WJEC
CBAC

GCE AS/A level

973/01

MATHEMATICS C1

Pure Mathematics

P.M. WEDNESDAY, 20 May 2009

1½ hours

ADDITIONAL MATERIALS

In addition to this examination paper, you will need:

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

INSTRUCTIONS TO CANDIDATES

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, C are such that A, B have coordinates $(-1, 5)$, $(7, 11)$, respectively and C is the mid-point of AB. The line L is the perpendicular bisector of AB.

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

(b) Find the coordinates of C. [2]

(c) Show that the equation of L is

$$4x + 3y - 36 = 0.$$ [4]

(d) The line L intersects the x-axis at the point D.

(i) Find the coordinates of D.

(ii) Find the length of CD.

(iii) Find the value of $\tan C\hat{A}D$. [6]

2. Simplify

(a) $\dfrac{8-\sqrt{7}}{\sqrt{7}-2}$, [4]

(b) $\sqrt{50}+\left(\sqrt{3}\times\sqrt{6}\right)-\dfrac{14}{\sqrt{2}}$. [4]

3. The curve C has equation $y = 2x^2 + 6x + 7$. The point P, whose x-coordinate is -1, lies on the curve C. Find the equation of the tangent to C at P. [5]

4. *(a)* (i) Express $x^2 - 5x + 8$ in the form $(x + a)^2 + b$, where the values of the constants a and b are to be found.

(ii) Deduce the greatest value of $-x^2 + 5x - 8$. [3]

(b) Solve the simultaneous equations $y = x^2 - x - 7$ and $y = 2x + 3$ algebraically. Write down a geometrical interpretation of your results. [5]

5. *(a)* Given that $y = 4x^2 - 5x - 3$, find $\dfrac{dy}{dx}$ from first principles. [5]

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

6. *(a)* Given that $k \neq -1$, show that the quadratic equation

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

has two distinct real roots. [4]

(b) Find the range of values of x satisfying the inequality

$$5x^2 + 7x - 6 \leqslant 0.$$ [3]

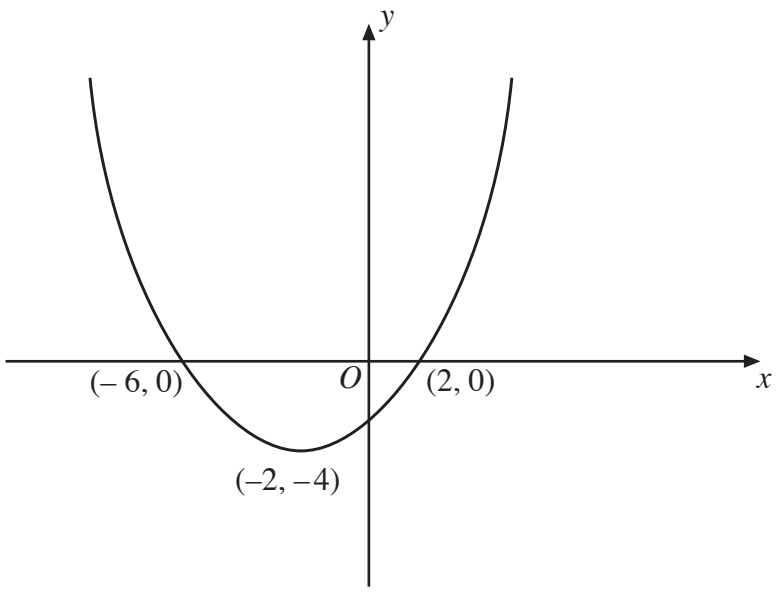
7. *(a)* Expand $\left(x+\frac{2}{x}\right)^4$, simplifying each term of the expansion. [4]

(b) The coefficient of x^2 in the expansion of $(1 + x)^n$ is 55. Given that n is a positive integer, find the value of n. [3]

8. *(a)* When $ax^3 - 12x^2 - 6x + 5$ is divided by $x + 1$, the remainder is -3.
Find the value of the constant a. [2]

(b) Factorise $8x^3 - 14x^2 - 7x + 6$. [5]

9. The diagram shows a sketch of the graph of $y = f(x)$. The graph passes through the points $(-6, 0)$ and $(2, 0)$, and has a minimum point at $(-2, -4)$.



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) $y = f(x + 1)$ [3]

(b) $y = f(2x)$ [3]

10. The curve C has equation

$$y = x^3 - 3x^2 + 3x + 5.$$

(a) Show that C has only one stationary point. Find the coordinates of this point. [4]

(b) Verify that this stationary point is a point of inflection. [2]