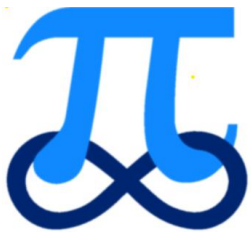
Edexcel

Pure Mathematics

Year 2

Radian Measures

Past paper questions from Core Maths 2 and IAL C12



Edited by: K V Kumaran

Past paper questions from

Edexcel Core Maths 2 and IAL C12.

From Jan 2005 to May 2019.

Please check the Edexcel website for the solutions.

1. **Figure 1**

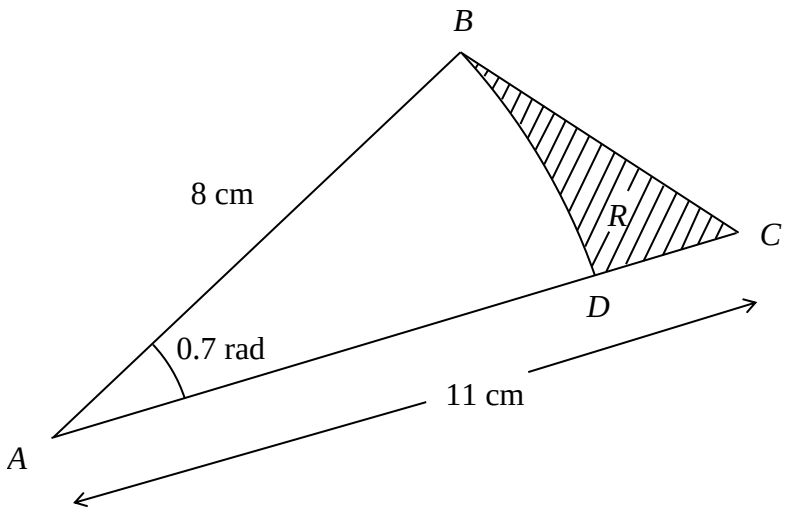


Figure 1 shows the triangle *ABC*, with *AB* = 8 cm, *AC* = 11 cm and $\angle BAC = 0.7$ radians. The arc *BD*, where *D* lies on *AC*, is an arc of a circle with centre *A* and radius 8 cm. The region *R*, shown shaded in Figure 1, is bounded by the straight lines *BC* and *CD* and the arc *BD*.

Find

(*a*) the length of the arc *BD*,

(2)

(*b*) the perimeter of *R*, giving your answer to 3 significant figures,

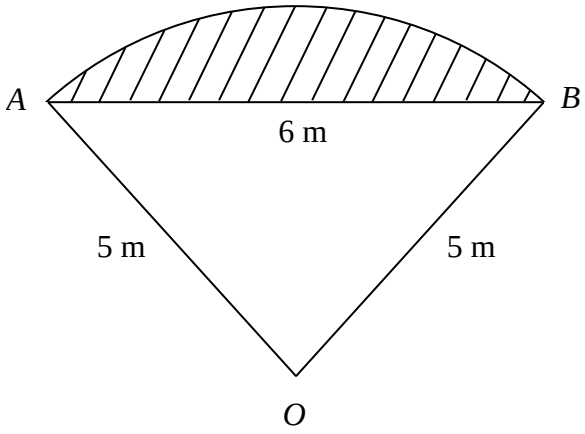
(4)

(*c*) the area of *R*, giving your answer to 3 significant figures.

(5)

(C2 Q7,Jan 2005)

2. **Figure 2**



In Figure 2 *OAB* is a sector of a circle, radius 5 m. The chord *AB* is 6 m long.

(*a*) Show that $\cos A\hat{O}B = \frac{7}{25}$.

(2)

(*b*) Hence find the angle $A\hat{O}B$ in radians, giving your answer to 3 decimal places.

(1)

(*c*) Calculate the area of the sector *OAB*.

(2)

(*d*) Hence calculate the shaded area.

(3)

(C2 Q5, Jan 2006)

3. **Figure 2**

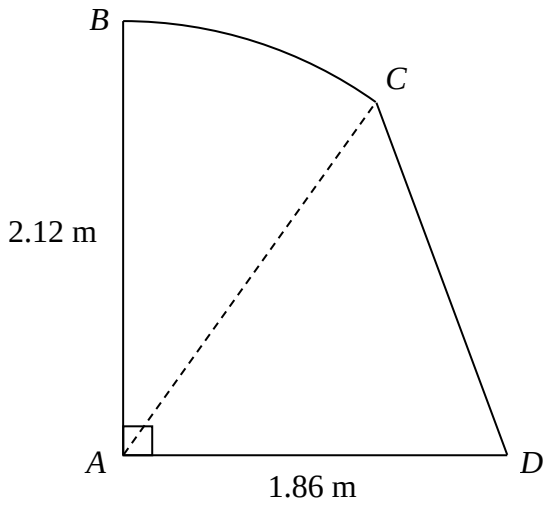


Figure 2 shows the cross-section *ABCD* of a small shed.

The straight line *AB* is vertical and has length 2.12 m.

The straight line *AD* is horizontal and has length 1.86 m.

The curve *BC* is an arc of a circle with centre *A*, and *CD* is a straight line.

Given that the size of $\angle BAC$ is 0.65 radians, find

(*a*) the length of the arc *BC*, in m, to 2 decimal places,

(2)

(*b*) the area of the sector *BAC*, in m^2, to 2 decimal places,

(2)

(*c*) the size of $\angle CAD$, in radians, to 2 decimal places,

(2)

(*d*) the area of the cross-section *ABCD* of the shed, in m^2, to 2 decimal places.

