**1**

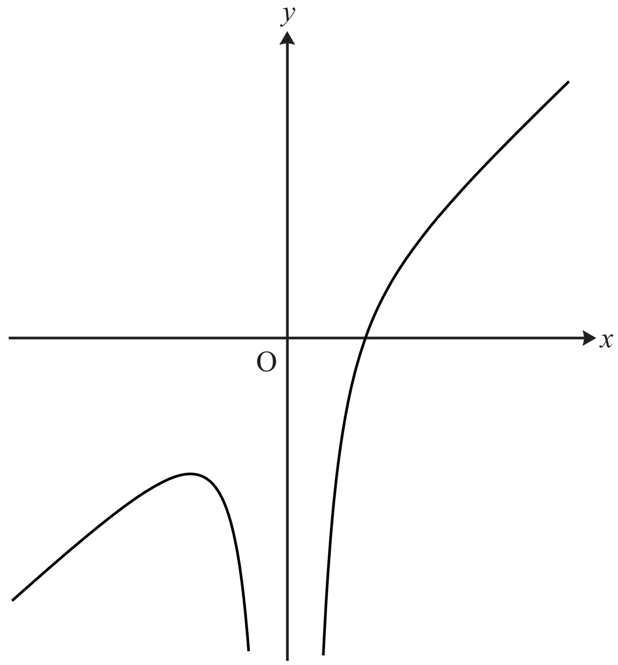


**Fig. 11**

Fig. 11 shows a sketch of the curve with equation $y = x - \frac{4}{x^2}$.

**(i)** Find $\frac{dy}{dx}$ and show that $\frac{d^2y}{dx^2} = -\frac{24}{x^4}$. **[3]**

**(ii)** Hence find the coordinates of the stationary point on the curve. Verify that the stationary point is a maximum. **[5]**

**(iii)** Find the equation of the normal to the curve when $x = -1$. Give your answer in the form $ax + by + c = 0$. **[5]**

**2** **(i)** Use calculus to find, correct to 1 decimal place, the coordinates of the turning points of the curve $y = x^3 - 5x$. [You need not determine the nature of the turning points.] **[4]**

**(ii)** Find the coordinates of the points where the curve $y = x^3 - 5x$ meets the axes and sketch the curve. **[4]**

**(iii)** Find the equation of the tangent to the curve $y = x^3 - 5x$ at the point (1, –4). Show that, where this tangent meets the curve again, the $x$-coordinate satisfies the equation

$$x^3 - 3x + 2 = 0.$$

Hence find the $x$-coordinate of the point where this tangent meets the curve again. **[6]**

**3** A cubic curve has equation $y = x^3 - 3x^2 + 1$.

**(i)** Use calculus to find the coordinates of the turning points on this curve. Determine the nature of these turning points. [5]

**(ii)** Show that the tangent to the curve at the point where $x = -1$ has gradient 9.

Find the coordinates of the other point, P, on the curve at which the tangent has gradient 9 and find the equation of the normal to the curve at P.

Show that the area of the triangle bounded by the normal at P and the $x$- and $y$-axes is 8 square units. [8]

**4** Fig. 10 shows a sketch of the graph of $y = 7x - x^2 - 6$.

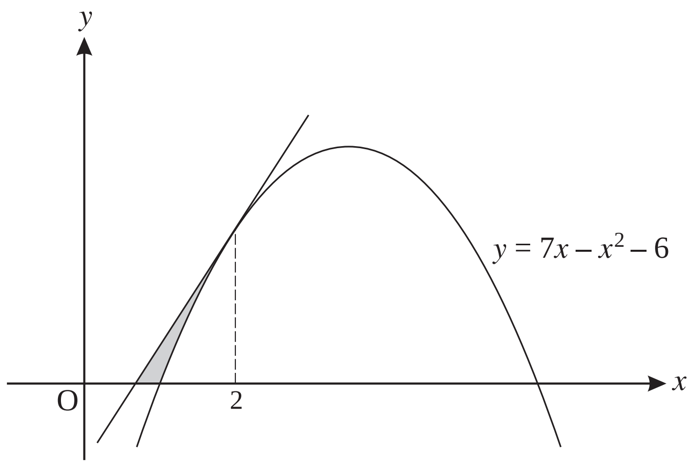


**Fig. 10**

**(i)** Find $\frac{dy}{dx}$ and hence find the equation of the tangent to the curve at the point on the curve where $x = 2$.

Show that this tangent crosses the $x$-axis where $x = \frac{2}{3}$. **[6]**

**(ii)** Show that the curve crosses the $x$-axis where $x = 1$ and find the $x$-coordinate of the other point of intersection of the curve with the $x$-axis. **[2]**

**(iii)** Find $\int_1^2 (7x - x^2 - 6)\,dx$.

Hence find the area of the region bounded by the curve, the tangent and the $x$-axis, shown shaded on Fig. 10. **[5]**

**5**

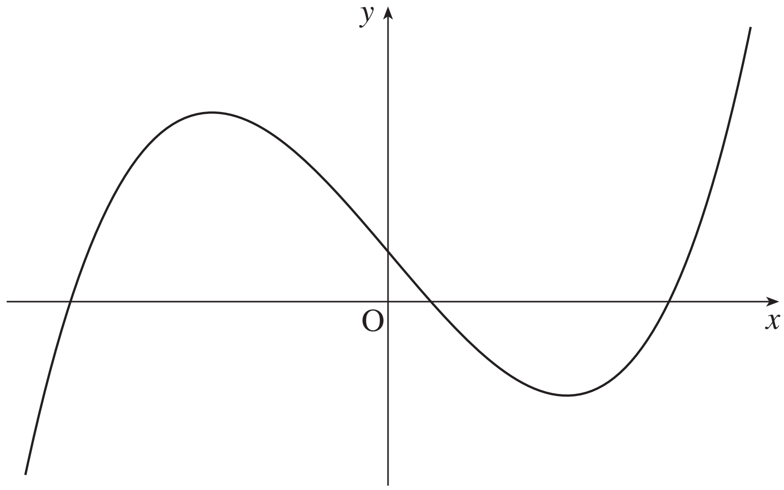


**Fig. 11**

The equation of the curve shown in Fig. 11 is $y = x^3 - 6x + 2$.

**(i)** Find $\frac{dy}{dx}$. [2]

**(ii)** Find, in exact form, the range of values of $x$ for which $x^3 - 6x + 2$ is a decreasing function. [3]

**(iii)** Find the equation of the tangent to the curve at the point $(-1, 7)$.

Find also the coordinates of the point where this tangent crosses the curve again. [6]