GCSE · Edexcel · Maths

4 hours 62 questions

Exam Questions

Circles, Arcs & Sectors

Area & Circumference of Circles / Arc Lengths & Sector Areas

Easy (12 questions)	/23
Medium (18 questions)	/67
Hard (14 questions)	/61
Very Hard (18 questions)	/92
Total Marks	**/243**

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Easy Questions

1 A circle has a diameter of 140 cm.

Work out the circumference of the circle.
Give your answer correct to 3 significant figures.

(2 marks)

2 Here is a circle.

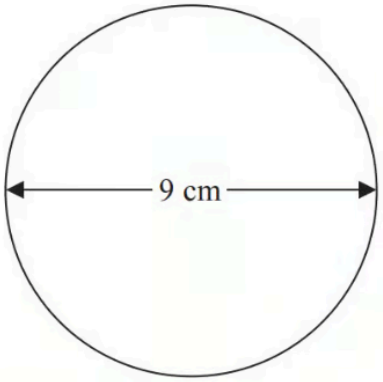


Diagram **NOT** accurately drawn

The diameter of the circle is 9 cm.

Work out the circumference of this circle.
Give your answer correct to 3 significant figures.

(2 marks)

3

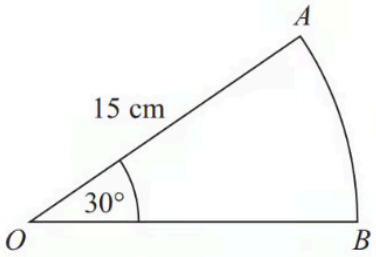


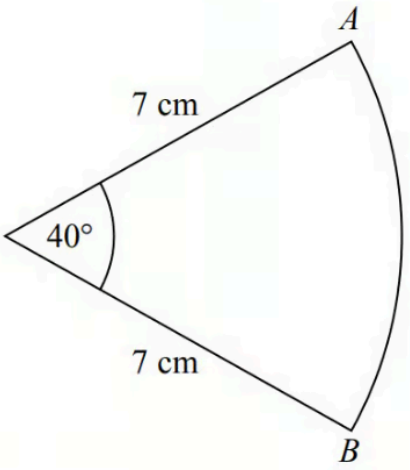
Diagram **NOT** accurately drawn

OAB is a sector of a circle, centre O.
The radius of the circle is 15 cm.
The angle of the sector is $30°$.

Calculate the area of sector OAB.
Give your answer correct to 3 significant figures.

(2 marks)

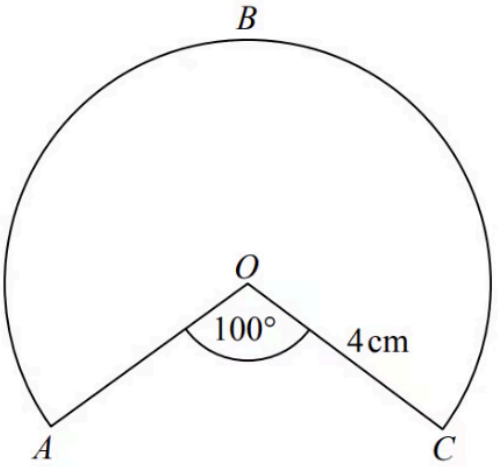
4 The diagram shows a sector of a circle of radius 7 cm.



Work out the length of arc AB.
Give your answer correct to 3 significant figures.

(2 marks)

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



Work out the length of the arc ABC.
Give your answer correct to 3 significant figures.

(2 marks)

6 The diagram shows sector OPQ of a circle, centre O

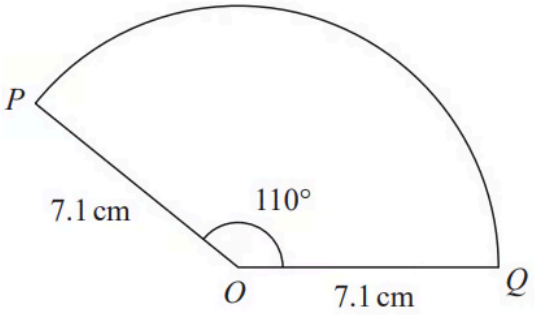


Diagram **NOT** accurately drawn

$OP = OQ = 7.1$ cm
Angle $POQ = 110°$

Calculate the area of sector OPQ
Give your answer correct to one decimal place.

(2 marks)

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

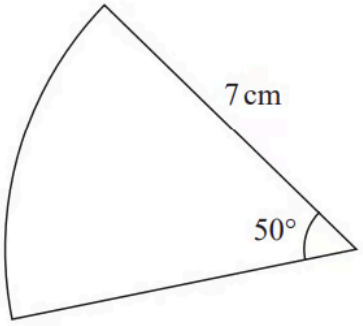


Diagram **NOT** accurately drawn

Work out the length of the arc of the sector.
Give your answer correct to one decimal place.

..... cm

(2 marks)

8 The shape, shown shaded in the diagram, is the region between two semicircles.

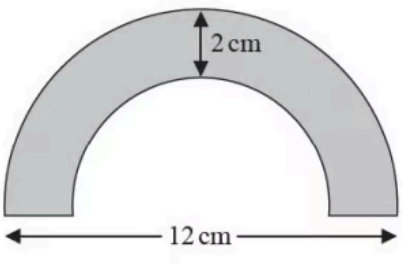


Diagram **NOT** accurately drawn

The diameter of the outer semicircle is 12cm.
The shape has constant thickness 2cm.

Calculate the area of the shape.
Give your answer as a multiple of π.

cm^2

(3 marks)

9 Work out the arc length, in metres, of a semicircle of radius 6 metres.

A. 3π

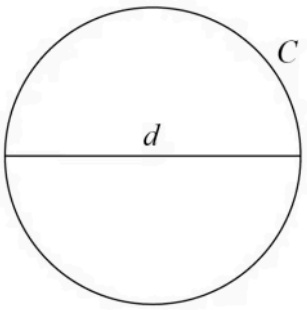
B. 6π

C. 12π

D. 18π

(1 mark)

10 A circle has circumference C and diameter d.

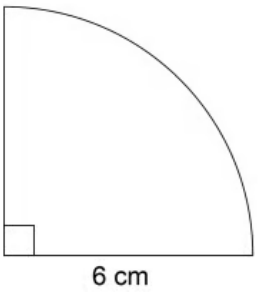


$C = kd$

What **value** does the constant k represent?

(1 mark)

11 Here is a quarter circle of radius 6 cm



Not drawn accurately

Work out the area of the quarter circle.
Give your answer in terms of π.

.....cm^2

(2 marks)

12 A circular table top has radius 70 cm.

Calculate the area of the table top in cm^2, giving your answer as a multiple of π.