(3)

(C2 Q8,May 2006)

4. **Figure 2**

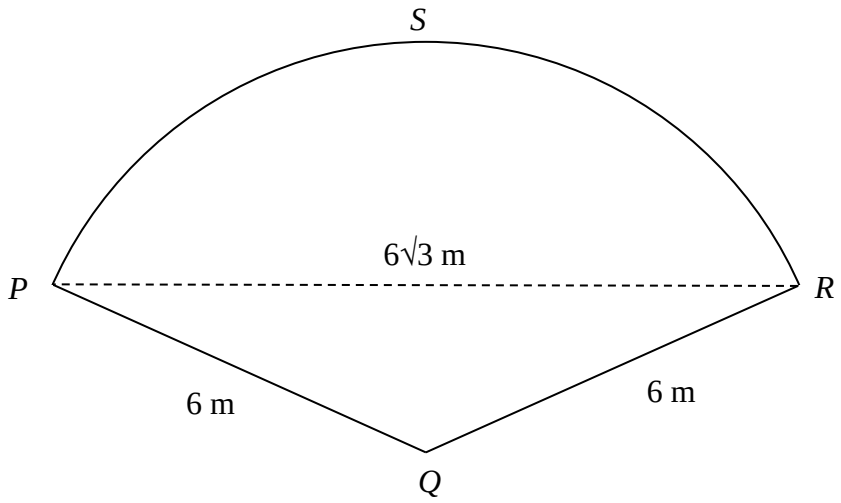


Figure 2 shows a plan of a patio. The patio *PQRS* is in the shape of a sector of a circle with centre *Q* and radius 6 m.

Given that the length of the straight line *PR* is $6\sqrt{3}$ m,

(*a*) find the exact size of angle *PQR* in radians.

(3)

(*b*) Show that the area of the patio *PQRS* is 12π m^2.

(2)

(*c*) Find the exact area of the triangle *PQR*.

(2)

(*d*) Find, in m^2 to 1 decimal place, the area of the segment *PRS*.

(2)

(*e*) Find, in m to 1 decimal place, the perimeter of the patio *PQRS*.

(C2 Q9, Jan 2007)

5.

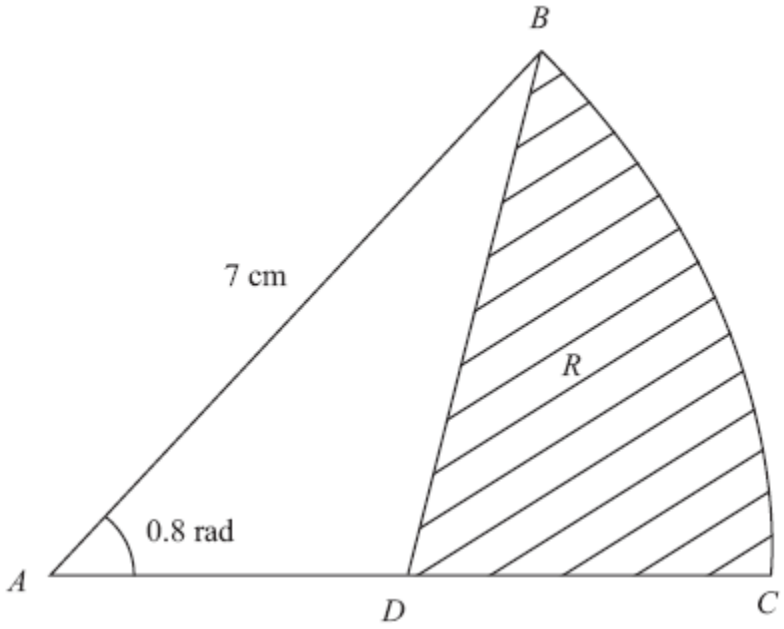


Figure 1

Figure 1 shows *ABC*, a sector of a circle with centre *A* and radius 7 cm.

Given that the size of $\angle BAC$ is exactly 0.8 radians, find

(*a*) the length of the arc *BC*,

(2)

(*b*) the area of the sector *ABC*.

(2)

The point *D* is the mid-point of *AC*. The region *R*, shown shaded in Figure 1, is bounded by *CD*, *DB* and the arc *BC*.

Find

(*c*) the perimeter of *R*, giving your answer to 3 significant figures,

(4)

(*d*) the area of *R*, giving your answer to 3 significant figures.

(4)

(C2 Q7,June 2008)

6.

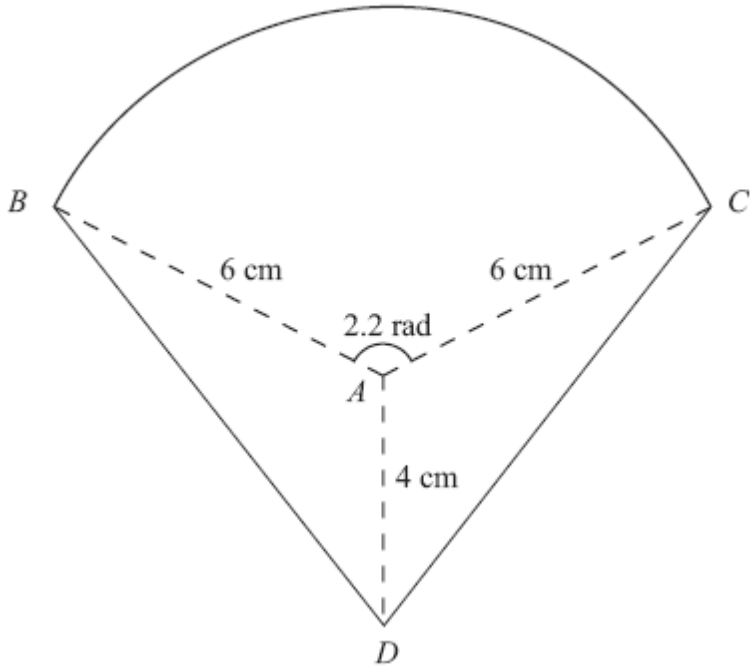


Figure 3

The shape *BCD* shown in Figure 3 is a design for a logo.

