

[Turn over

- 1** Solve the equation $4 \sin \theta + \tan \theta = 0$ for $0^\circ < \theta < 180^\circ$. [3]

[illegible]

- 2 (a) Find the first three terms in the expansion, in ascending powers of x , of $(2 + 3x)^4$. [2]

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- (b) Find the first three terms in the expansion, in ascending powers of x , of $(1 - 2x)^5$. [2]

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- (c) Hence find the coefficient of x^2 in the expansion of $(2 + 3x)^4(1 - 2x)^5$. [2]

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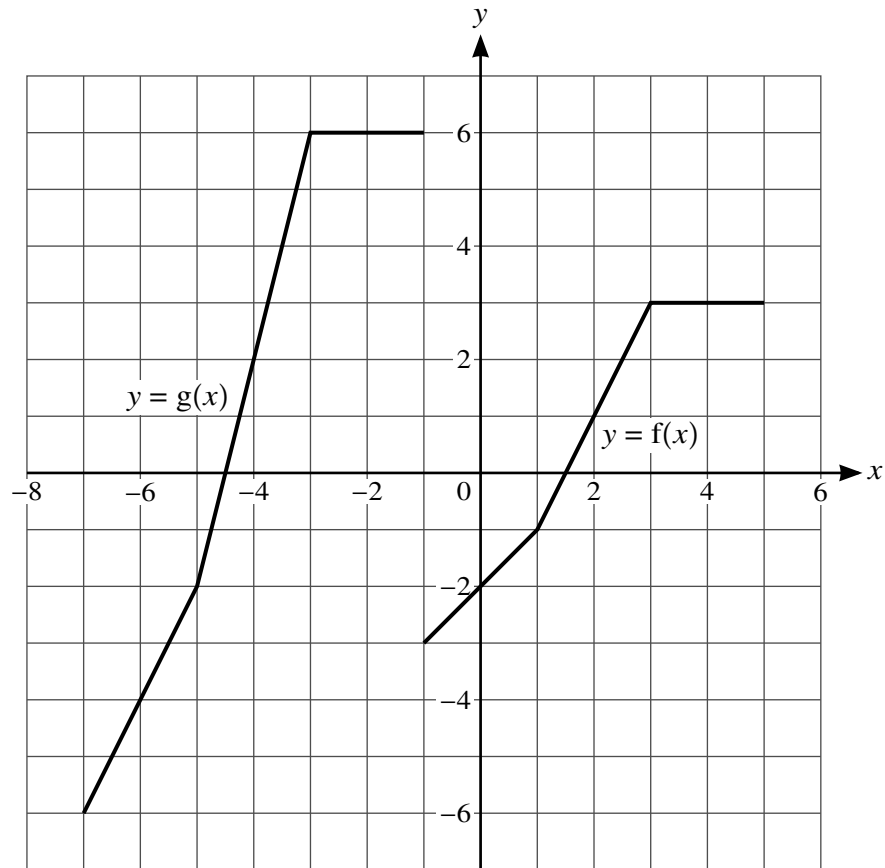
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The diagram shows graphs with equations $y = f(x)$ and $y = g(x)$.

Describe fully a sequence of two transformations which transforms the graph of $y = f(x)$ to $y = g(x)$. [4]

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A diagram showing a triangle ABC with a circular arc centered at C passing through B and D on AB . The base AB is labeled 8 cm . The angle at vertex A is labeled θ .

Find the perimeter of the segment BCD .

[4]

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- Find, in either order, the value of k and the coordinates of the point where the tangent meets the curve. [5]

[illegible]

- 6 The first three terms of an arithmetic progression are $\frac{p^2}{6}$, $2p - 6$ and p .

(a) Given that the common difference of the progression is not zero, find the value of p . [3]

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(b) Using this value, find the sum to infinity of the geometric progression with first two terms $\frac{p^2}{6}$ and $2p - 6$. [2]

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7 A curve has equation $y = 2 + 3 \sin \frac{1}{2}x$ for $0 \leq x \leq 4\pi$.

