Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

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Radians: arc length and sector area

Time allowed: 1 hour 50 minutes

Subject code **0606**

Additional Mathematics

Questions from Paper 1 and Paper 2

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.
Questions 2-5, 7, 10 (Paper 1): no calculator.
Questions 1, 6, 8-9 (Paper 2): calculator allowed.

Total marks

/ 73

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.
- Unless a question says otherwise, give answers that are not exact to 3 significant figures, and angles in degrees to 1 decimal place.

Information

- This paper has 10 questions worth 73 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

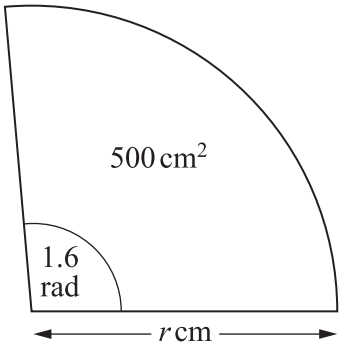
Advice

- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

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Print at 100% (Actual size) so diagrams keep their real measurements.

1



The diagram shows a sector of a circle of radius r cm. The angle of the sector is 1.6 radians and the area of the sector is $500\,\text{cm}^2$.

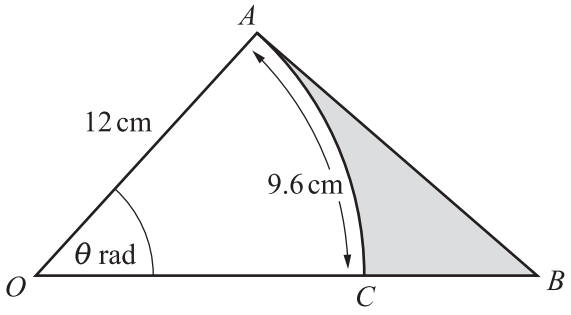
(i) Find the value of r. [2]

(ii) Hence find the perimeter of the sector. [2]

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Circular measure Click for more variations

2



The diagram shows the right-angled triangle OAB. The point C lies on the line OB. Angle $OAB = \frac{\pi}{2}$ radians and angle $AOB = \theta$ radians. AC is an arc of the circle, centre O, radius 12 cm and AC has length 9.6 cm.

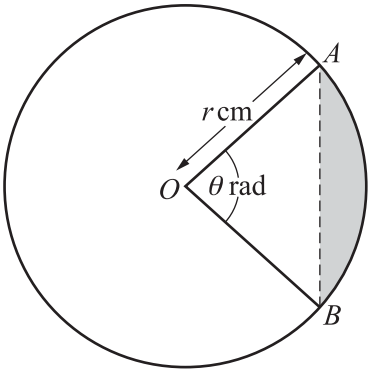
(i) Find the value of θ. [2]

(ii) Find the area of the shaded region. [4]

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3



The diagram shows a circle with centre O and radius r cm. The minor arc AB is such that angle AOB is θ radians. The area of the minor sector AOB is 48 cm^2.

(i) Show that $\theta = \frac{96}{r^2}$. [2]

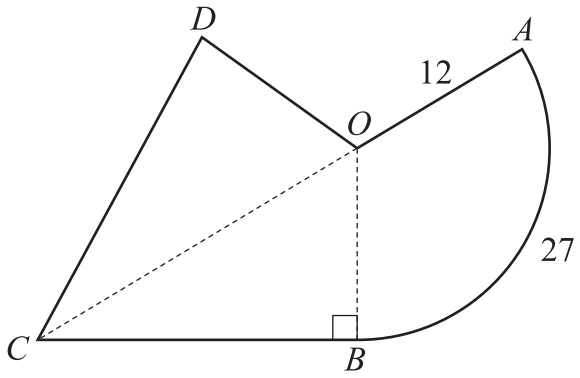
(ii) Given that the minor arc AB has length 12 cm, find the value of r and of θ. [3]

(iii) Using your values of r and θ, find the area of the shaded region. [2]

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4 In this question all lengths are in centimetres and all angles are in radians.



The diagram shows a badge which consists of a minor sector, OAB, of the circle with centre O and radius 12, and a kite $OBCD$, where $OB = OD$ and $CD = CB$. The arc AB has length 27. The line OB is perpendicular to the line CB, and COA is a straight line.

(a) Find the perimeter of the badge. [4]

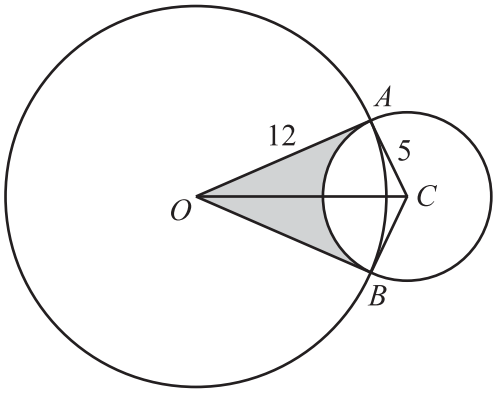
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(b) Find the area of the badge. [3]

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Circular measure Click for more variations

5 In this question, all lengths are in centimetres and all angles are in radians.



The diagram shows a circle with centre O and radius 12, and a circle with centre C and radius 5. The circles intersect at the points A and B, such that OA and OB are tangents to the circle with centre C.

(a) Show that the obtuse angle ACB is 2.35 radians, correct to 2 decimal places. [2]

(b) Find the perimeter of the shaded region. [2]

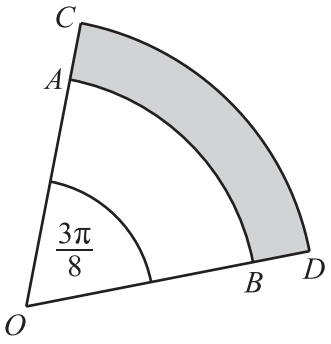
(c) Find the area of the shaded region. [3]

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6 In this question, all lengths are in centimetres and all angles are in radians.