The straight lines *DB* and *DC* are equal in length. The curve *BC* is an arc of a circle with centre *A* and radius 6 cm. The size of $\angle BAC$ is 2.2 radians and $AD = 4$ cm.

Find

(*a*) the area of the sector *BAC*, in cm^2,

(2)

(*b*) the size of $\angle DAC$, in radians to 3 significant figures,

(2)

(*c*) the complete area of the logo design, to the nearest cm^2.

(4)

(C2 Q7,Jan 2009)

7.

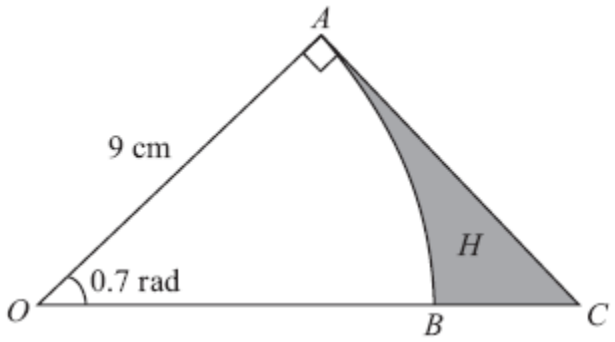


Figure 1

Figure 1 shows the sector *OAB* of a circle with centre *O*, radius 9 cm and angle 0.7 radians.

(*a*) Find the length of the arc *AB*.

(2)

(*b*) Find the area of the sector *OAB*.

(2)

The line *AC* shown in Figure 1 is perpendicular to *OA*, and *OBC* is a straight line.

(*c*) Find the length of *AC*, giving your answer to 2 decimal places.

(2)

The region *H* is bounded by the arc *AB* and the lines *AC* and *CB*.

(*d*) Find the area of *H*, giving your answer to 2 decimal places.

(3)

(C2 Q6, Jun 2010)

8.

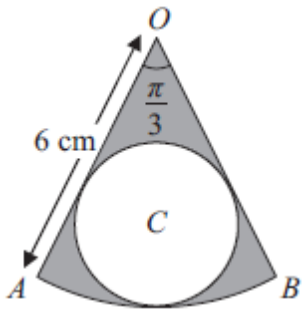


Figure 1

The shape shown in Figure 1 is a pattern for a pendant. It consists of a sector OAB of a circle centre O, of radius 6 cm, and angle $AOB = \frac{\pi}{3}$. The circle C, inside the sector, touches the two straight edges, OA and OB, and the arc AB as shown.

Find

(a) the area of the sector OAB,

(2)

(b) the radius of the circle C.

(3)

The region outside the circle C and inside the sector OAB is shown shaded in Figure 1.

(c) Find the area of the shaded region.

(2)

(C2 Q5, May 2011)

9.

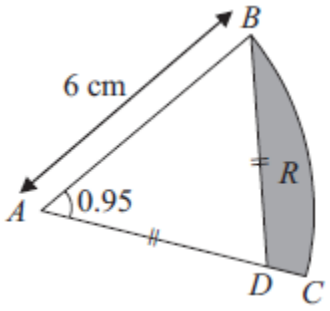


Figure 2

Figure 2 shows *ABC*, a sector of a circle of radius 6 cm with centre *A*. Given that the size of angle *BAC* is 0.95 radians, find

(*a*) the length of the arc *BC*,

(2)

(*b*) the area of the sector *ABC*.

(2)

The point *D* lies on the line *AC* and is such that *AD* = *BD*. The region *R*, shown shaded in Figure 2, is bounded by the lines *CD*, *DB* and the arc *BC*.

(*c*) Show that the length of *AD* is 5.16 cm to 3 significant figures.

(2)

Find

(*d*) the perimeter of *R*,

(2)

(*e*) the area of *R*, giving your answer to 2 significant figures.

(4)

(C2 Q7, Jan 2012)

10.

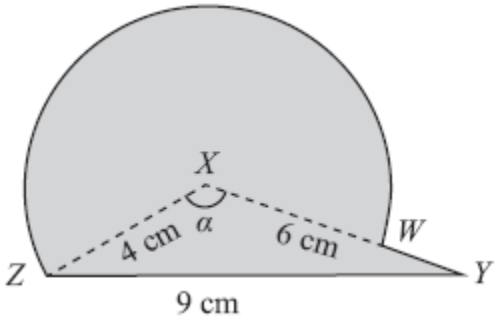


Figure 2

The triangle XYZ in Figure 1 has $XY = 6$ cm, $YZ = 9$ cm, $ZX = 4$ cm and angle $ZXY = \alpha$.
The point W lies on the line XY.

The circular arc ZW, in Figure 1 is a major arc of the circle with centre X and radius 4 cm.

(a) Show that, to 3 significant figures, $\alpha = 2.22$ radians.

(2)

(b) Find the area, in cm^2, of the major sector $XZWX$.

(3)

The region enclosed by the major arc ZW of the circle and the lines WY and YZ is shown shaded in Figure 1.

Calculate

(c) the area of this shaded region,

(3)

(d) the perimeter $ZWYZ$ of this shaded region.

(4)

(C2 Q7, Jan 2013)

11.

