WJEC
CBAC

GCE AS/A level

973/01

MATHEMATICS C1

Pure Mathematics

A.M. MONDAY, 10 January 2011

1½ hours

ADDITIONAL MATERIALS

In addition to this examination paper, you will need:

- a 12 page answer book;
- a Formula Booklet.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Answer **all** questions.

Sufficient working must be shown to demonstrate the **mathematical** method employed.

Calculators are **not** allowed for this paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

1. The points A, B have coordinates $(-1, 2)$, $(8, 5)$ respectively.

(a) Find the gradient of AB. [2]

(b) Find the equation of AB and simplify your answer. [3]

(c) The line AB is extended to the point C so that B is the mid-point of AC. Find the coordinates of C. [2]

The line L is parallel to AB. This line L intersects the y-axis at the point $(0, -\frac{1}{6})$ and the x-axis at the point D.

(d) (i) Write down the equation of L.

(ii) Find the coordinates of D.

(iii) Find the length of AD. [6]

2. Simplify $\dfrac{\sqrt{2}}{10 - 7\sqrt{2}}$. [4]

3. Given that the quadratic equation

$$2x^2 + (3k - 1)x + (3k^2 - 1) = 0$$

has two distinct real roots, show that

$$5k^2 + 2k - 3 < 0.$$

Find the range of values of k satisfying this inequality. [7]

4. *(a)* Given that $y = 6x^2 + 4x - 9$, find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ from first principles. [5]

(b) Differentiate $\dfrac{3}{x^4} - 7x^{\frac{1}{3}}$ with respect to x. [2]

5. **Use the binomial theorem** to express $\left(1+\sqrt{3}\right)^5$ in the form $a + b\sqrt{3}$, where a, b are integers whose values are to be found. [5]

6. Show that $x^2 - 1{\cdot}4x - 8{\cdot}51$ may be expressed in the form $(x + p)^2 - 9$, where p is a constant whose value is to be found.
Hence solve the quadratic equation $x^2 - 1{\cdot}4x - 8{\cdot}51 = 0$. [5]

7. *(a)* Find the remainder when $x^3 - 3$ is divided by $x + 2$. [2]

(b) Solve the equation $6x^3 + x^2 - 11x - 6 = 0$. [6]

8. The curve C has equation $y = x^2 - 6x + 7$.

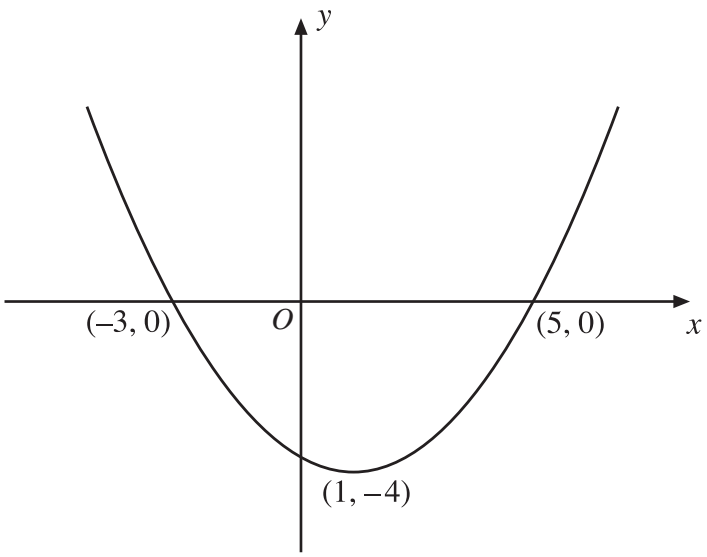
(a) The point P, whose x-coordinate is 5, lies on the curve C. Find the equation of the tangent to C at P. [5]

The line L has equation $y = \frac{1}{2}x - 2$.

(b) (i) Find the coordinates of the two points of intersection of C and L.

(ii) Verify that L is in fact the normal to C at one of these points of intersection. [8]

9. The diagram shows a sketch of the graph of $y = f(x)$. The graph passes through the points $(-3, 0)$ and $(5, 0)$ and has a minimum point at $(1, -4)$.



Sketch the following graphs, using a separate set of axes for each graph. In each case, you should indicate the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x-axis.

(a) $y = f(x + 3)$, [3]

(b) $y = -f(x)$. [3]

TURN OVER.

10. The curve C has equation

$$y = x^3 + kx^2 - 9x - 10,$$

where k is a constant. The two stationary points on the graph of C are denoted by Q and R. The x-coordinate of Q is -1.

(a) Find $\frac{dy}{dx}$ and hence show that $k = -3$. [3]

(b) Find the x-coordinate of R. [2]

(c) Determine the nature of each of the stationary points Q and R. [2]