diagram.

let  $x$  = radius of small circle

Small circle area

$$= \pi \times x^2$$

$$= x^2 \pi$$



large circle

$$= \pi \times (3x)^2$$

$$= 9x^2 \pi$$

x 3 circles

$$= 3x^2 \pi$$

The centres of the small circles lie on the diameter of the large circle.

Find the fraction of the large circle that is shaded.

fraction not shaded

$$= \frac{3x^2 \pi}{9x^2 \pi} = \frac{3}{9} = \frac{1}{3}$$

so fraction shaded =

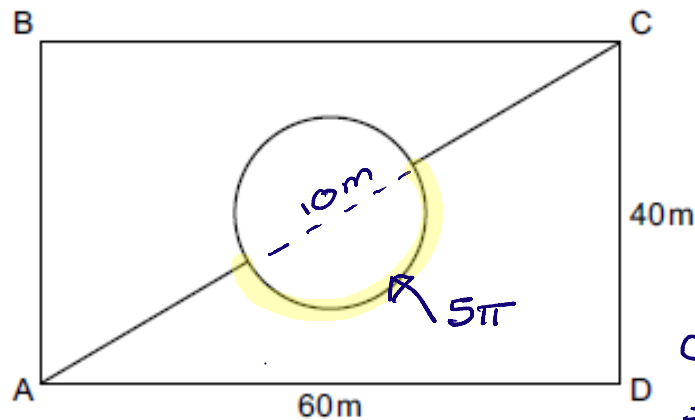
$$1 - \frac{1}{3}$$

$$= \frac{2}{3} \dots \dots \dots [3]$$

7. The rectangle ABCD represents a park.

$$C = \pi D$$

$$A = \pi r^2$$



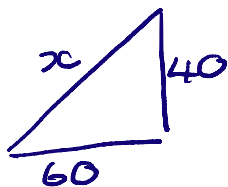
Not to scale

Circumference of  
circle =  $\pi \times D$   
=  $\pi \times 10$

The lines show all the paths in the park.

The circular path is in the centre of the rectangle and has a diameter of 10m.

Calculate the shortest distance from A to C across the park, using only the paths shown.



$$x^2 = 40^2 + 60^2$$

$$= 5200$$

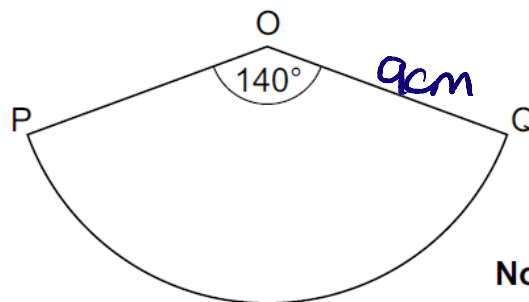
$$x = \sqrt{5200}$$

$$= 72.11102...$$

Shortest distance  
=  $77.11 - 10 + 5\pi$   
=  $77.8189...$   
which is shorter than  $60 + 40$

.....  $77.82$  (2dp) m [6]

8. OPQ is a sector of a circle, centre O and radius 9 cm.



$$C = \pi D$$

$$A = \pi r^2$$

Not to scale

Find the perimeter of the sector.

$$C = \pi \times 18 = 18\pi$$

Give your answer in terms of  $\pi$ .

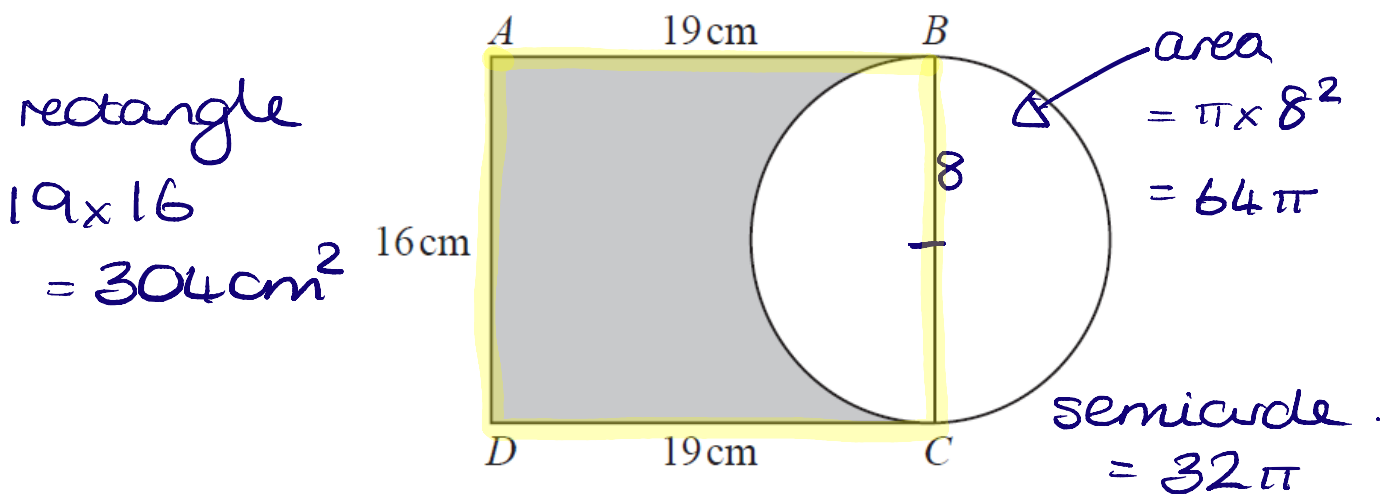
$$PQ = \frac{140}{360} \times 18\pi = 7\pi$$