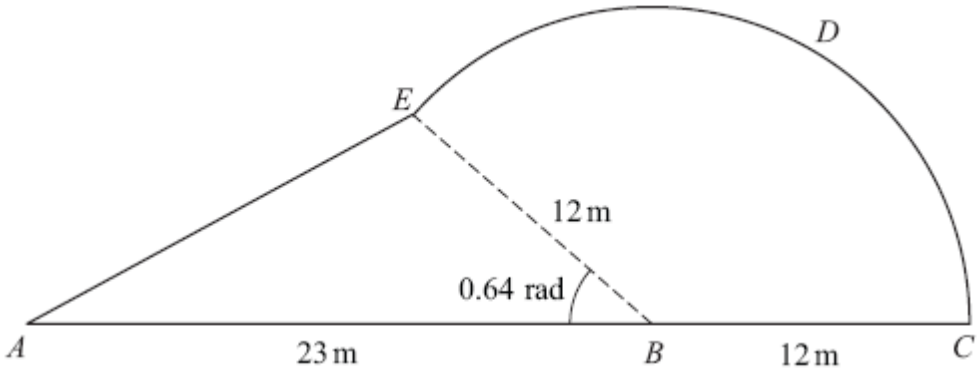


Figure 2

Figure 2 shows a plan view of a garden.

The plan of the garden *ABCDEA* consists of a triangle *ABE* joined to a sector *BCDE* of a circle with radius 12 m and centre *B*.

The points *A*, *B* and *C* lie on a straight line with *AB* = 23 m and *BC* = 12 m.

Given that the size of angle *ABE* is exactly 0.64 radians, find

(*a*) the area of the garden, giving your answer in m^2, to 1 decimal place,

(4)

(*b*) the perimeter of the garden, giving your answer in metres, to 1 decimal place.

(5)

(C2 Q5 ,May 2013)

12.

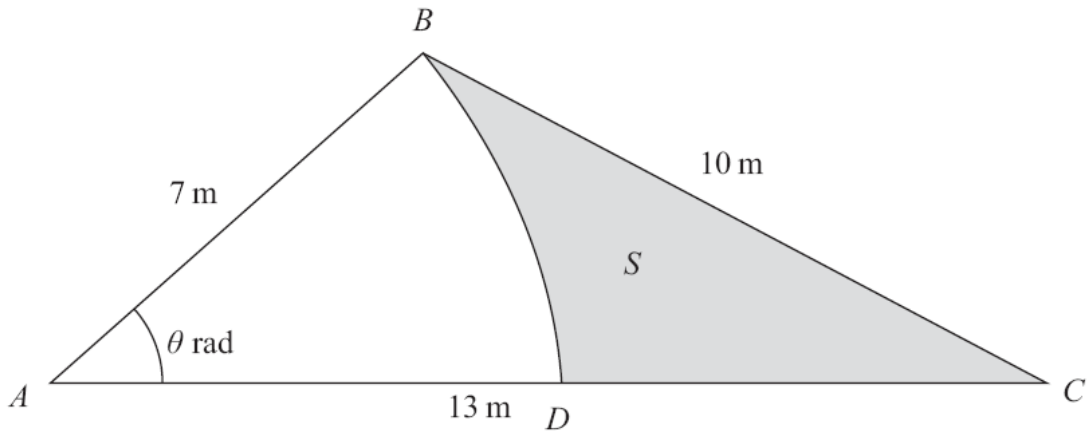


Figure 2

Figure 2 shows the design for a triangular garden ABC where AB = 7 m, AC = 13 m and BC = 10 m.

Given that angle $BAC = \theta$ radians,

(a) show that, to 3 decimal places, $\theta = 0.865$

(3)

The point D lies on AC such that BD is an arc of the circle centre A, radius 7 m.

The shaded region S is bounded by the arc BD and the lines BC and DC. The shaded region S will be sown with grass seed, to make a lawned area.

Given that 50 g of grass seed are needed for each square metre of lawn,

(b) find the amount of grass seed needed, giving your answer to the nearest 10 g.

(7)

(C2 Q8, May 2013_R)

13.

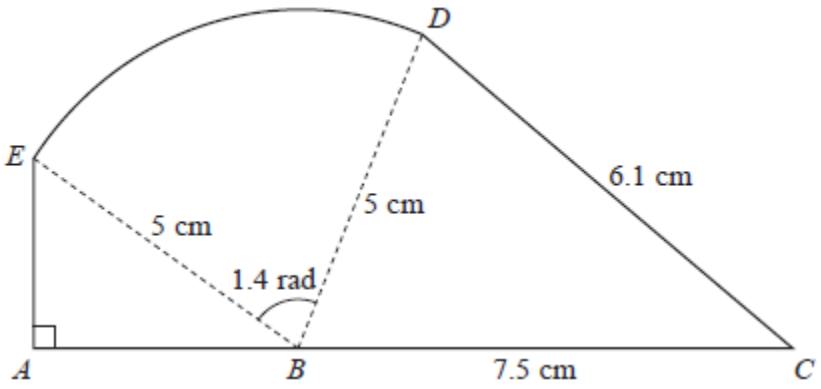


Figure 2

The shape *ABCDEA*, as shown in Figure 2, consists of a right-angled triangle *EAB* and a triangle *DBC* joined to a sector *BDE* of a circle with radius 5 cm and centre *B*.

The points *A*, *B* and *C* lie on a straight line with *BC* = 7.5 cm.

Angle *EAB* = $\frac{\pi}{2}$ radians, angle *EBD* = 1.4 radians and *CD* = 6.1 cm.

(*a*) Find, in cm^2, the area of the sector *BDE*.

(2)

(*b*) Find the size of the angle *DBC*, giving your answer in radians to 3 decimal places.

(2)

(*c*) Find, in cm^2, the area of the shape *ABCDEA*, giving your answer to 3 significant figures.