(a) State greatest and least values of y .

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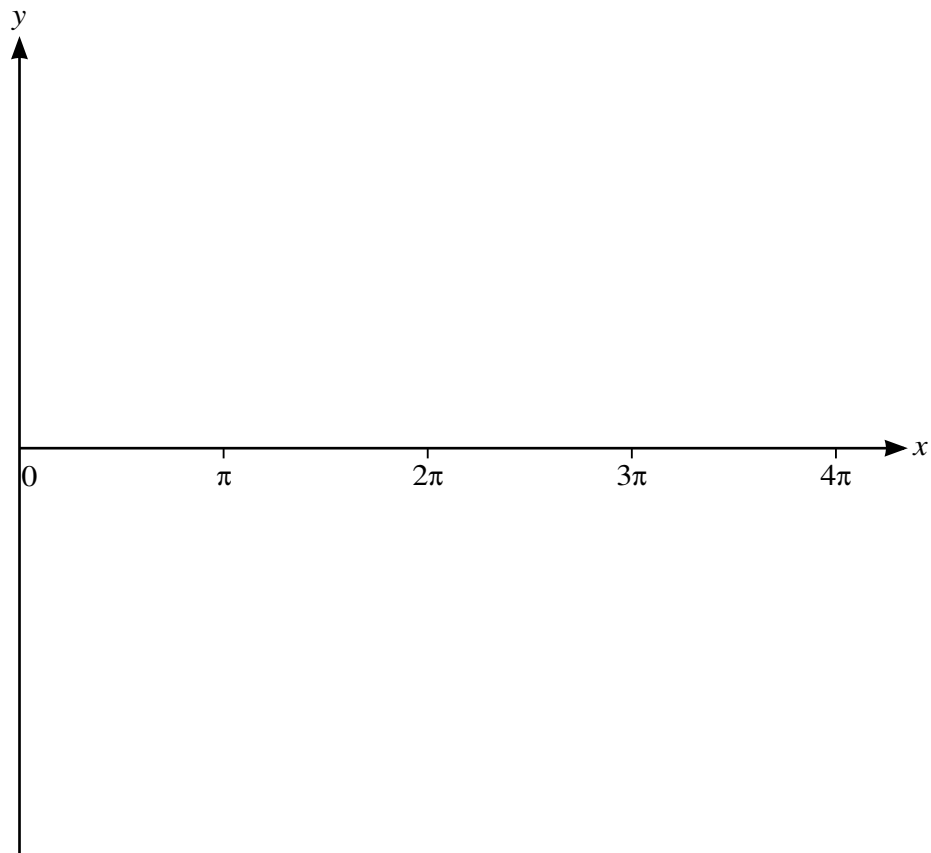
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(b) Sketch the curve.

[2]



(c) State the number of solutions of the equation

$$2 + 3 \sin \frac{1}{2}x = 5 - 2x$$

for $0 \leq x \leq 4\pi$.

[1]

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- 8** The functions f and g are defined as follows, where a and b are constants.

$$f(x) = 1 + \frac{2a}{x-a} \text{ for } x > a$$

$$g(x) = bx - 2 \text{ for } x \in \mathbb{R}$$

- (a) Given that $f(7) = \frac{5}{2}$ and $gf(5) = 4$, find the values of a and b . [4]

This image shows a full page of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page, typical of notebook or legal stationery. There are no margins, text, or other markings on the page.

For the rest of this question, you should use the value of a which you found in (a).

- (b) Find the domain of f^{-1} . [1]

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

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- 9 Water is poured into a tank at a constant rate of 500 cm^3 per second. The depth of water in the tank, t seconds after filling starts, is $h\text{ cm}$. When the depth of water in the tank is $h\text{ cm}$, the volume, $V\text{ cm}^3$, of water in the tank is given by the formula $V = \frac{4}{3}(25 + h)^3 - \frac{62500}{3}$.