..... cm^2

(2 marks)

Medium Questions

1

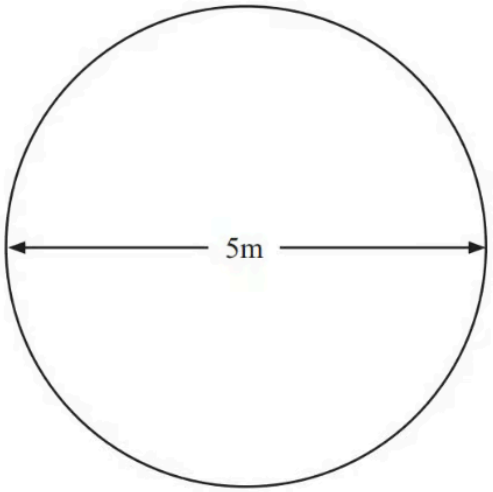


Diagram **NOT** accurately drawn

Jon has a flower garden in the shape of a circle.
The diameter of the garden is 5 metres.

Jon wants to put fencing around the edge of the garden.
The fencing costs £1.80 per metre.

Work out the total cost of the fencing.

£ .....

(3 marks)

2 The diagram shows a circle drawn inside a square.

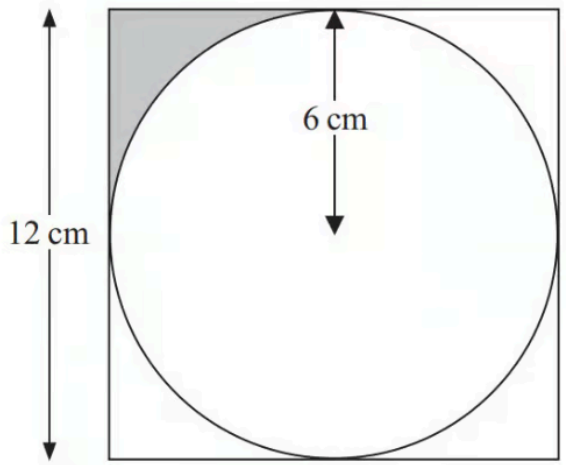


Diagram **NOT** accurately drawn

The circle has a radius of 6 cm.
The square has a side of length 12 cm.

Work out the shaded area.
Give your answer in terms of π.

(3 marks)

3 The diagram shows a circle inside a square.

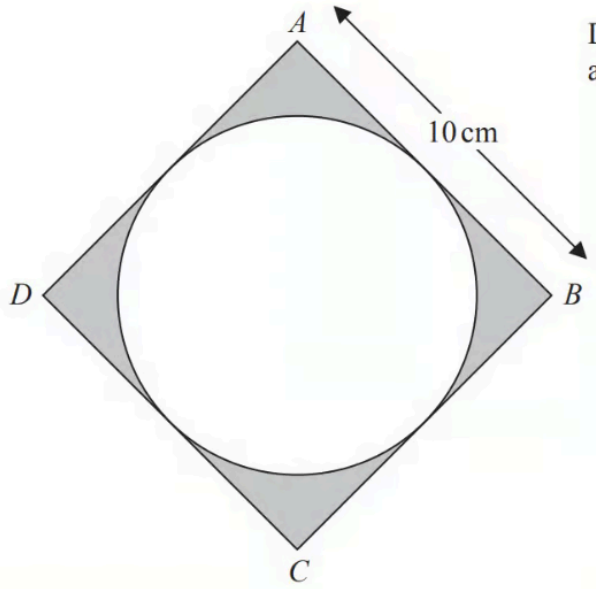


Diagram **NOT** accurately drawn

$ABCD$ is a square of side 10cm.
Each side of the square is a tangent to the circle.

Work out the total area of the shaded regions in terms of π.
Give your answer in its simplest form.

(3 marks)

4 The diagram shows the top of Levi's birthday cake.

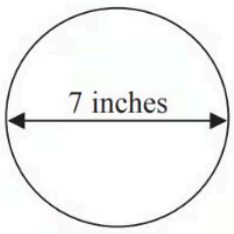


Diagram **NOT** accurately drawn

The top of the cake is in the shape of a circle.
The diameter of the circle is 7 inches.

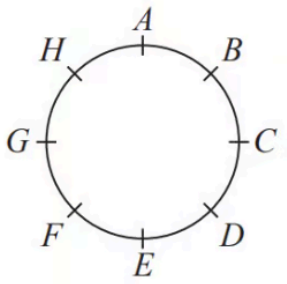
A ribbon is going to be put around the side of the cake.
Ribbons are sold in 50 cm lengths.

1 inch is 2.54 cm.

Work out if one length of ribbon is long enough to go all the way around the cake.
You must show your working.

(4 marks)

5 (a) Hasmeet walks once round a circle with diameter 80 metres.

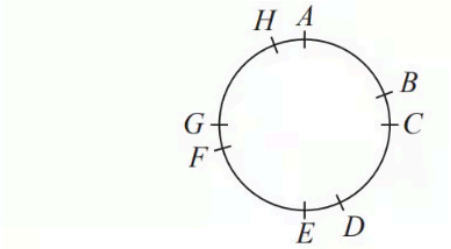


There are 8 points equally spaced on the circumference of the circle.

Find the distance Hasmeet walks between one point and the next point.

(2 marks)

(b) Four of the points are moved, as shown in the diagram below.

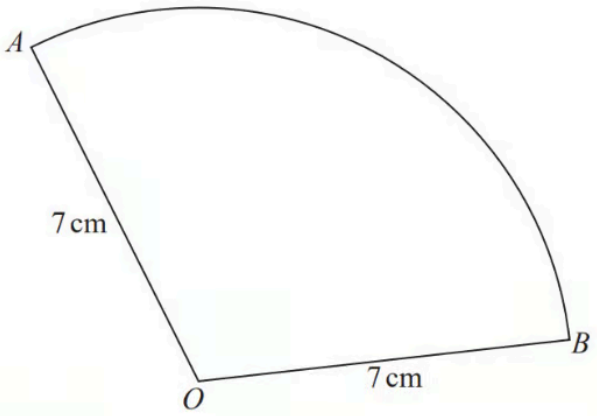


Hasmeet walks once round the circle again.

Has the mean distance that Hasmeet walks between one point and the next point changed?
You must give a reason for your answer.

(1 mark)

6 OAB is a sector of a circle with centre O and radius 7 cm.



The area of the sector is 40 cm^2.

Calculate the perimeter of the sector.
Give your answer correct to 3 significant figures.

(4 marks)

7 The diagram shows a circle with centre O

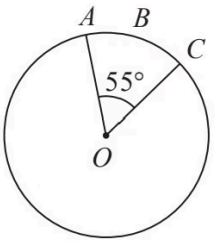


Diagram **NOT** accurately drawn

A, B and C are points on the circle so that the length of the arc ABC is 5 cm.

Given that angle $AOC = 55°$

work out the area of the circle.
Give your answer correct to one decimal place.

(4 marks)

8 The region, shown shaded in the diagram, is a path.

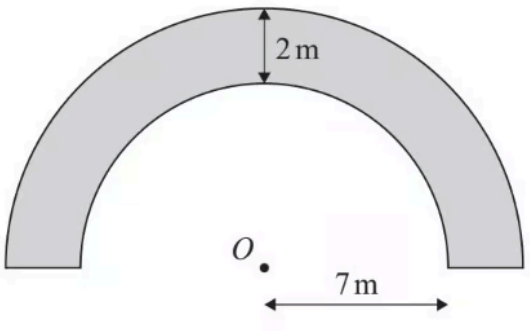


Diagram **NOT** accurately drawn

The boundary of the path is formed by two semicircles, with the same centre O, and two straight lines.