(5)

(C2 Q5, May 2014)

14.

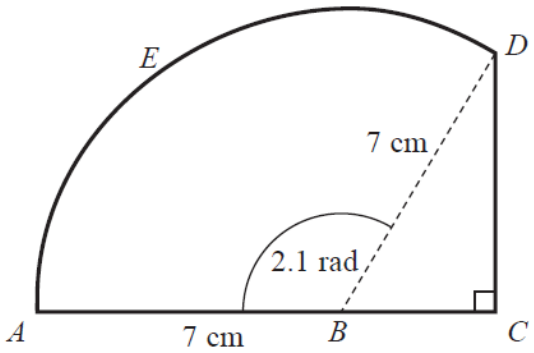


Figure 2

Figure 2 shows the shape *ABCDEA* which consists of a right-angled triangle *BCD* joined to a sector *ABDEA* of a circle with radius 7 cm and centre *B*.

A, *B* and *C* lie on a straight line with *AB* = 7 cm.

Given that the size of angle *ABD* is exactly 2.1 radians,

(*a*) find, in cm, the length of the arc *DEA*,

(2)

(*b*) find, in cm, the perimeter of the shape *ABCDEA*, giving your answer to 1 decimal place.

(4)

(C2 Q5, May 2014_R)

15.

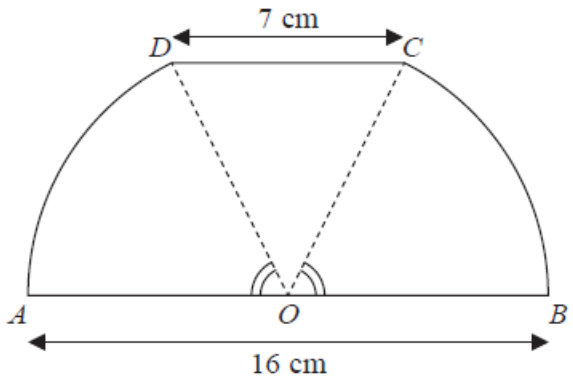


Figure 1

Figure 1 shows a sketch of a design for a scraper blade. The blade *AOBCDA* consists of an isosceles triangle *COD* joined along its equal sides to sectors *OBC* and *ODA* of a circle with centre *O* and radius 8 cm. Angles *AOD* and *BOC* are equal. *AOB* is a straight line and is parallel to the line *DC*. *DC* has length 7 cm.

(*a*) Show that the angle *COD* is 0.906 radians, correct to 3 significant figures.

(2)

(*b*) Find the perimeter of *AOBCDA*, giving your answer to 3 significant figures.

(3)

(*c*) Find the area of *AOBCDA*, giving your answer to 3 significant figures.

(3)

(C2 Q4, May 2015)

16.

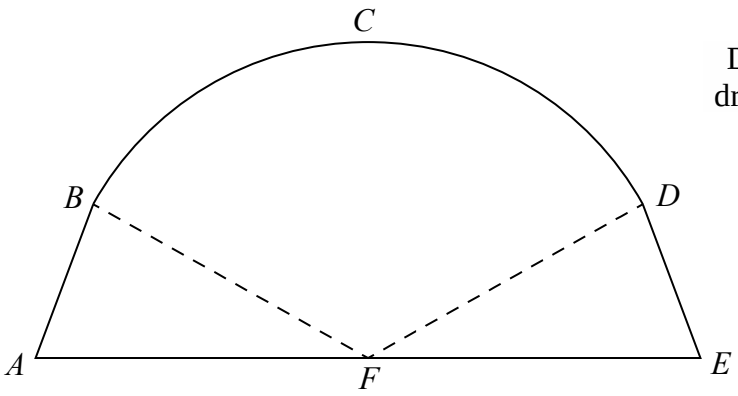


Diagram not drawn to scale

Figure 1

Figure 1 is a sketch representing the cross-section of a large tent *ABCDEF*.
AB and *DE* are line segments of equal length.
Angle *FAB* and angle *DEF* are equal.
F is the midpoint of the straight line *AE* and *FC* is perpendicular to *AE*.
BCD is an arc of a circle of radius 3.5 m with centre at *F*.
It is given that

$$AF = FE = 3.7 \text{ m}$$

$$BF = FD = 3.5 \text{ m}$$

$$\text{angle } BFD = 1.77 \text{ radians}$$

Find

(*a*) the length of the arc *BCD* in metres to 2 decimal places,

(2)

(*b*) the area of the sector *FBCD* in m^2 to 2 decimal places,

(2)

(*c*) the total area of the cross-section of the tent in m^2 to 2 decimal places.

(4)

(C2 Q4, May 2016)

17.

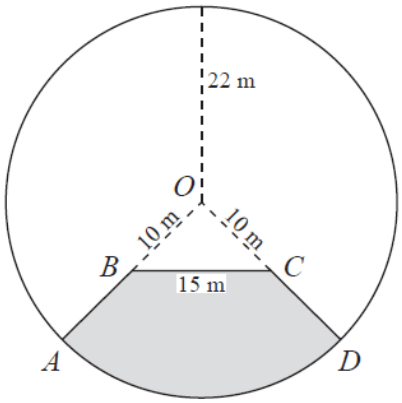


Diagram **NOT** drawn to scale

Figure 1

Figure 1 shows the plan for a pond and platform. The platform is shown shaded in the figure and is labelled *ABCD*.

The pond and platform together form a circle of radius 22 m with centre *O*.

OA and *OD* are radii of the circle. Point *B* lies on *OA* such that the length of *OB* is 10 m and point *C* lies on *OD* such that the length of *OC* is 10 m. The length of *BC* is 15 m.

