

1 The equation of a curve is $y = 7 + 6x - x^2$.

(i) Use calculus to find the coordinates of the turning point on this curve.

Find also the coordinates of the points of intersection of this curve with the axes, and sketch the curve. [8]

(ii) Find $\int_1^5 (7 + 6x - x^2) dx$, showing your working. [3]

(iii) The curve and the line $y = 12$ intersect at $(1, 12)$ and $(5, 12)$. Using your answer to part **(ii)**, find the area of the finite region between the curve and the line $y = 12$. [1]

2 The gradient of a curve is given by $\frac{dy}{dx} = 4x + 3$. The curve passes through the point $(2, 9)$.

(i) Find the equation of the tangent to the curve at the point $(2, 9)$. [3]

(ii) Find the equation of the curve and the coordinates of its points of intersection with the x -axis. Find also the coordinates of the minimum point of this curve. [7]

(iii) Find the equation of the curve after it has been stretched parallel to the x -axis with scale factor $\frac{1}{2}$. Write down the coordinates of the minimum point of the transformed curve. [3]

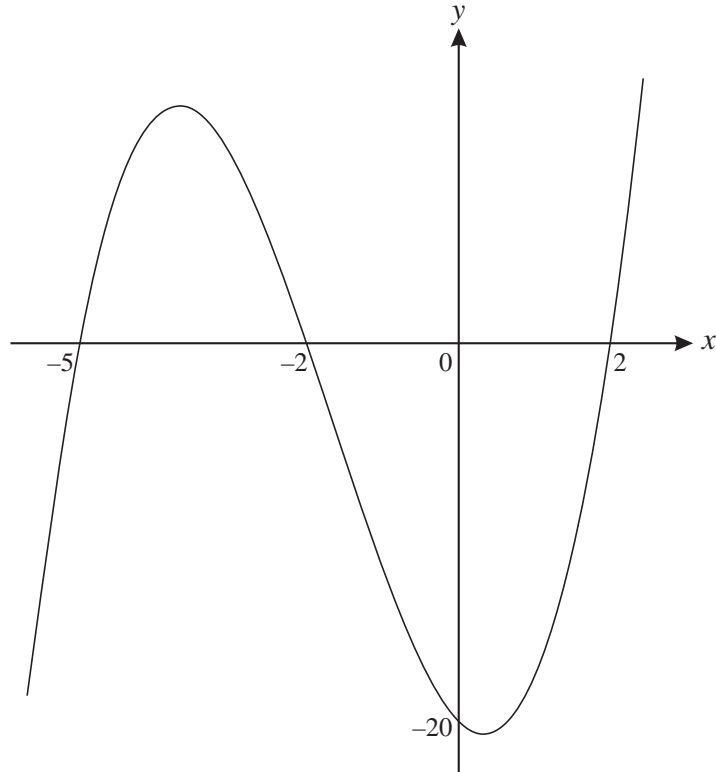


Fig. 11

Fig. 11 shows a sketch of the cubic curve $y = f(x)$. The values of x where it crosses the x -axis are -5 , -2 and 2 , and it crosses the y -axis at $(0, -20)$.

- (i) Express $f(x)$ in factorised form. [2]
- (ii) Show that the equation of the curve may be written as $y = x^3 + 5x^2 - 4x - 20$. [2]
- (iii) Use calculus to show that, correct to 1 decimal place, the x -coordinate of the minimum point on the curve is 0.4.
Find also the coordinates of the maximum point on the curve, giving your answers correct to 1 decimal place. [6]
- (iv) State, correct to 1 decimal place, the coordinates of the maximum point on the curve $y = f(2x)$. [2]

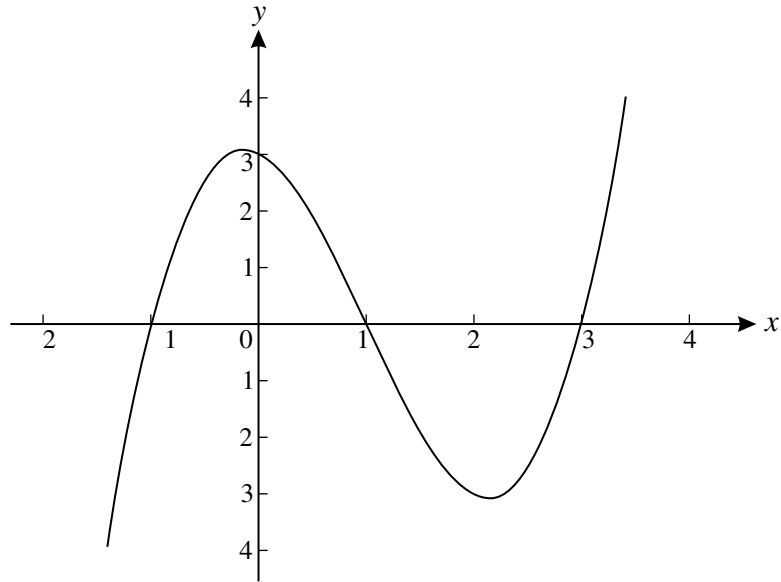


Fig. 11

Fig. 11 shows the curve $y = x^3 - 3x^2 - x + 3$.

(i) Use calculus to find $\int_1^3 (x^3 - 3x^2 - x + 3) dx$ and state what this represents. [6]

(ii) Find the x -coordinates of the turning points of the curve $y = x^3 - 3x^2 - x + 3$, giving your answers in surd form. Hence state the set of values of x for which $y = x^3 - 3x^2 - x + 3$ is a decreasing function. [5]

5 (i) Differentiate $x^3 - 3x^2 - 9x$. Hence find the x -coordinates of the stationary points on the curve $y = x^3 - 3x^2 - 9x$, showing which is the maximum and which the minimum. [6]

(ii) Find, in exact form, the coordinates of the points at which the curve crosses the x -axis. [3]

(iii) Sketch the curve. [2]

6 A curve has equation $y = x^3 - 6x^2 + 12$.

(i) Use calculus to find the coordinates of the turning points of this curve. Determine also the nature of these turning points. [7]

(ii) Find, in the form $y = mx + c$, the equation of the normal to the curve at the point $(2, -4)$. [4]