Core Mathematics C1 Paper B

1. Find the set of values of the constant k such that the equation

$$x^2 - 6x + k = 0$$

has real and distinct roots. [3]

2. The points A, B and C have coordinates $(-3, 0)$, $(5, -2)$ and $(4, 1)$ respectively.

Find an equation for the straight line which passes through C and is parallel to AB. Give your answer in the form $ax + by = c$, where a, b and c are integers. [4]

3. *(i)* Express $\frac{18}{\sqrt{3}}$ in the form $k\sqrt{3}$. [2]

(ii) Express $(1 - \sqrt{3})(4 - 2\sqrt{3})$ in the form $a + b\sqrt{3}$ where a and b are integers. [2]

4. Solve the inequality

$$2x^2 - 9x + 4 < 0.$$ [4]

5. Given that

$$(x^2 + 2x - 3)(2x^2 + kx + 7) \equiv 2x^4 + Ax^3 + Ax^2 + Bx - 21,$$

find the values of the constants k, A and B. [7]

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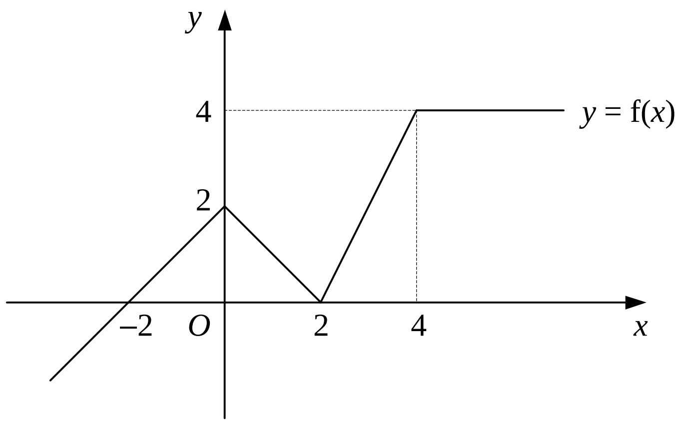
6.



The diagram shows the graph of $y = \mathrm{f}(x)$.

(a) Write down the number of solutions that exist for the equation

(i) $\mathrm{f}(x) = 1$, [1]

(ii) $\mathrm{f}(x) = -x$. [1]

(b) Labelling the axes in a similar way, sketch on separate diagrams the graphs of

(i) $y = \mathrm{f}(x - 2)$, [3]

(ii) $y = \mathrm{f}(2x)$. [3]

7.

$$\mathrm{f}(x) = x^3 - 9x^2.$$

(i) Find $\mathrm{f}'(x)$. [2]

(ii) Find $\mathrm{f}''(x)$. [1]

(iii) Find the coordinates of the stationary points of the curve $y = \mathrm{f}(x)$. [4]

(iv) Determine whether each stationary point is a maximum or a minimum point. [2]

Turn over

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8. $$f(x) = 9 + 6x - x^2.$$

(i) Find the values of A and B such that

$$f(x) = A - (x + B)^2.$$ [4]

(ii) State the maximum value of f(x). [1]

(iii) Solve the equation $f(x) = 0$, giving your answers in the form $a + b\sqrt{2}$ where a and b are integers. [3]

(iv) Sketch the curve $y = f(x)$. [2]

9. The circle C has centre (–3, 2) and passes through the point (2, 1).

(i) Find an equation for C. [4]

(ii) Show that the point with coordinates (–4, 7) lies on C. [1]

(iii) Find an equation for the tangent to C at the point (–4, 7). Give your answer in the form $ax + by + c = 0$, where a, b and c are integers. [5]

10. A curve has the equation $y = (\sqrt{x} - 3)^2$, $x \geq 0$.

(i) Show that $\dfrac{dy}{dx} = 1 - \dfrac{3}{\sqrt{x}}$. [4]

The point P on the curve has x-coordinate 4.

(ii) Find an equation for the normal to the curve at P in the form $y = mx + c$. [5]

(iii) Show that the normal to the curve at P does not intersect the curve again. [4]

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