The platform is bounded by the arc *AD* of the circle, and the straight lines *AB*, *BC* and *CD*.

Find

(*a*) the size of the angle *BOC*, giving your answer in radians to 3 decimal places,

(3)

(*b*) the perimeter of the platform to 3 significant figures,

(4)

(*c*) the area of the platform to 3 significant figures.

(4)

(IAL C12 Jan 2014, Q12)

18..

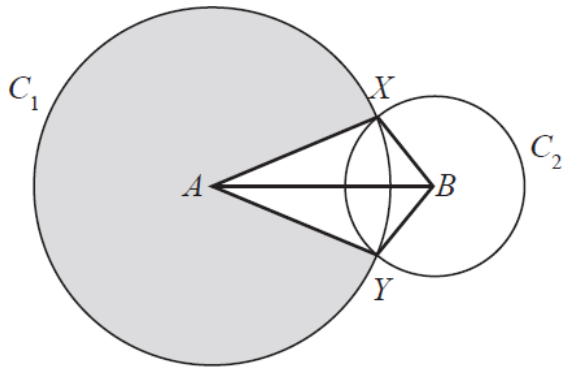


Figure 3

In Figure 3, the points A and B are the centres of the circles C_1 and C_2 respectively. The circle C_1 has radius 10 cm and the circle C_2 has radius 5 cm. The circles intersect at the points X and Y, as shown in the figure.

Given that the distance between the centres of the circles is 12 cm,

(a) calculate the size of the acute angle XAB, giving your answer in radians to 3 significant figures,

(2)

(b) find the area of the major sector of circle C_1, shown shaded in Figure 3,

(3)

(c) find the area of the kite $AYBX$.

(3)

(IAL C12 Jan 2015, Q9)

19.

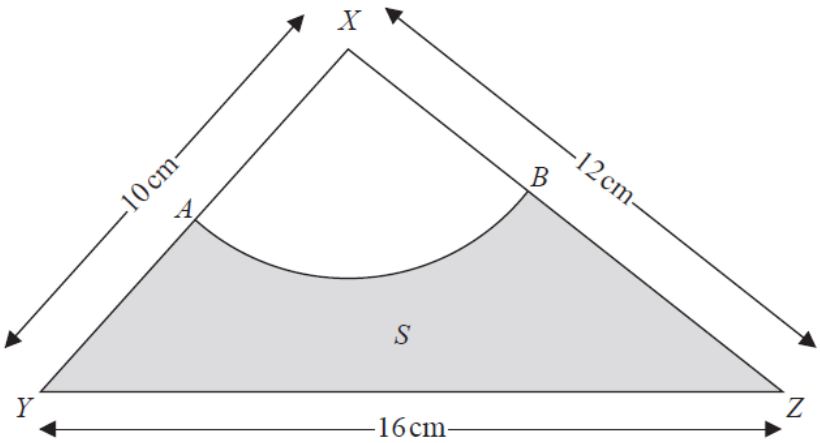


Figure 1

Figure 1 shows a triangle XYZ with $XY = 10$ cm, $YZ = 16$ cm and $ZX = 12$ cm.

(a) Find the size of the angle YXZ, giving your answer in radians to 3 significant figures.

(3)

The point A lies on the line XY and the point B lies on the line XZ and $AX = BX = 5$ cm. AB is the arc of a circle with centre X.

The shaded region S, shown in Figure 1, is bounded by the lines BZ, ZY, YA and the arc AB.

Find

(b) the perimeter of the shaded region to 3 significant figures,

(4)

(c) the area of the shaded region to 3 significant figures.

(4)

(IAL C12 Jan 2016, Q11)

20.

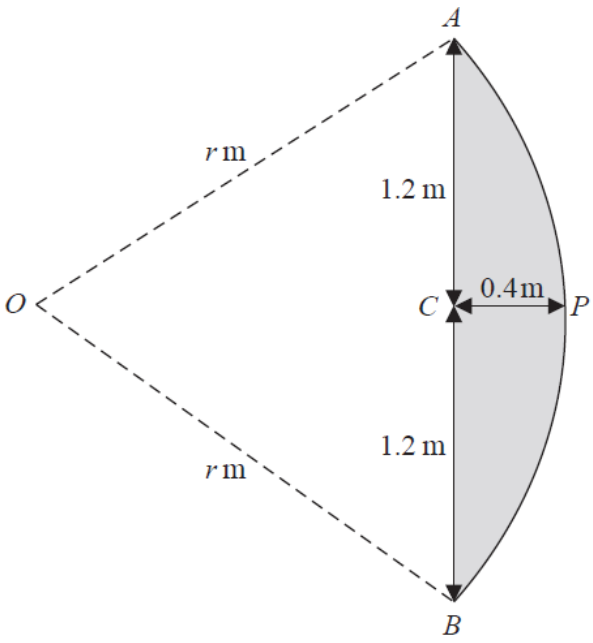


Figure 2

Figure 2 shows the design for a sail *APBCA*.

The curved edge *APB* of the sail is an arc of a circle centre *O* and radius *r* m.

The straight edge *ACB* is a chord of the circle.

The height *AB* of the sail is 2.4 m.

The maximum width *CP* of the sail is 0.4 m.

(*a*) Show that $r = 2$

(2)

(*b*) Show, to 4 decimal places, that angle *AOB* = 1.2870 radians.

(2)

(*c*) Hence calculate the area of the sail, giving your answer, in m^2, to 3 decimal places.

(4)

(IAL C12 May 2016, Q11)

21.

