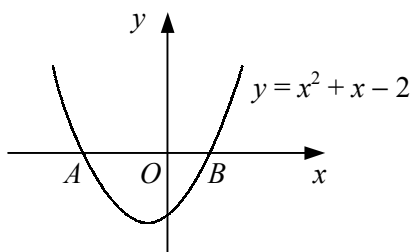


- 1 $f(x) = (x + 1)(x - 2)^2$.
- a Sketch the curve $y = f(x)$, showing the coordinates of any points where the curve meets the coordinate axes. (3)
- b Find $f'(x)$. (4)
- c Show that the tangent to the curve $y = f(x)$ at the point where $x = 1$ has the equation $y = 5 - 3x$. (3)

- 2 The curve C has the equation $y = x - 3x^{\frac{1}{3}} + 3$ and passes through the point $P(4, 1)$.
- a Show that the tangent to C at P passes through the origin. (5)
- The normal to C at P crosses the y -axis at the point Q .
- b Find the area of triangle OPQ , where O is the origin. (4)

3



The diagram shows the curve $y = x^2 + x - 2$. The curve crosses the x -axis at the points $A(a, 0)$ and $B(b, 0)$ where $a < b$.

- a Find the values of a and b . (3)
- b Show that the normal to the curve at A has the equation $x - 3y + 2 = 0$. (5)
- The tangent to the curve at B meets the normal to the curve at A at the point C .
- c Find the exact coordinates of C . (4)
- 4 Given that $y = \frac{x^2 - 6x - 3}{3x^{\frac{1}{3}}}$, show that $\frac{dy}{dx}$ can be expressed in the form $\frac{(x+a)^2}{bx^{\frac{3}{2}}}$, where a and b are integers to be found. (6)

- 5 The point A lies on the curve $y = \frac{12}{x^2}$ and the x -coordinate of A is 2.
- a Find an equation of the tangent to the curve at A . Give your answer in the form $ax + by + c = 0$, where a , b and c are integers. (5)
- b Verify that the point where the tangent at A intersects the curve again has the coordinates $(-1, 12)$. (3)
- 6 A curve has the equation $y = 2 + 3x + kx^2 - x^3$ where k is a constant.
- Given that the gradient of the curve is -6 at the point P where $x = -1$,
- a find the value of k . (4)
- Given also that the tangent to the curve at the point Q is parallel to the tangent at P ,
- b find the length PQ , giving your answer in the form $k\sqrt{5}$. (5)

7 Differentiate $x^2 + \frac{1}{2x}$ with respect to x . (3)

8 A curve has the equation $y = 2x^2 - 7x + 1$ and the point A on the curve has x -coordinate 2.

a Find an equation of the tangent to the curve at A . (4)

The normal to the curve at the point B is parallel to the tangent at A .

b Find the coordinates of B . (3)

9 $y = x^2 + 3x^{\frac{1}{3}}$.

a Find $\frac{dy}{dx}$. (2)

b Show that $2x \frac{d^2y}{dx^2} + \frac{dy}{dx} - 6x = 0$. (4)

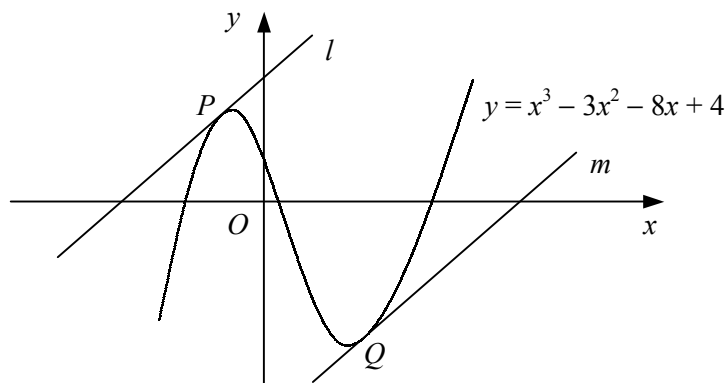
10 A curve has the equation $y = 2 + \frac{4}{x}$.

a Find an equation of the normal to the curve at the point $M(4, 3)$. (5)

The normal to the curve at M intersects the curve again at the point N .

b Find the coordinates of the point N . (5)

11



The diagram shows the curve with equation $y = x^3 - 3x^2 - 8x + 4$.

The straight line l is the tangent to the curve at the point $P(-1, 8)$.

a Find an equation of line l . (4)

The straight line m is parallel to l and is the tangent to the curve at the point Q .

b Find an equation of line m . (4)

c Find an equation of the normal to the curve at P . (2)

d Hence, or otherwise, show that the distance between lines l and m is $16\sqrt{2}$. (4)

12 A curve has the equation $y = \sqrt{x}(k - x)$, where k is a constant.

Given that the gradient of the curve is $\sqrt{2}$ at the point P where $x = 2$,

a find the value of k , (5)

b show that the normal to the curve at P has the equation

$$x + \sqrt{2}y = c,$$

where c is an integer to be found. (5)