Perimeter =  $7\pi + 9 + 9$

.....  $7\pi + 18$  cm [3]



9. Here is a diagram showing a rectangle, ABCD, and a circle.



BC is a diameter of the circle.

Calculate the percentage of the area of the rectangle that is shaded.

Give your answer correct to 1 decimal place.

$$\begin{aligned} \text{Shaded area} &= 304 - 32\pi \\ &= 203.46903... \end{aligned}$$

$$\frac{203.469}{304} \times 100 = 66.93060...$$

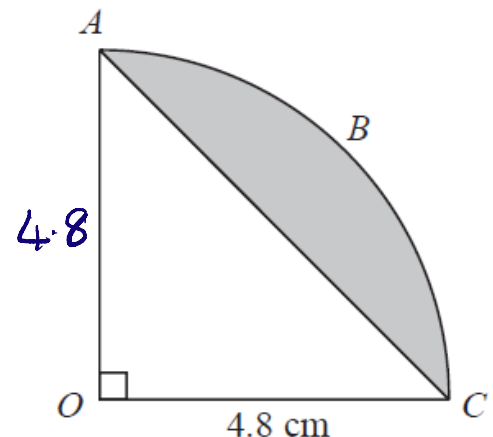
$$= \underline{66.9\% \text{ (1dp)}} [4]$$

10. The arc ABC is a quarter of a circle with centre O and radius 4.8 cm.

Triangle ABC area

$$= \frac{1}{2} \times 4.8 \times 4.8$$

$$= 11.52 \text{ cm}^2$$



AC is a chord of the circle.

Work out the area of the shaded segment.

Give your answer correct to 3 significant figures.

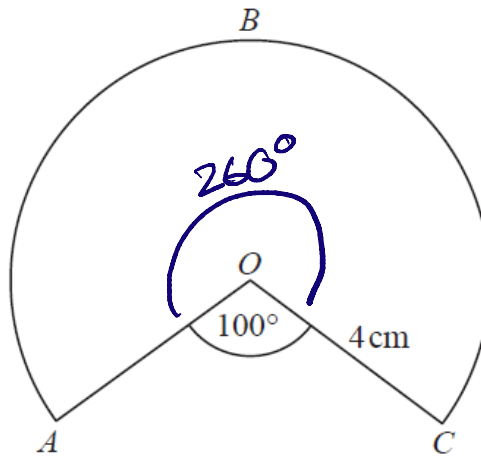
area of sector

$$\begin{aligned} \text{AOC} &= \frac{1}{4} \times \pi \times 4.8^2 \\ &= 18.09557368 \end{aligned}$$

shaded segment

$$\begin{aligned} &= 18.0955... - 11.52 \\ &= 6.5755736 \\ &= \underline{6.58 \text{ cm}^2 \text{ (3s.f.)}} [3] \end{aligned}$$

11. The diagram shows a sector of a circle of radius 4 cm.



$$C = \pi D \quad \checkmark$$

$$A = \pi r^2$$

$$r = 4$$

$$D = 8$$

Work out the length of the arc ABC.

Give your answer correct to 3 significant figures.

$$\frac{260}{360} \times \pi \times 8 = 18.151424 \dots$$

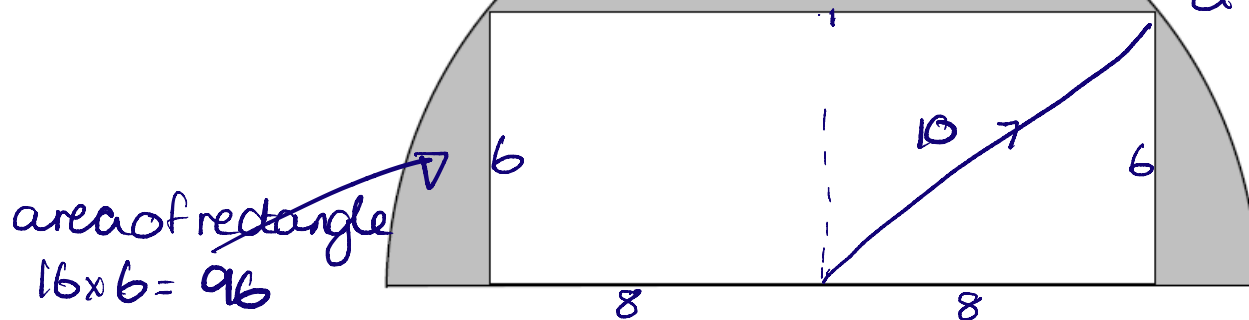
$$18.2 \dots \text{ cm [2]}$$

12. The diagram shows a rectangle inside a semicircle.

$$C = \pi D$$

$$A = \pi r^2$$

Not drawn accurately



radius of circle is hypotenuse of triangle.

$$6^2 + 8^2$$

$$36 + 64 = 100$$

$$\sqrt{100} = 10$$

The rectangle has dimensions 16 cm by 6 cm

Work out the shaded area.