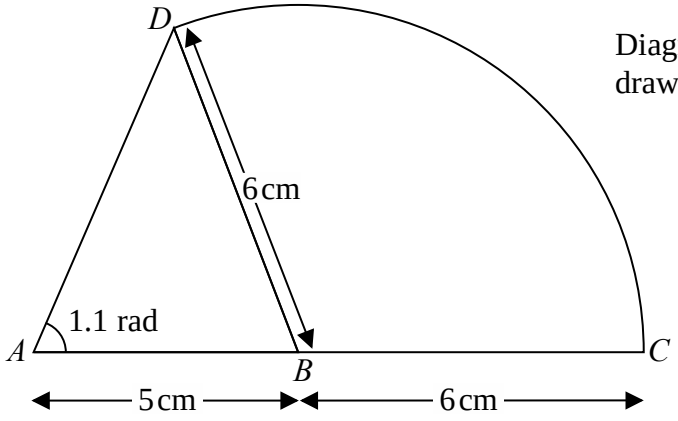


Figure 1

The compound shape *ABCDA*, shown in Figure 1, consists of a triangle *ABD* joined along its edge *BD* to a sector *DBC* of a circle with centre *B* and radius 6 cm.
The points *A*, *B* and *C* lie on a straight line with *AB* = 5 cm and *BC* = 6 cm.
Angle *DAB* = 1.1 radians.

(*a*) Show that angle *ABD* = 1.20 radians to 3 significant figures.

(4)

(*b*) Find the area of the compound shape, giving your answer to 3 significant figures.

(4)

(IAL C12 Oct 2016, Q8)

22.

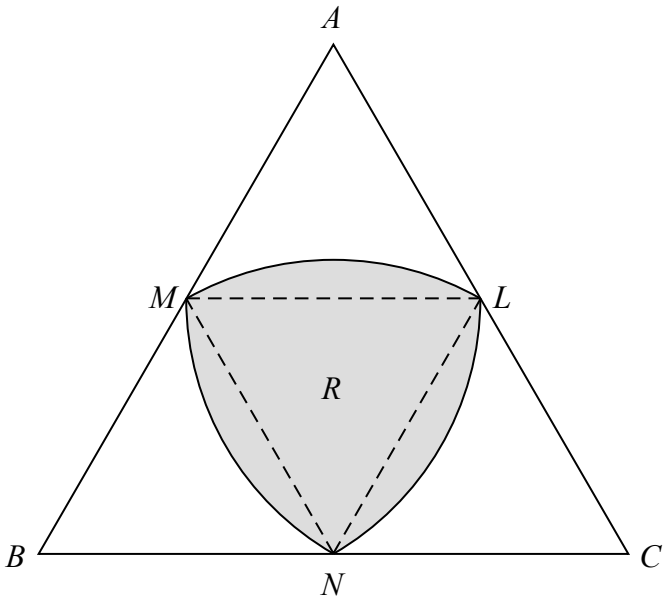


Figure 5

Figure 5 shows the design for a logo.

The logo is in the shape of an equilateral triangle ABC of side length $2r$ cm, where r is a constant.

The points L, M and N are the midpoints of sides AC, AB and BC respectively.

The shaded section R, of the logo, is bounded by three curves MN, NL and LM.

The curve MN is the arc of a circle centre L, radius r cm.

The curve NL is the arc of a circle centre M, radius r cm.

The curve LM is the arc of a circle centre N, radius r cm.

Find, in cm^2, the area of R. Give your answer in the form kr^2, where k is an exact constant to be determined.

(5)

(IAL C12 Jan 2017, Q15)

23.

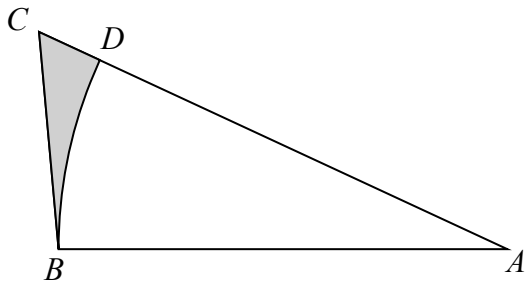


Figure 2

Figure 2 shows a sketch of a design for a triangular garden *ABC*.

The garden has sides *BA* with length 10 m, *BC* with length 6 m and *CA* with length 12 m.

The point *D* lies on *AC* such that *BD* is an arc of the circle centre *A*, radius 10 m.

A flowerbed *BCD* is shown shaded in Figure 2.

(*a*) Find the size of angle *BAC*, in radians, to 4 decimal places.

(2)

(*b*) Find the perimeter of the flowerbed *BCD*, in m, to 2 decimal places.

(3)

(*c*) Find the area of the flowerbed *BCD*, in m^2, to 2 decimal places.

(4)

(IAL C12 May 2017, Q6)

24.

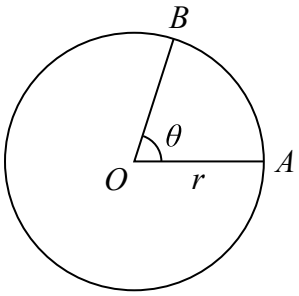


Figure 3

Figure 3 shows a circle with centre O and radius r cm.

The points A and B lie on the circumference of this circle.

The minor arc AB subtends an angle θ radians at O, as shown in Figure 3.

Given the length of minor arc AB is 6 cm and the area of minor sector OAB is 20 cm^2,

(a) write down two different equations in r and θ.

(2)

(b) Hence find the value of r and the value of θ.

(4)

(IAL C12 Oct 2017, Q8)

25.