The inner semicircle has a radius of 7 metres.
The path has a width of 2 metres.

Work out the perimeter of the path.
Give your answer correct to one decimal place.

..... m

(3 marks)

9 A circle centre O has radius 9 cm.

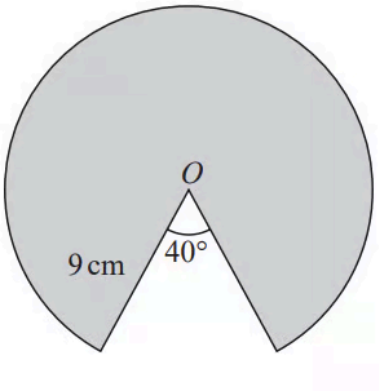


Diagram **NOT** accurately drawn

Calculate the perimeter of the shaded sector of the circle.
Give your answer correct to 3 significant figures.

..... cm

(4 marks)

10 The diagram shows Yuen's garden.

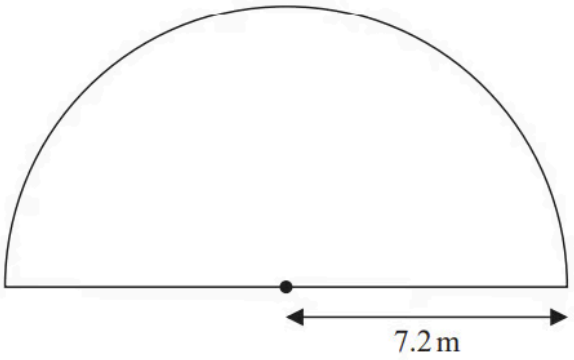


Diagram **NOT** accurately drawn

The garden is in the shape of a semicircle of radius 7.2m.
Yuen is going to cover his garden with grass seed.

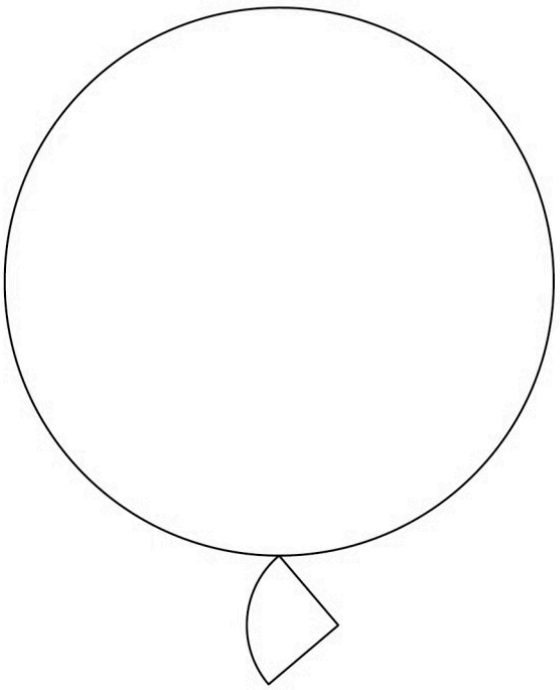
Yuen has 12 boxes of grass seed.
Each box of grass seed contains enough seed to cover 6m^2 of the garden.

Has Yuen enough grass seed for his garden?
Show your working clearly.

(3 marks)

11 (a) Two wire shapes make an earring.
The shapes are

- a circle with radius 21 mm
- and a quarter circle.



radius of circle : radius of quarter circle = 7 : 2

Show that the radius of the quarter circle is 6 mm

(1 mark)

(b) Work out the **total** length of the wire in the earring.

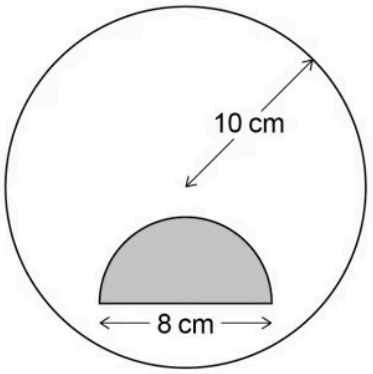
Give your answer in the form $a\pi + b$ where a and b are integers.

.....mm

(4 marks)

12 A shaded semicircle is inside a circle as shown.

Not drawn accurately



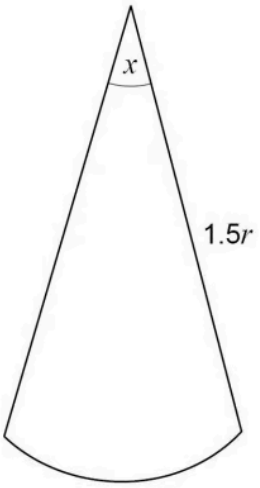
The **radius** of the circle is 10 cm
The **diameter** of the semicircle is 8 cm

How many times bigger is the unshaded area than the shaded area?

(4 marks)

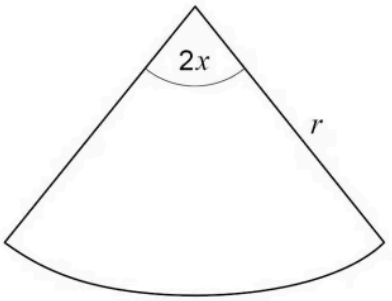
13 Here are two sectors from different circles.

Sector A



Sector B

Not drawn accurately



Which sector has the bigger area?

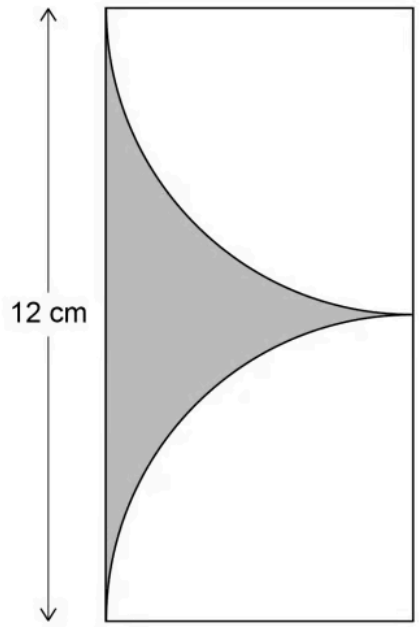
Tick a box.

☐ Sector A ☐ Sector B

Show working to support your answer.

(2 marks)

14 Two identical quarter circles are cut from a rectangle as shown.



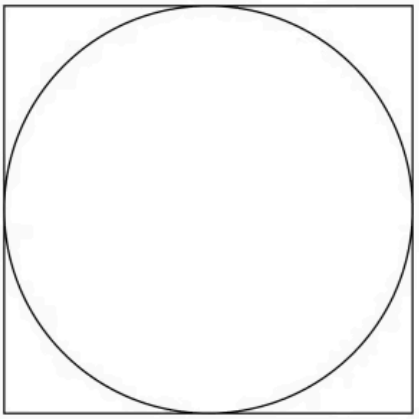
Not drawn accurately

Work out the shaded area.