(a) Find the rate at which h is increasing at the instant when $h = 10$ cm. [3]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

- (b)** At another instant, the rate at which h is increasing is 0.075 cm per second.

Find the value of V at this instant.

[3]

This image shows a full page of white paper with horizontal dashed lines, typical of primary school writing paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

The graph shows the function $y = \frac{4}{(2x-1)^2}$ for $x > \frac{1}{2}$. The curve passes through point $A(1, 4)$ and point $B(\frac{3}{2}, 1)$. A shaded region is bounded by the curve, the vertical line $x = 1$, and the horizontal line $y = 1$. The x-axis and y-axis are shown, with the origin labeled O . Dashed lines connect point B to the axes at $x = \frac{3}{2}$ and $y = 1$.

(a) Find the exact volume generated when the shaded region is rotated through 360° about the x -axis. [5]

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

- (b) A triangle is formed from the tangent to the curve at B , the normal to the curve at B and the x -axis.

Find the area of this triangle.

[6]

[illegible]

- 11** The equation of a curve is such that $\frac{dy}{dx} = 6x^2 - 30x + 6a$, where a is a positive constant. The curve has a stationary point at $(a, -15)$.

(a) Find the value of a .

[2]

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(b) Determine the nature of this stationary point.

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(c) Find the equation of the curve.

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(d) Find the coordinates of any other stationary points on the curve.

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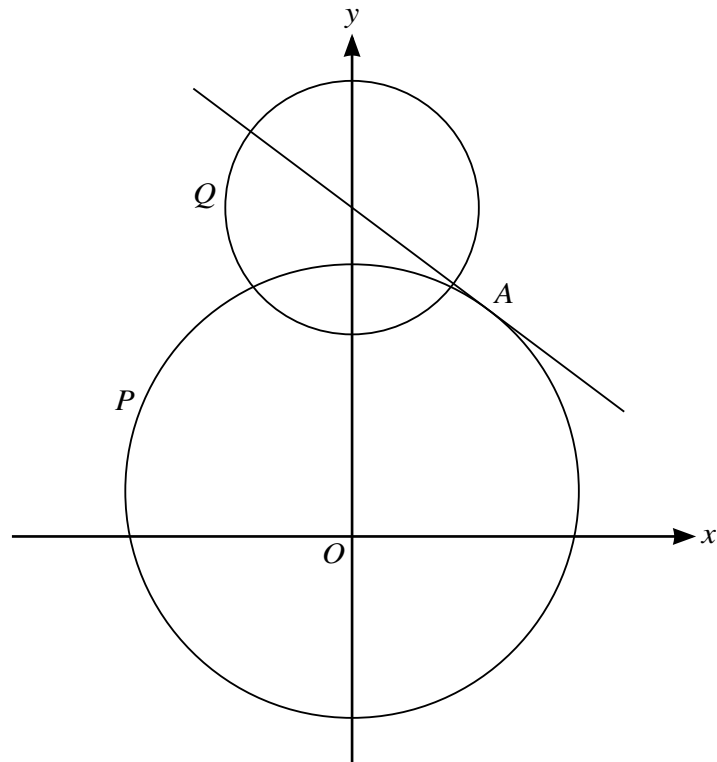
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The diagram shows a circle P with centre $(0, 2)$ and radius 10 and the tangent to the circle at the point A with coordinates $(6, 10)$. It also shows a second circle Q with centre at the point where this tangent meets the y -axis and with radius $\frac{5}{2}\sqrt{5}$.

- (a) Write down the equation of circle P . [1]

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- (b) Find the equation of the tangent to the circle P at A . [2]

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- (c) Find the equation of circle Q and hence verify that the y -coordinates of both of the points of intersection of the two circles are 11. [3]

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- (d) Find the coordinates of the points of intersection of the tangent and circle Q , giving the answers in surd form. [3]

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Additional Page

If you use the following lined page to complete the answer(s) to any question(s), the question number(s) must be clearly shown.

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