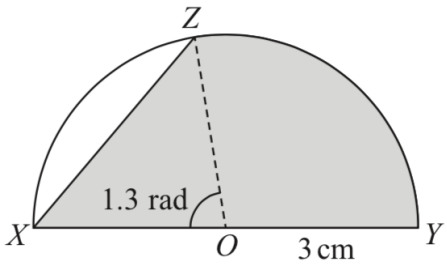


Diagram not drawn to scale

Figure 1

Figure 1 shows a semicircle with centre O and radius 3 cm. XY is the diameter of this semicircle. The point Z is on the circumference such that angle $XOZ = 1.3$ radians.
The shaded region enclosed by the chord XZ, the arc ZY and the diameter XY is a template for a badge.

Find, giving each answer to 3 significant figures,

(*a*) the length of the chord XZ,

(2)

(*b*) the perimeter of the template $XZYX$,

(4)

(*c*) the area of the template.

(4)

(IAL C12 May 2018, Q10)

26.

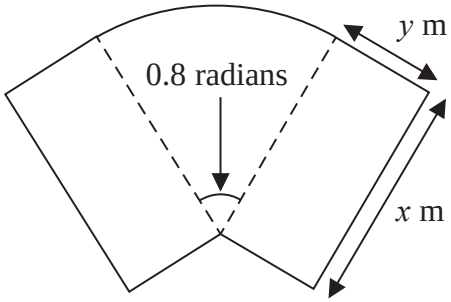


Figure 2

Figure 2 shows a plan for a garden.
The garden consists of two identical rectangles of width y m and length x m, joined to a sector of a circle with radius x m and angle 0.8 radians, as shown in Figure 2.

The area of the garden is 60 m^2.

(a) Show that the perimeter, P m, of the garden is given by

$$P = 2x + \frac{120}{x}$$

(5)

(b) Use calculus to find the exact minimum value for P, giving your answer in the form $a\sqrt{b}$, where a and b are integers.

(4)

(c) Justify that the value of P found in part (b) is the minimum.

(2)

(IAL C12 Oct 2018, Q15)

27.

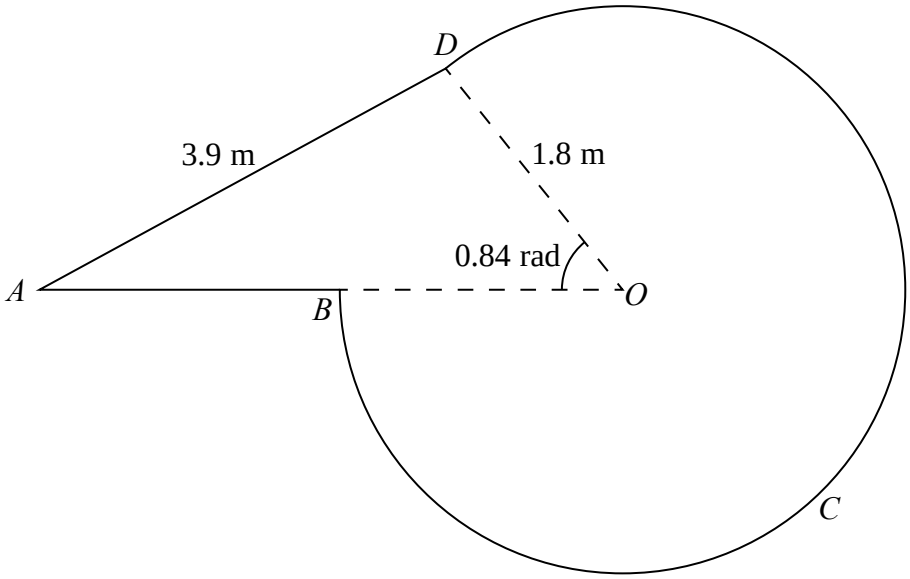


Diagram not drawn to scale

Figure 1

Figure 1 shows the design for a shop sign *ABCDA*.

The sign consists of a triangle *AOD* joined to a sector of a circle *DOBCD* with radius 1.8 m and centre *O*.

The points *A*, *B* and *O* lie on a straight line.

Given that *AD* = 3.9 m and angle *BOD* is 0.84 radians,

(*a*) calculate the size of angle *DAO*, giving your answer in radians to 3 decimal places.

(2)

(*b*) Show that, to one decimal place, the length of *AO* is 4.9 m.

(3)

(*c*) Find, in m^2, the area of the shop sign, giving your answer to one decimal place.

(3)

(*d*) Find, in m, the perimeter of the shop sign, giving your answer to one decimal place.

(3)

(IAL C12 Jan 2019, Q10)

28.

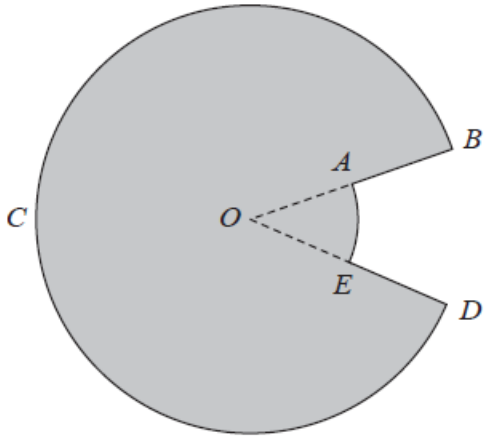


Figure 3

The design for a logo, *ABCDEA*, is shown shaded in Figure 3.

The logo consists of a sector *OBCDO* of a circle with centre *O*, joined to a sector *OAEO* of a smaller circle, also with centre *O*.

Given that the size of the acute angle *AOE* is $\frac{\pi}{6}$ radians, the length of arc *AE* is π cm and *OB* = 2 × *OA*, find the exact value of

(*a*) the length *OA*,

(2)

(*b*) the area of the logo,

(4)

(*c*) the perimeter of the logo.

(3)

(IAL C12 Oct 2019, Q10)