1. The equation of a cubic curve is \( y = 2x^3 - 9x^2 + 12x - 2 \).

   (i) Find \( \frac{dy}{dx} \) and show that the tangent to the curve when \( x = 3 \) passes through the point \((-1, -41)\). [5]

   (ii) Use calculus to find the coordinates of the turning points of the curve. You need not distinguish between the maximum and minimum. [4]

   (iii) Sketch the curve, given that the only real root of \( 2x^3 - 9x^2 + 12x - 2 = 0 \) is \( x = 0.2 \) correct to 1 decimal place. [3]

2. 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]

3. A curve has equation \( y = x + \frac{1}{x} \).

   Use calculus to show that the curve has a turning point at \( x = 1 \).

   Show also that this point is a minimum. [5]
4 The equation of a curve is \( y = 9x^2 - x^4 \).

(i) Show that the curve meets the \( x \)-axis at the origin and at \( x = \pm a \), stating the value of \( a \). \[2\]

(ii) Find \( \frac{dy}{dx} \) and \( \frac{d^2y}{dx^2} \).

Hence show that the origin is a minimum point on the curve. Find the \( x \)-coordinates of the maximum points. \[6\]

(iii) Use calculus to find the area of the region bounded by the curve and the \( x \)-axis between \( x = 0 \) and \( x = a \), using the value you found for \( a \) in part (i). \[4\]

5 Differentiate \( 4x^2 + \frac{1}{x} \) and hence find the \( x \)-coordinate of the stationary point of the curve \( y = 4x^2 + \frac{1}{x} \). \[5\]
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]