

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Mensuration

Arc Length = $r\theta$, where θ is in radians

Sector area = $\frac{1}{2}r^2\theta$, where θ is in radians

2. TRIGONOMETRY

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2}ab \sin C$$

- 1 (i) Factorise $4x^2 - 7x + 3$. [1]
 (ii) Hence, solve the equation $4x^2 - 7x + 3 = 5(x-1)^2$. [2]

2 Make x the subject of the formula $\frac{y}{2} = \frac{2z}{3} \sqrt{\frac{x^2+5}{1-x^2}}$ where $x \neq \pm 1$. [3]

- 3 (i) Factorise $x^3 + 125$. [1]
 (ii) Hence, express $\frac{x^3+125}{x^2-25} \div \frac{2x^2-8x-10}{x^2-10x+25}$ as a single fraction in its simplest form. [4]

4

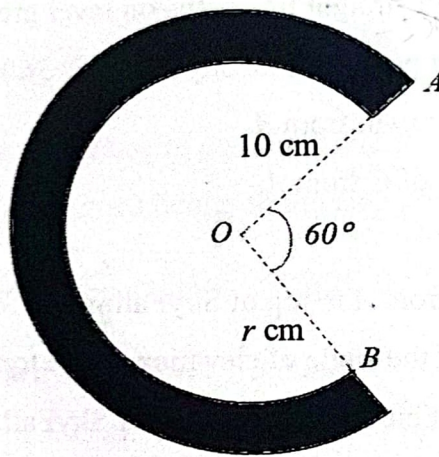


Diagram is not drawn to scale

In the diagram, an air-conditioning company Celsius has designed a new logo in the shape of the letter "C". The letter "C" is formed by two concentric arcs, with centre O . The point A lies on the circumference of the outer circle with radius 10 cm. The point B lies on the circumference of the inner circle with radius r cm, where $r < 10$. The letter "C" is shown by the shaded area in the diagram.

- (i) Given that $\angle AOB = 60^\circ$, show that the area of the letter "C" is given by

$$\frac{5}{6}\pi(100 - r^2) \text{ cm}^2. \quad [2]$$

The area of the letter "C" is $\frac{255}{6}\pi \text{ cm}^2$.

- (ii) Find the value of r . [2]
 (iii) Hence, find the perimeter of the letter "C". [3]

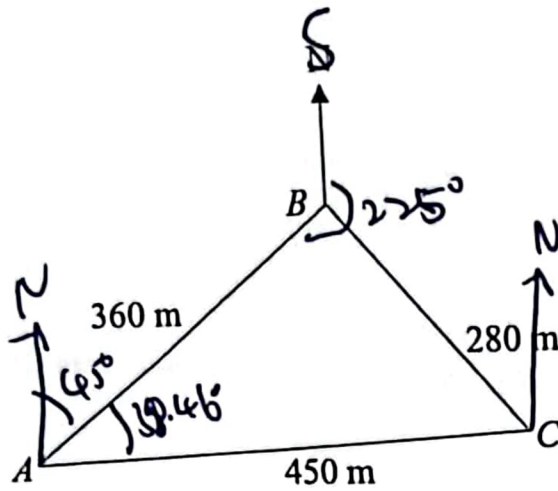


Diagram is not
drawn to scale.

AB , BC and CA represent straight line paths on level ground in an amusement park.

B is the base of the most popular ride, SkyFall. A is 360 m from B on a bearing of 225° .

C is 280 m from B and 450 m from A .

- (i) Find the bearing of C from A . [3]

The angle of elevation from A to top of SkyFall is 7.2° . Eric walks from A towards C and reaches a point X where the angle of elevation of the top of SkyFall from X is the largest.

- (ii) Find the angle of elevation of the top of SkyFall from X . [3]

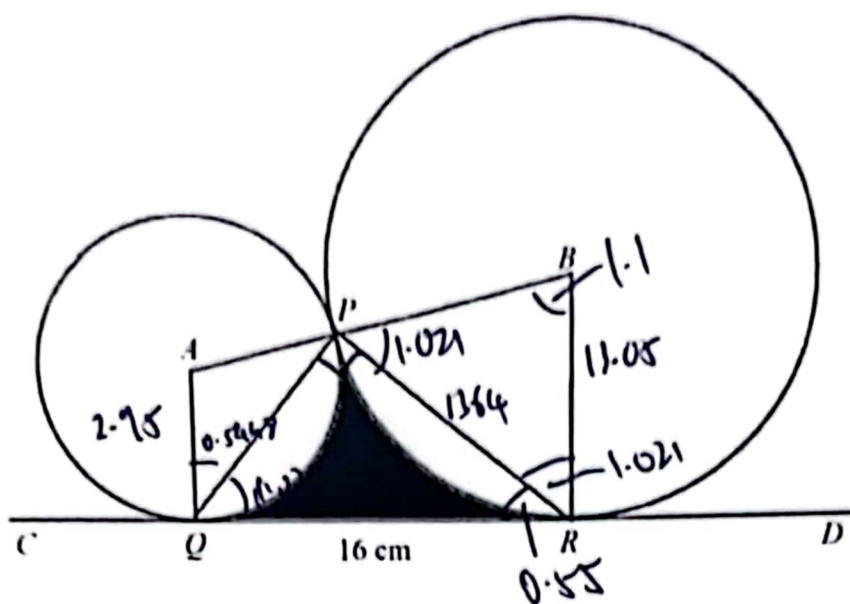


Diagram is not drawn to scale.

The diagram shows two circles, with centres A and B , touching externally at point P . The radii, AQ and BR , are perpendicular to the tangent CD . $CQRD$ is a straight line.

Given $QR = 16$ cm, $\angle QPR = \frac{\pi}{2}$ radians, $\angle PRQ = 0.55$ radians,

- (i) Explain clearly why $\angle PBR = 1.1$ radians. [1]
- (ii) Show that $BR = 13.05$ cm (4 s.f.). [2]
- (iii) Find the area of the shaded region bounded by the arcs PQ and PR , and the tangent QR . [3]

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