

11 A curve passes through the point $P(4, 3)$ and is such that

$$\frac{dy}{dx} = \frac{8}{x^2} - \frac{10}{(2x-3)^2}.$$

- (a) Find the equation of the normal to the curve at P . Give your answer in the form $y = mx + c$. [3]

[illegible]

- (b) Find the rate of change of the gradient of the curve when $x = 4$. [3]

This image shows a blank sheet of primary-ruled paper. It features multiple sets of horizontal dashed lines spaced evenly down the page, typical of handwriting practice paper. At the bottom center, there is a small circle containing the number 1. The rest of the page is empty white space.

- (c) Given that the curve also passes through the point $(-1, q)$, find the value of q . [5]

[illegible]

Additional page

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

③

- 4 The equation of a curve is such that $\frac{dy}{dx} = kx^3 + \frac{2}{x^2}$, where k is a constant. The curve passes through the point $S(2, 20)$ and the gradient of the curve at S is $\frac{65}{2}$.

(a) Find the value of k .

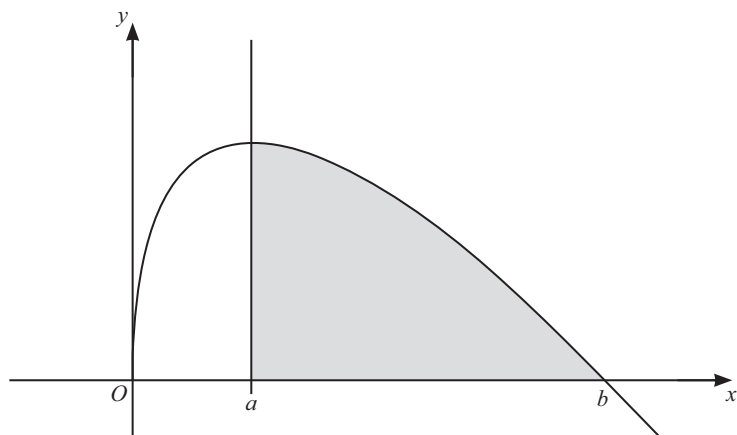
[1]

- (b) The coordinates of a point T on the curve are $(1, t)$.

Find the value of t .

[5]

... ④



(a) Find the value of a .

[3]

[5]

9 The function f is defined by $f(x) = \frac{4}{(3x-6)^2} + \frac{1}{(3x-6)^3}$ for $x > 2$.

- (a) Find an expression for $f'(x)$ and hence determine whether f is an increasing function, a decreasing function or neither. [4]

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- (b) State whether f^{-1} exists. Give a reason for your answer. [1]

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The function g is defined by $g(x) = 4x - 3$ for $x > a$.

- (c) Find the range of g in terms of the constant a . [1]

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- (d) Find the set of values of a for which the composite function fg exists. [2]

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2 The equation of a curve is such that $\frac{dy}{dx} = 4(2x-5)^5 - 9x^{\frac{2}{3}}$. The curve passes through the point $A\left(4, -\frac{11}{2}\right)$.

- (a) Find the gradient of the normal to the curve at the point A .

[2]

(b) Find the equation of the curve.

[4]

7 The equation of a curve is $y = 4x^2 + \frac{7}{x^2} - 8$.

- (a) A point P is moving along the curve in such a way that its y -coordinate is decreasing at 5 units per second.

Find the rate at which the x -coordinate of point P is changing when $x = 2$.

[4]

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- [5]

11

- 4 A point P is moving along the curve with equation $y = ax^{\frac{5}{2}} - 12x$ in such a way that the x -coordinate of P is increasing at a constant rate of 5 units per second.

- [3]

Given that the curve has a minimum point when $x = \frac{1}{4}$, find the value of a . [2]

9 The equation of a curve is such that $\frac{dy}{dx^2} = -\frac{2x}{x^3}$. It is given that the curve has a stationary point at $(-2, 19)$.

- (a) Find an expression for $\frac{dy}{dx}$. [3]

(b) Find the x -coordinate of the other stationary point of the curve, and determine the nature of this stationary point. [2]

- (c) Find the equation of the curve. [3]

(d) Find the equation of the normal to the curve at the point where $\frac{dy}{dx} = -\frac{9}{4}$ and x is positive. Express your answer in the form $px + qy + r = 0$, where p , q and r are integers. [4]