Core Mathematics C1 Paper J

1. Evaluate $49^{\frac{1}{2}} + 8^{\frac{2}{3}}$. [3]

2. Solve the equation

$$3x - \frac{5}{x} = 2.$$ [4]

3. Find the set of values of x for which

(i) $6x - 11 > x + 4$, [2]

(ii) $x^2 - 6x - 16 < 0$. [3]

4. *(i)* Sketch on the same diagram the graphs of $y = (x - 1)^2(x - 5)$ and $y = 8 - 2x$.

Label on your diagram the coordinates of any points where each graph meets the coordinate axes. [5]

(ii) Explain how your diagram shows that there is only one solution, α, to the equation

$$(x - 1)^2(x - 5) = 8 - 2x.$$ [1]

(iii) State the integer, n, such that

$$n < \alpha < n + 1.$$ [1]

5. $$f(x) = x^2 - 10x + 17.$$

(a) Express f(x) in the form $a(x + b)^2 + c$. [3]

(b) State the coordinates of the minimum point of the curve $y = f(x)$. [1]

(c) Deduce the coordinates of the minimum point of each of the following curves:

(i) $y = f(x) + 4$, [2]

(ii) $y = f(2x)$. [2]

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6. The points P, Q and R have coordinates $(-5, 2)$, $(-3, 8)$ and $(9, 4)$ respectively.

(i) Show that $\angle PQR = 90°$. [4]

Given that P, Q and R all lie on a circle,

(ii) find the coordinates of the centre of the circle, [3]

(iii) show that the equation of the circle can be written in the form

$$x^2 + y^2 - 4x - 6y = k,$$

where k is an integer to be found. [3]

7. The straight line l_1 has gradient $\frac{3}{2}$ and passes through the point A (5, 3).

(i) Find an equation for l_1 in the form $y = mx + c$. [2]

The straight line l_2 has the equation $3x - 4y + 3 = 0$ and intersects l_1 at the point B.

(ii) Find the coordinates of B. [3]

(iii) Find the coordinates of the mid-point of AB. [2]

(iv) Show that the straight line parallel to l_2 which passes through the mid-point of AB also passes through the origin. [4]

Turn over

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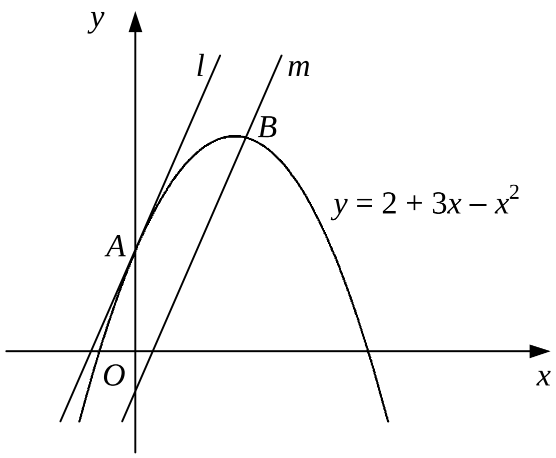
8.



The diagram shows the curve with equation $y = 2 + 3x - x^2$ and the straight lines l and m.

The line l is the tangent to the curve at the point A where the curve crosses the y-axis.

(i) Find an equation for l. [5]

The line m is the normal to the curve at the point B.

Given that l and m are parallel,

(ii) find the coordinates of B. [6]

9. The curve C has the equation

$$y = 3 - x^{\frac{1}{2}} - 2x^{-\frac{1}{2}}, \quad x > 0.$$

(i) Find the coordinates of the points where C crosses the x-axis. [4]

(ii) Find the exact coordinates of the stationary point of C. [5]

(iii) Determine the nature of the stationary point. [2]

(iv) Sketch the curve C. [2]

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