.....cm^2

(4 marks)

15 Here is a circle touching a square.



Not drawn accurately

The area of the square is 64 cm^2

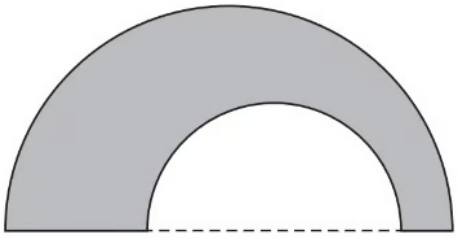
Work out the area of the circle.

Give your answer in terms of π.

..... cm^2

(3 marks)

16 The shape below is formed from two semicircles and a straight line.



Not to scale

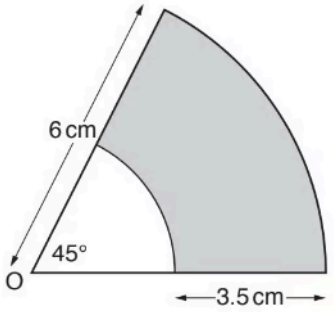
The radius of the large semicircle is 8cm.
The radius of the small semicircle is $t$cm.

Find an expression, in terms of t, for the **exact perimeter** of the shaded shape.

..... cm

(3 marks)

17 The design below is made from two sectors of circles, centre O.



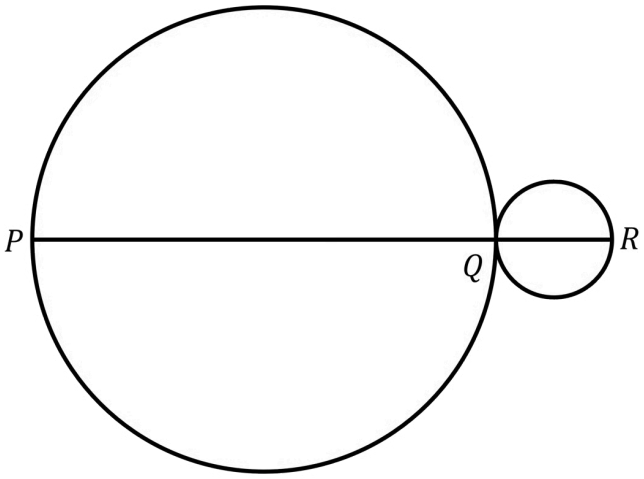
Calculate the perimeter of the shaded part.
Give your answer correct to 3 significant figures.

..... cm

(5 marks)

18 (a) Below are two circles.

PQR is a straight line.



This diagram is not to scale.

PQ is the diameter of the larger circle.

QR is the diameter of the smaller circle.

The length PQ is four times the length QR.

$PR = 70$ cm

Work out the length of PQ.

(2 marks)

(b) Work out the area of the smaller circle.

Give your answer to 2 decimal places.

Include units in your answer.

(3 marks)

(c) Work out the circumference of the larger circle.

Give your answer in terms of π.

(2 marks)

Hard Questions

1 The diagram shows a plan of Brian's lawn.

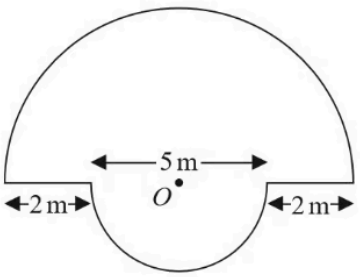


Diagram **NOT** accurately drawn

The edge of the lawn consists of two semicircles and two straight lines.
Each semicircle has centre O.
The diameters of the semicircles are 9 m and 5 m.

Brian is going to put lawn edging around the edge of the lawn. Lawn edging is sold in 2.4 metre rolls.

Brian has £35

Lawn edging
£3.99 per roll or 3 rolls for £10

Has Brian got enough money to buy all the rolls of lawn edging he needs?
You must show all your working.

(5 marks)

2 Saphia is organising a conference.

People at the conference will sit at circular tables.

Diagram **NOT** accurately drawn

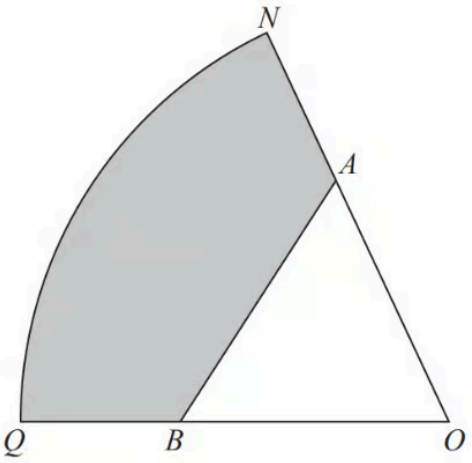
Each table has a diameter of 140 cm.
Each person needs 60 cm around the circumference of the table.

There are 12 of these tables in the conference room.
A total of 90 people will be at the conference.

Are there enough tables in the conference room?

(4 marks)

3



ONQ is a sector of a circle with centre O and radius 11 cm.

A is the point on ON and B is the point on OQ such that AOB is an equilateral triangle of side 7 cm.

Calculate the area of the shaded region as a percentage of the area of the sector ONQ. Give your answer correct to 1 decimal place.

(5 marks)

4 The diagram shows a square $ABCD$ inside a circle.

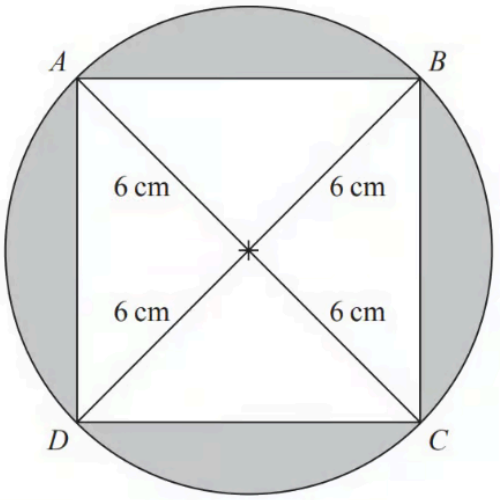


Diagram **NOT** accurately drawn

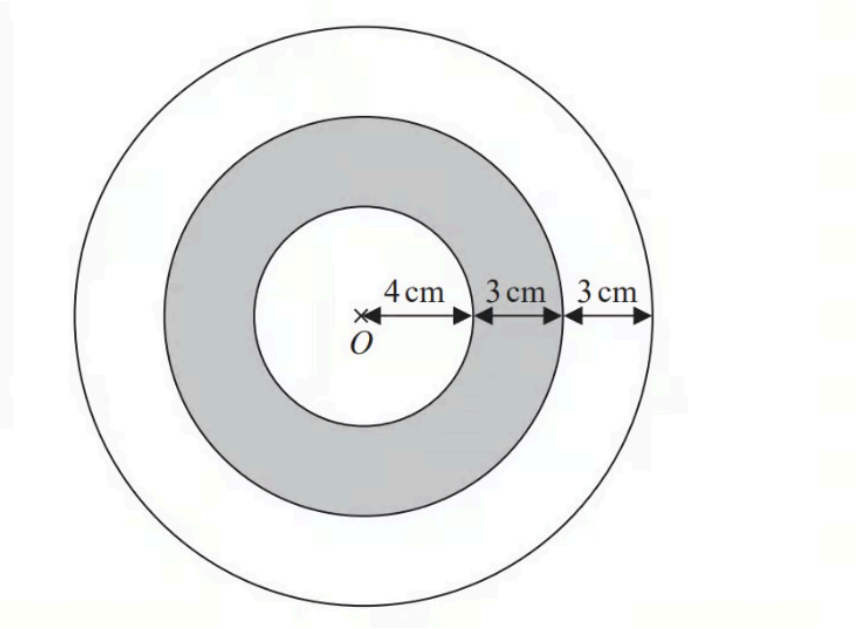
The points A, B, C and D lie on the circle.