Give your answer in terms of  $\pi$ .

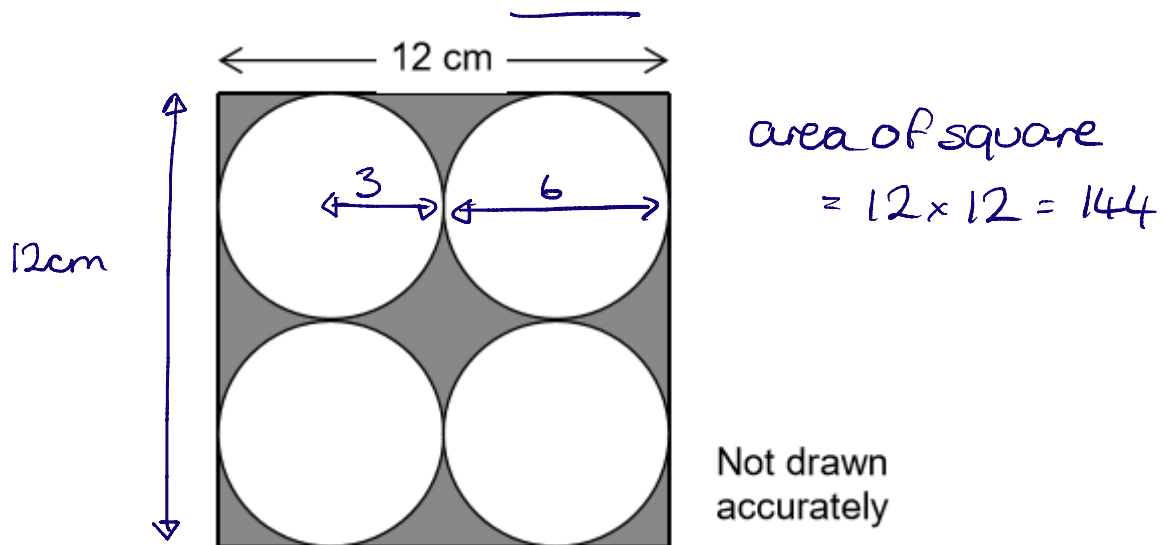
radius of circle = 10 cm

$$A = \frac{\pi \times 10^2}{2} = 50\pi$$

$$\text{shaded area} = 50\pi - 96$$

[4]

13. Four identical circles just fit inside a square as shown.



Work out the area of the shaded section.

Give your answer in terms of  $\pi$ .

$$\text{area of 1 circle} = \pi \times 3^2 = 9\pi$$

$$4 \text{ circles} = 4 \times 9\pi = 36\pi$$

[4]

$$\text{Shaded area} = 144 - 36\pi$$

$$\text{or, } = 36(4 - \pi) \text{ cm}^2$$

## CREDITS AND NOTES

Question	Awarding Body	Question	Awarding Body
1	WJEC Eduqas	8	OCR
2	OCR	9	Pearson Edexcel
3	OCR	10	Pearson Edexcel
4	Pearson Edexcel	11	Pearson Edexcel
5	AQA	12	AQA
6	OCR	13	AQA
7	OCR		

### Notes:

These questions have been retyped from the original sample/specimen assessment materials and whilst every effort has been made to ensure there are no errors, any that do appear are mine and not the exam board s (similarly any errors I have corrected from the originals are also my corrections and not theirs!).

Please also note that the layout in terms of fonts, answer lines and space given to each question does not reflect the actual papers to save space.

These questions have been collated by me as the basis for a GCSE working party set up by the GLOW maths hub - if you want to get involved please get in touch. The objective is to provide support to fellow teachers and to give you a flavour of how different topics "could" be examined. They should not be used to form a decision as to which board to use. There is no guarantee that a topic will or won't appear in the "live" papers from a specific exam board or that examination of a topic will be as shown in these questions.



### Links:

AQA <http://www.aqa.org.uk/subjects/mathematics/gcse/mathematics-8300>

OCR <http://ocr.org.uk/gcsemaths>

Pearson Edexcel <http://qualifications.pearson.com/en/qualifications/edexcel-gcses/mathematics-2015.html>

WJEC Eduqas <http://www.eduqas.co.uk/qualifications/mathematics/gcse/>

### Contents:

This version contains questions from:

AQA – Sample Assessment Material, Practice set 1 and Practice set 2

OCR – Sample Assessment Material and Practice set 1

Pearson Edexcel – Sample Assessment Material, Specimen set 1 and Specimen set 2

WJEC Eduqas – Sample Assessment Material