

- 1 Solve the equation $2 \cos \theta = 7 - \frac{3}{\cos \theta}$ for $-90^\circ < \theta < 90^\circ$. [4]

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2 The graph of $y = f(x)$ is transformed to the graph of $y = f(2x) - 3$.

(a) Describe fully the two single transformations that have been combined to give the resulting transformation. [3]

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The point $P(5, 6)$ lies on the transformed curve $y = f(2x) - 3$.

(b) State the coordinates of the corresponding point on the original curve $y = f(x)$. [2]

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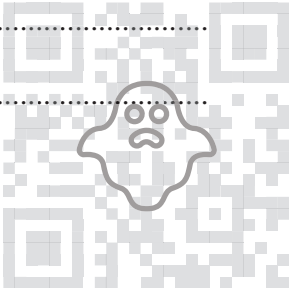
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3 The function f is defined as follows:

$$f(x) = \frac{x+3}{x-1} \text{ for } x > 1.$$

- (a) Find the value of $ff(5)$. [2]

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- (b) Find an expression for $f^{-1}(x)$. [3]

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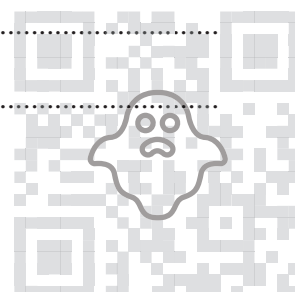
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5 The first, third and fifth terms of an arithmetic progression are $2 \cos x$, $-6\sqrt{3} \sin x$ and $10 \cos x$ respectively, where $\frac{1}{2}\pi < x < \pi$.

(a) Find the exact value of x . [3]

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(b) Hence find the exact sum of the first 25 terms of the progression. [3]

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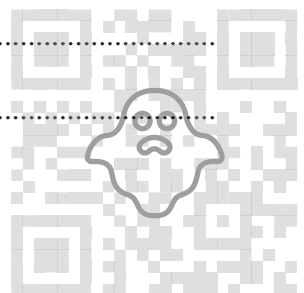
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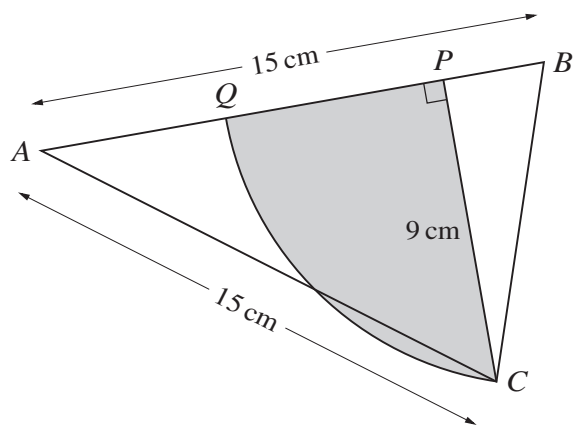
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In the diagram the lengths of AB and AC are both 15 cm. The point P is the foot of the perpendicular from C to AB . The length $CP = 9$ cm. An arc of a circle with centre B passes through C and meets AB at Q .

(a) Show that angle $ABC = 1.25$ radians, correct to 3 significant figures. [2]

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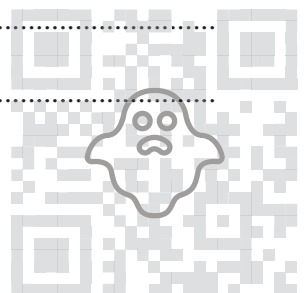
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- (b) Calculate the area of the shaded region which is bounded by the arc CQ and the lines CP and PQ . [4]

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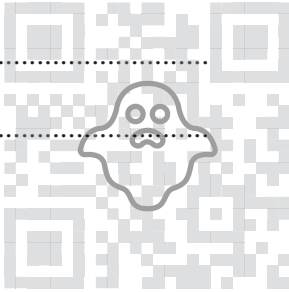
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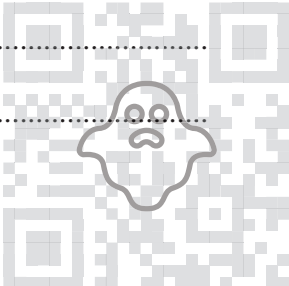
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9 The volume $V \text{ m}^3$ of a large circular mound of iron ore of radius $r \text{ m}$ is modelled by the equation $V = \frac{3}{2}\left(r - \frac{1}{2}\right)^3 - 1$ for $r \geq 2$. Iron ore is added to the mound at a constant rate of 1.5 m^3 per second.

(a) Find the rate at which the radius of the mound is increasing at the instant when the radius is 5.5 m .
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- (b) Find the volume of the mound at the instant when the radius is increasing at 0.1 m per second. [3]

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(b) Determine the nature of the stationary point. [2]

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(c) Given that this is the only stationary point of the curve, find the range of f . [2]

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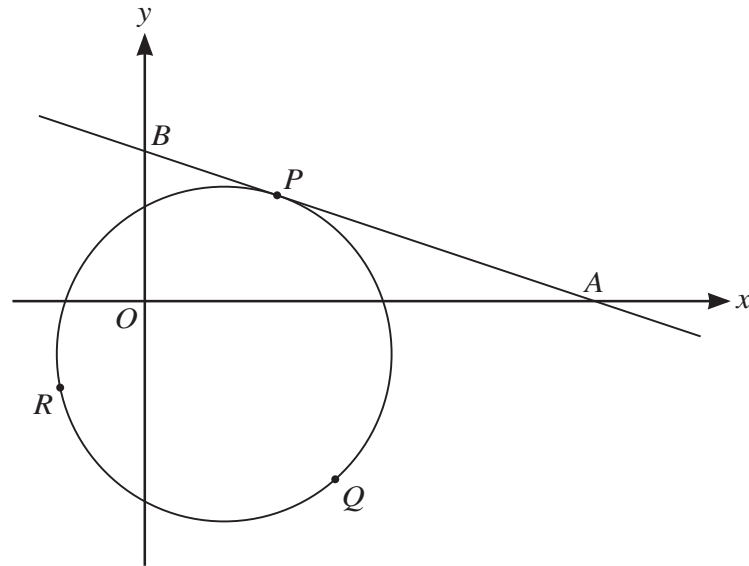
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The diagram shows the circle with equation $x^2 + y^2 - 6x + 4y - 27 = 0$ and the tangent to the circle at the point $P(5, 4)$.

- (a) The tangent to the circle at P meets the x -axis at A and the y -axis at B .

Find the area of triangle OAB , where O is the origin. [5]

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