The radius of the circle is 6 cm.

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

(4 marks)

5 The diagram shows a logo made from three circles.



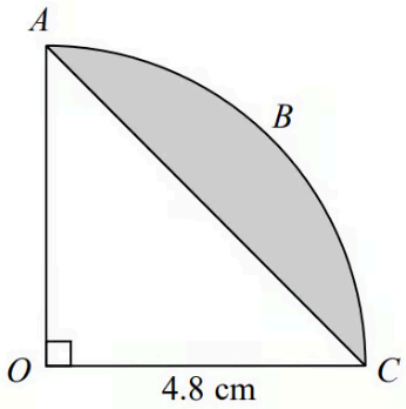
Each circle has centre O.

Daisy says that exactly $\frac{1}{3}$ of the logo is shaded.

Is Daisy correct?
You must show all your working.

(4 marks)

6



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

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

(3 marks)

7

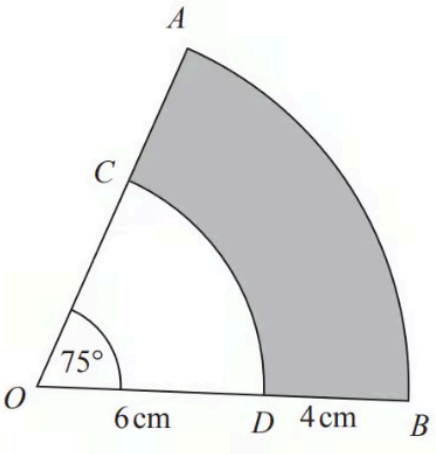


Diagram **NOT** accurately drawn

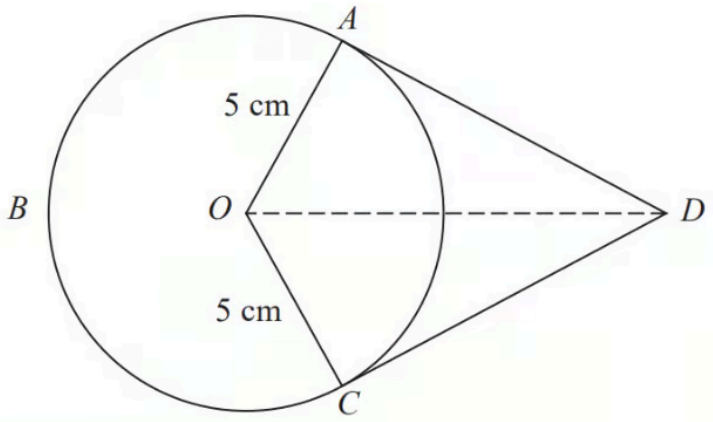
OAB is a sector of a circle, centre O.
OCD is a sector of a circle, centre O.
OCA and ODB are straight lines.

Angle $AOB = 75°$
$OD = 6$ cm
$DB = 4$ cm

Calculate the perimeter of the shaded region.
Give your answer correct to 3 significant figures.

(3 marks)

8

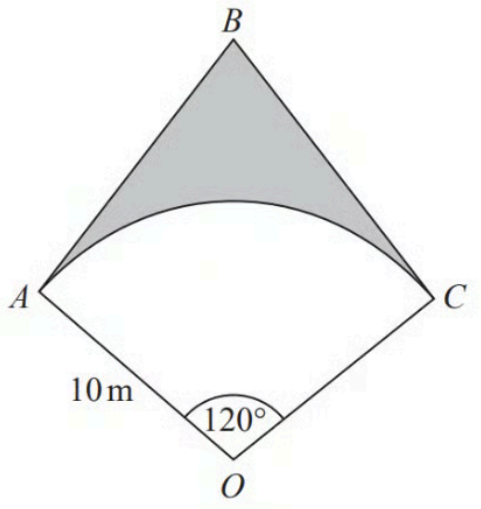


A, B and C are points on a circle of radius 5 cm, centre O.
DA and DC are tangents to the circle.
$DO = 9$ cm

Work out the length of arc ABC.
Give your answer correct to 3 significant figures.

(5 marks)

9



OAC is a sector of a circle, centre O, radius 10 m.

BA is the tangent to the circle at point A.
BC is the tangent to the circle at point C.

Angle $AOC = 120°$

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

(5 marks)

10 The diagram shows a shaded shape $ABCD$ made from a semicircle ABC and a right-

angled triangle ACD.

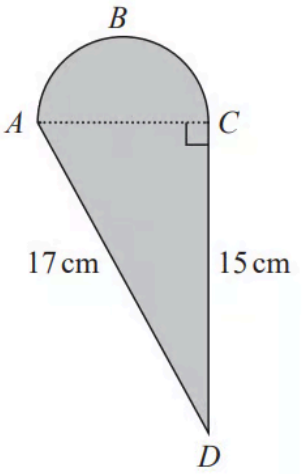


Diagram **NOT** accurately drawn

AC is the diameter of the semicircle ABC.

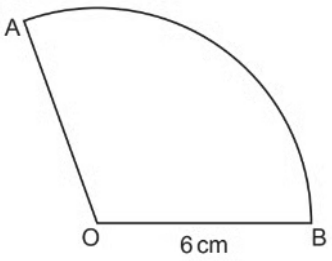
Work out the perimeter of the shaded shape.
Give your answer correct to 3 significant figures.

.....cm

(5 marks)

11 AOB is a sector of a circle, centre O and radius 6cm.

The length of arc AB is 5π cm.



Not to scale

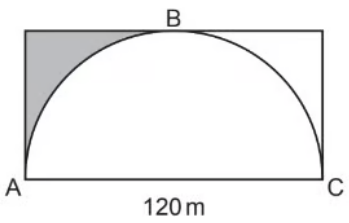
Find the area of the sector.
Give your answer in terms of π.

..... cm^2

(5 marks)

12 The diagram shows a semi-circle inside a rectangle of length 120 m.
The semi-circle touches the rectangle at A, B and C.

Not to scale

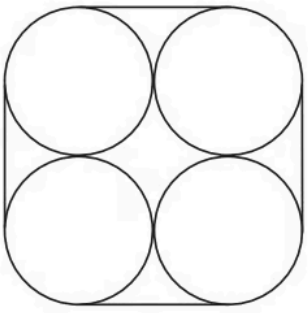


Calculate the **perimeter** of the shaded region.
Give your answer correct to 3 significant figures.