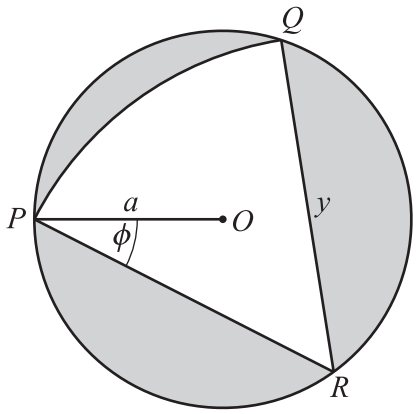
(a)



The diagram shows sectors AOB and COD of two circles with the same centre, O. Angle AOB is $\frac{3\pi}{8}$ and the length of OC is 6.5. It is given that OAC and OBD are straight lines and $OA : OC$ is 4 : 5. Find the perimeter of the shaded region. [3]

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(b)

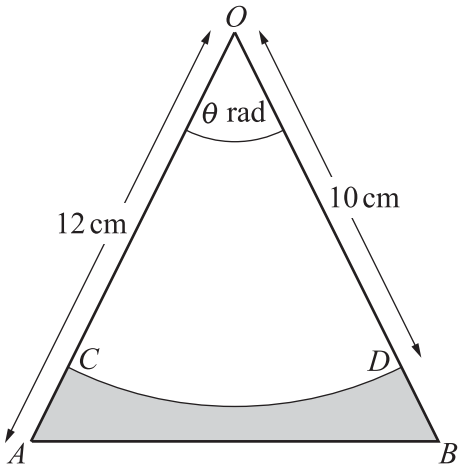


The diagram shows a circle with centre O and radius a. Sector PQR is a sector of a different circle with centre R and radius y. Angle OPR is ϕ. Find, in terms of a and ϕ only, the total area of the three shaded regions. Simplify your answer. [4]

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7



The diagram shows an isosceles triangle OAB such that $OA = OB = 12\,\text{cm}$ and angle $AOB = \theta$ radians. Points C and D lie on OA and OB respectively such that CD is an arc of the circle, centre O, radius 10 cm. The area of the sector $OCD = 35\,\text{cm}^2$.

(a) Show that $\theta = 0.7$. [1]

(b) Find the perimeter of the shaded region. [4]

(c) Find the area of the shaded region. [3]

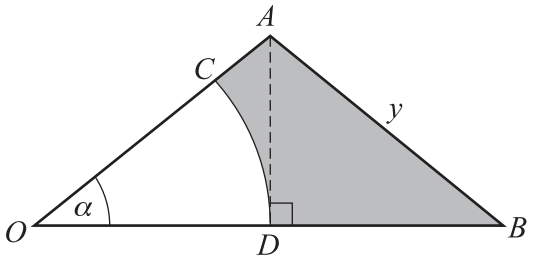
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Circular measure Click for more variations

8 In this question all lengths are in centimetres and all angles are in radians.

(a) The area of a sector of a circle of radius 24 is $432\,\text{cm}^2$. Find the length of the arc of the sector. [4]

(b)



The diagram shows an isosceles triangle, OAB, with $AO = AB = y$ and height AD. OCD is a sector of the circle with centre O. Angle AOB is α.

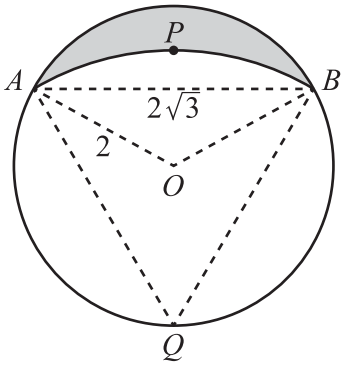
(i) Find an expression for OB in terms of y and α. [1]

(ii) Hence show that the area of the shaded region can be written as $\frac{y^2}{2}\cos\alpha(2\sin\alpha - \alpha\cos\alpha)$. [3]

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9 In this question the units are metres.



The diagram shows a circle, centre O and radius 2.
The chord AB has length $2\sqrt{3}$.
The point Q lies on the circle such that $AQ = BQ$.
The arc APB is part of a circle, centre Q.

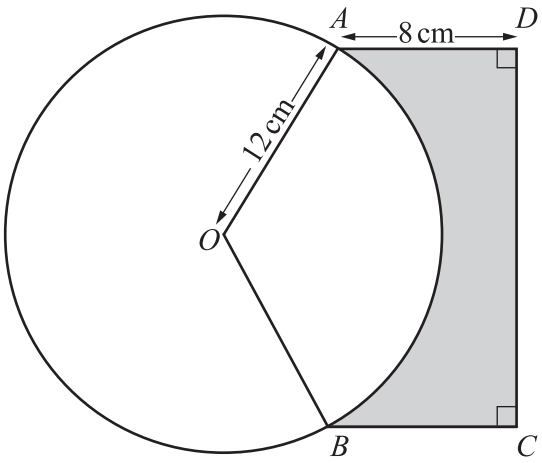
(a) Find the exact value of angle AQB in radians. [2]

(b) Hence find the area of the shaded region. Give your answer in terms of π. [6]

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10



The diagram shows a circle, centre O, radius 12 cm. The points A and B lie on the circumference of the circle and form a rectangle with the points C and D. The length of AD is 8 cm and the area of the minor sector AOB is 150 cm^2.

(i) Show that angle AOB is 2.08 radians, correct to 2 decimal places. [2]

(ii) Find the area of the shaded region $ADCB$. [6]

(iii) Find the perimeter of the shaded region $ADCB$. [3]

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