Core Mathematics C1 Paper L

1. Solve the inequality

$$4(x - 2) < 2x + 5.$$ [3]

2. $$f(x) = 2 - x - x^3.$$

Show that f(x) is decreasing for all values of x. [4]

3. *(i)* Solve the equation

$$y^2 + 8 = 9y.$$ [2]

(ii) Hence solve the equation

$$x^3 + 8 = 9x^{\frac{3}{2}}.$$ [3]

4. Given that

$$y = \frac{x^4 - 3}{2x^2},$$

(i) find $\frac{dy}{dx}$, [4]

(ii) show that $\frac{d^2y}{dx^2} = \frac{x^4 - 9}{x^4}$. [2]

5. Find the pairs of values (x, y) which satisfy the simultaneous equations

$$3x^2 + y^2 = 21$$

$$5x + y = 7$$ [7]

6. *(i)* Evaluate $(5\frac{4}{9})^{-\frac{1}{2}}$. [2]

(ii) Find the value of x such that

$$\frac{1+x}{x} = \sqrt{3},$$

giving your answer in the form $a + b\sqrt{3}$ where a and b are rational. [5]

7. The straight line l passes through the point P (–3, 6) and the point Q (1, –4).

(i) Find an equation for l in the form $ax + by + c = 0$, where a, b and c are integers. [4]

The straight line m has the equation $2x + ky + 7 = 0$, where k is a constant.

Given that l and m are perpendicular,

(ii) find the value of k. [4]

8. *(i)* Describe fully a single transformation that maps the graph of $y = \frac{1}{x}$ onto the graph of $y = \frac{3}{x}$. [2]

(ii) Sketch the graph of $y = \frac{3}{x}$ and write down the equations of any asymptotes. [3]

(iii) Find the values of the constant c for which the straight line $y = c - 3x$ is a tangent to the curve $y = \frac{3}{x}$. [4]

Turn over

9. The circle C has the equation

$$x^2 + y^2 - 12x + 8y + 16 = 0.$$

(i) Find the coordinates of the centre of C. [2]

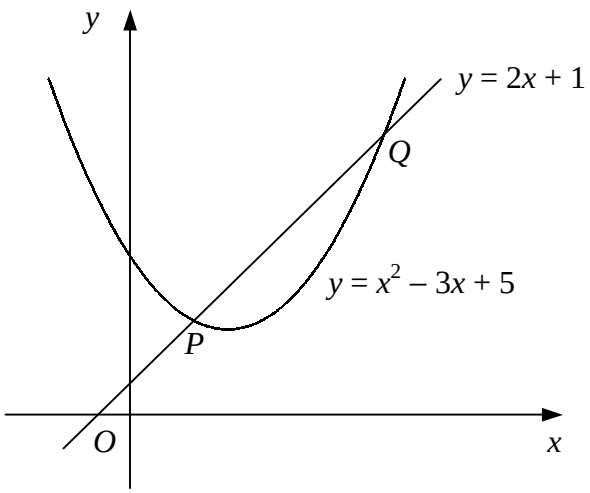
(ii) Find the radius of C. [2]

(iii) Sketch C. [2]

Given that C crosses the x-axis at the points A and B,

(iv) find the length AB, giving your answer in the form $k\sqrt{5}$. [4]

10.



The diagram shows the curve $y = x^2 - 3x + 5$ and the straight line $y = 2x + 1$.
The curve and line intersect at the points P and Q.

(i) Using algebra, show that P has coordinates (1, 3) and find the coordinates of Q. [4]

(ii) Find an equation for the tangent to the curve at P. [4]

(iii) Show that the tangent to the curve at Q has the equation $y = 5x - 11$. [2]

(iv) Find the coordinates of the point where the tangent to the curve at P intersects the tangent to the curve at Q. [3]