..... m

(5 marks)

13 Four pencils are held together with a band.
The figure below shows the bottom end of the pencils and the band.

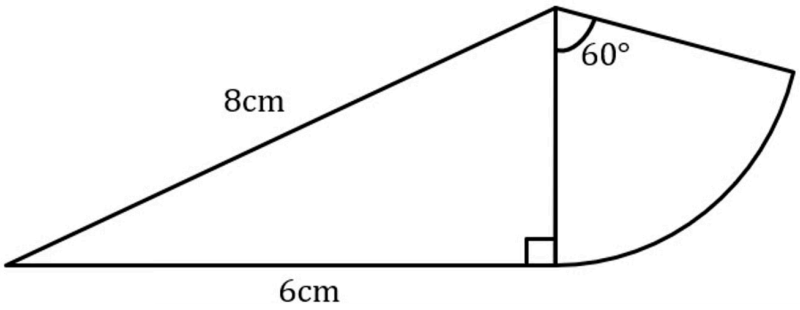


Each of the pencils has diameter 9 mm.
Find the length of the band in this position.

..... mm

(4 marks)

14 The diagram shows a right angled triangle and a sector of a circle with angle 60 degrees.



Calculate the area of the sector.

(4 marks)

Very Hard Questions

1 Here are two watch faces, **A** and **B**.

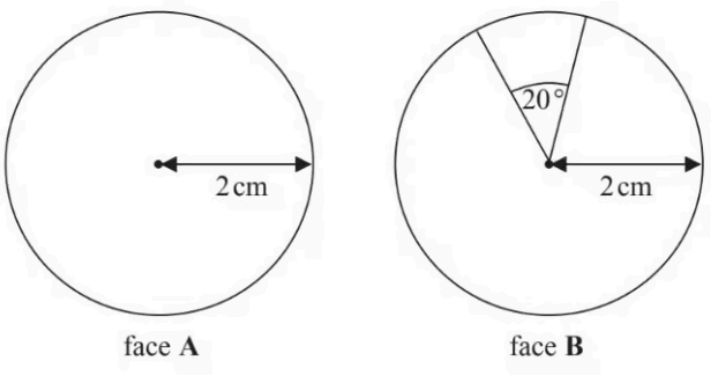


Diagram **NOT** accurately drawn

Both watch faces are circular with radius 2cm.

The materials used to make both watch faces have the same thickness.

A is made entirely of plastic.
B has a 20° sector of metal and a 340° sector of plastic.

The ratio of the cost per cm^2 of the metal to the cost per cm^2 of the plastic is 3 : 2

Work out the ratio of the cost of the materials for **A** to the cost of the materials for **B**.
Give your answer in its simplest form.
You must show all your working.

(4 marks)

2 In the diagram, ABC is a right-angled triangle and DEF is a semicircular arc.

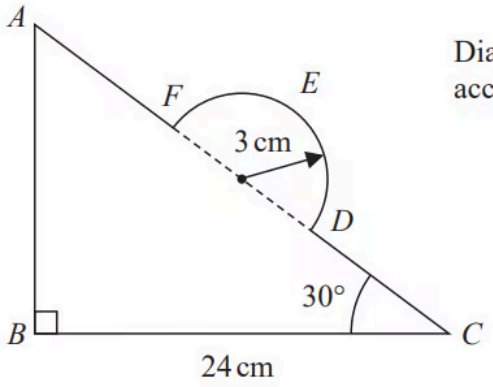


Diagram **NOT** accurately drawn

In triangle ABC

$BC = 24$ cm	angle $ABC = 90°$	angle $BCA = 30°$

The points D and F lie on AC so that DF is the diameter of the semicircular arc DEF
The radius of the semicircular arc is 3cm.

Work out the length of $AFEDC$
Give your answer correct to 2 significant figures.

(5 marks)

3 The diagram shows a sector OBC of a circle with centre O and radius $(6 + x)$ cm.

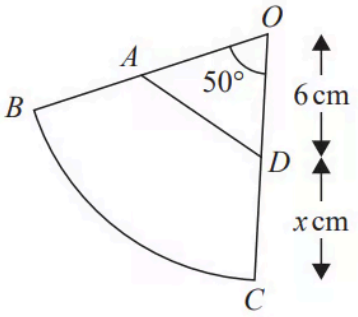


Diagram **NOT** accurately drawn

A is the point on OB and D is the point on OC such that $OA = OD = 6$ cm

Angle $BOC = 50°$

Given that

the perimeter of sector $OBC = 2 \times$ the perimeter of triangle OAD

find the value of x.
Give your answer correct to 3 significant figures.

(6 marks)

4 A, B and C are points on a circle with centre O.

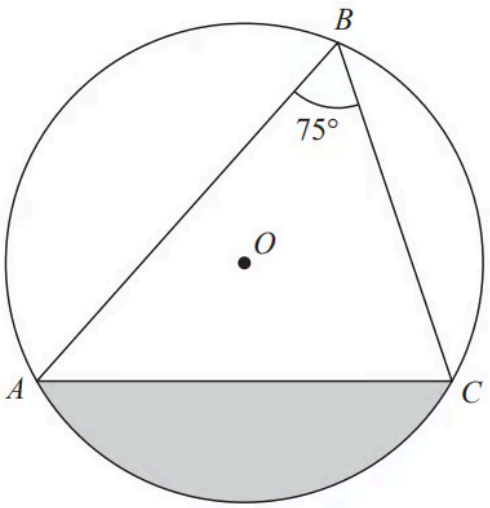


Diagram **NOT** accurately drawn

Angle $ABC = 75°$

The area of the shaded segment is 200cm^2

Calculate the radius of the circle.
Give your answer correct to 3 significant figures.

..... cm

(5 marks)

5 The diagram shows two circles such that the region **R**, shown shaded in the diagram, is

the region common to both circles.

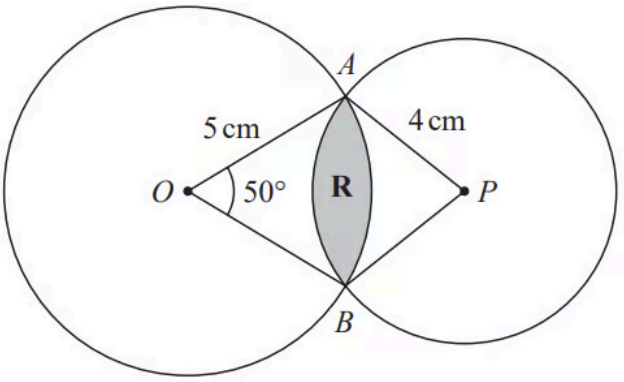


Diagram **NOT** accurately drawn

One of the circles has centre O and radius 5cm.
The other circle has centre P and radius 4 cm.
Angle $AOB = 50°$

Calculate the area of region $\mathbf{R}$.
Give your answer correct to 3 significant figures.

..... cm^2

(6 marks)

6 Here is a sector, AOB , of a circle with centre O and angle $AOB = x°$

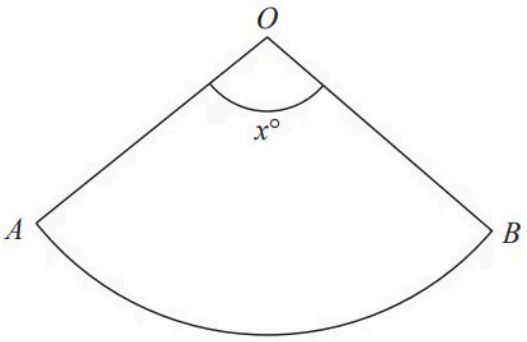


Diagram **NOT** accurately drawn

The sector can form the curved surface of a cone by joining OA to OB .

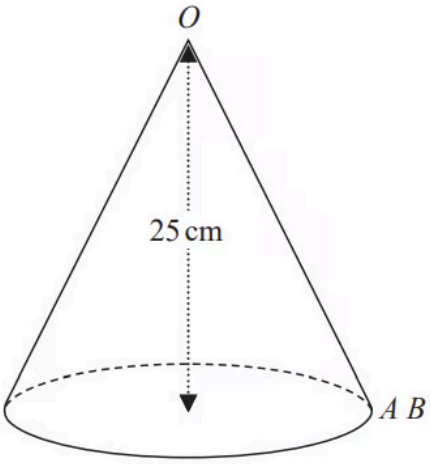


Diagram **NOT** accurately drawn

The height of the cone is 25 cm.
The volume of the cone is 1600 cm^3

Work out the value of x.
Give your answer correct to the nearest whole number.

x = ...

(6 marks)

7

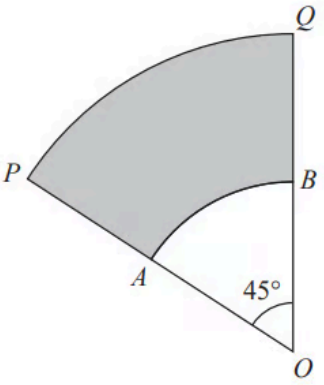


Diagram **NOT** accurately drawn

OPQ is a sector of a circle, centre O
OAB is a sector of a circle, centre O

A is the point on OP such that $OA : AP = 3:2$
B is the point on OQ such that $OB : BQ = 3:2$
Angle $POQ = 45°$

The area of the shaded region is $\frac{81}{2}\pi$ cm^2 Work out the perimeter of the shaded region.
Give your answer in terms of π.

(6 marks)

8 The diagram shows a sector $OAPB$ of a circle, centre O

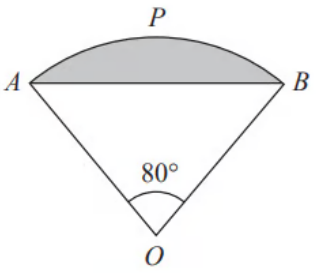


Diagram **NOT** accurately drawn

AB is a chord of the circle.

Angle $AOB = 80°$

The area of sector $OAPB$ is $\frac{25}{2}\ \pi\ \text{cm}^2$

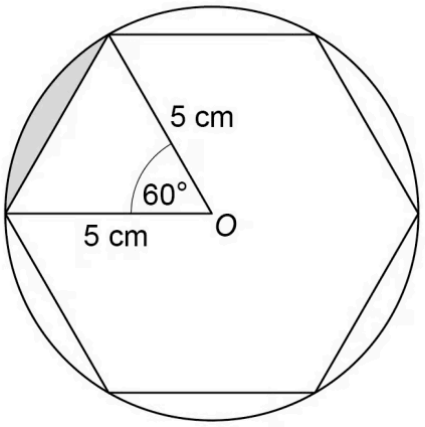
Work out the perimeter of the shaded segment.
Give your answer correct to 3 significant figures.

.....cm

(6 marks)

9 The vertices of a regular hexagon lie on a circle with centre O and radius 5 cm

Not drawn accurately



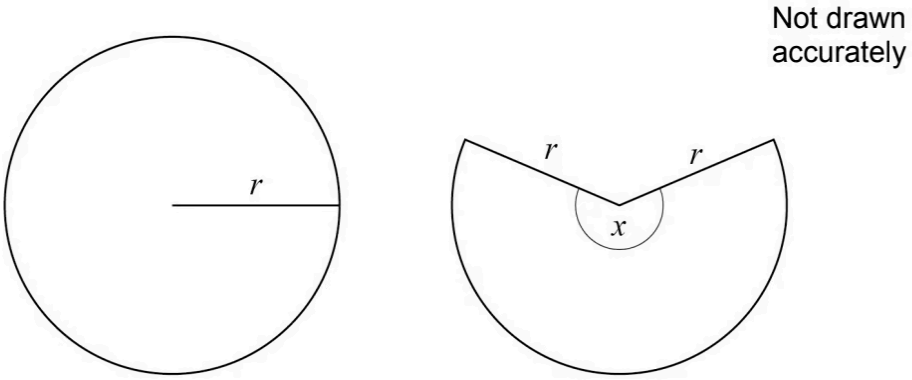
Work out the shaded area.

Give your answer in the form $\frac{a\pi - b\sqrt{c}}{12}$ where a, b and c are integers.

(4 marks)

10 Here are a circle and a sector of the circle.

They each have radius r.



circumference of circle = perimeter of sector

Work out the size of angle x.

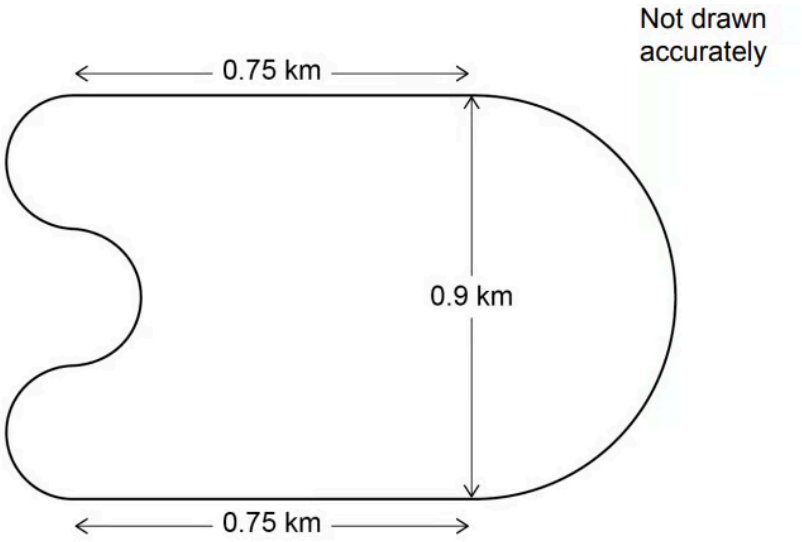
Give your answer in terms of π.

.....degrees

(4 marks)

11 A motor racing circuit consists of

two parallel straight sections, each of length 0.75 km
a semicircle of diameter 0.9 km
three equal, smaller semicircles.

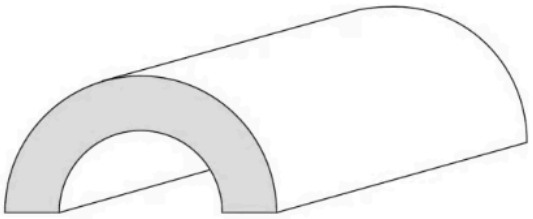


The length of a motor race must be greater than 305 km

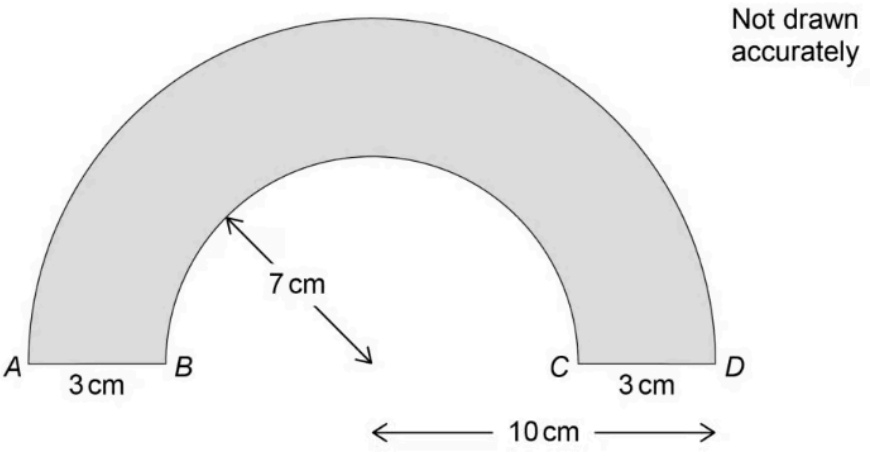
What is the lowest number of **full** laps needed at this circuit?
You **must** show your working.

(5 marks)

12 Here is a tunnel for a toy train.



The diagram below shows the cross section of the tunnel.



AD is a semicircular arc of radius 10 cm
BC is a semicircular arc of radius 7 cm
The length of the tunnel is 30 cm

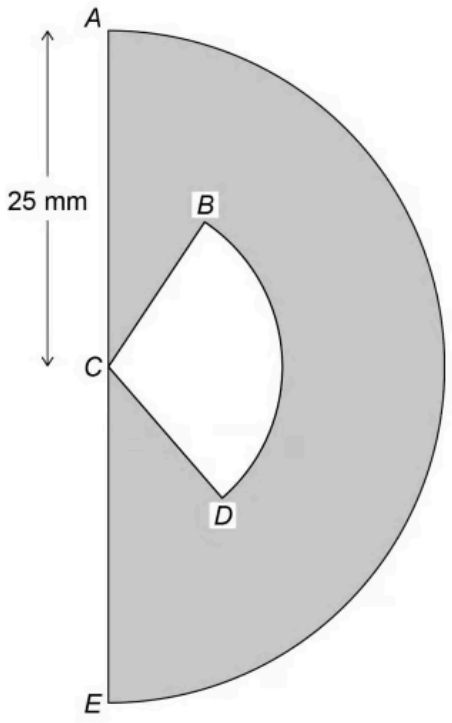
Work out the total area of all **six** faces of the tunnel.
Give your answer in terms of π.

.....cm^2

(5 marks)

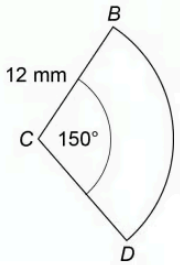
13 The cross section of an earring is a semicircle, centre C, radius 25 mm
The earring is black and white.

The shaded area is black.



Not drawn accurately

Sector BCD is white and has radius 12 mm



Not drawn accurately

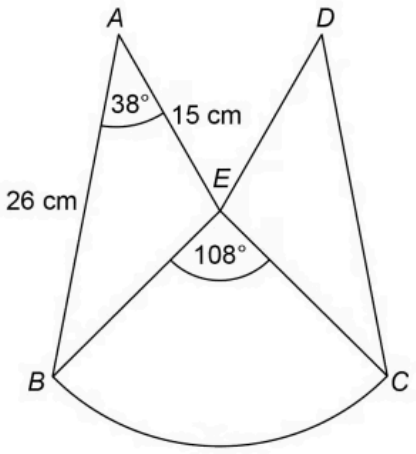
Is more than 20% of the semicircle white?

You **must** show your working.

(5 marks)

14 The diagram shows a logo.

ABE and DCE are congruent triangles.
BCE is a sector of a circle, centre E.

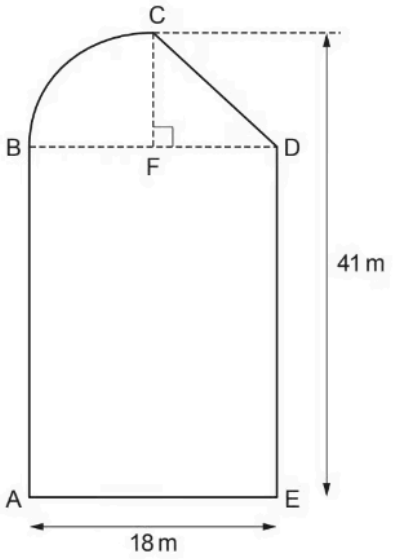


Not drawn accurately

Show that the area of the logo is 510 cm^2 to 2 significant figures.

(5 marks)

15 The diagram shows a shape ABCDE.
The shape is made from a rectangle, a right-angled triangle and a quarter of a circle.



Not to scale

F is the mid-point of BD.
AE = 18 m and the perpendicular distance from C to AE is 41 m.

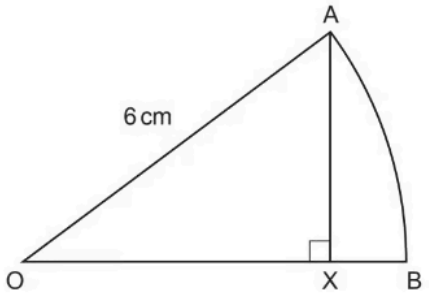
Work out the **perimeter** of the shape ABCDE.

..... m

(6 marks)

16 OAB is a sector of a circle, centre O.

OA = 6 cm and AX is perpendicular to OB.



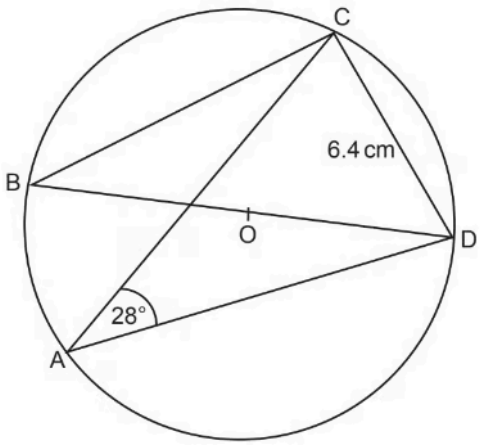
Not to scale

The area of sector OAB is $6\pi \text{cm}^2$.

Show that AX = $3\sqrt{3}$ cm.

(6 marks)

17 A, B, C and D are points on the circumference of a circle, centre O.



Not to scale

Angle CAD = 28° and CD = 6.4cm.
BD is a diameter of the circle.

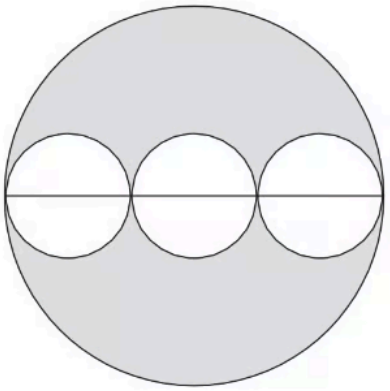
Calculate the area of the circle.

..... cm^2

(5 marks)

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

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



Find the fraction of the large circle that is shaded.

(3 marks)