WJEC CBAC

GCE AS/A level

973/01

MATHEMATICS C1
Pure Mathematics

A.M. MONDAY, 11 January 2010

$1\frac{1}{2}$ hours

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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 have coordinates $(-11, 10), (-5, 12), (3, 8)$ respectively.
The line L_1 passes through the point A and is **parallel** to BC.
The line L_2 passes through the point C and is **perpendicular** to BC.

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

(b) (i) Show that L_1 has equation

$$x + 2y - 9 = 0.$$

(ii) Find the equation of L_2. [6]

(c) The lines L_1 and L_2 intersect at the point D.

(i) Show that D has coordinates $(1, 4)$.

(ii) Find the length of BD.

(iii) Find the coordinates of the mid-point of BD. [6]

2. Simplify

(a) $\dfrac{2\sqrt{11}-3}{\sqrt{11}+2}$, [4]

(b) $\dfrac{22}{\sqrt{2}} - \sqrt{50} - \left(\sqrt{2}\right)^5$. [4]

3. The curve C has equation $y = \dfrac{6}{x^2} + \dfrac{7x}{4} - 2$. The point P has coordinates $(2, 3)$ and lies on C.

Find the equation of the **normal** to C at P. [6]

4. *(a)* Express $4x^2 - 8x + 7$ in the form $a(x + b)^2 + c$, where a, b and c are constants whose values are to be found. [3]

(b) Use your answer to part *(a)* to find the greatest value of

$$\frac{1}{4x^2 - 8x + 7} .$$ [2]

5. *(a)* Find the range of values of k for which the quadratic equation

$$kx^2 + 3x - 5 = 0$$

has no real roots. [4]

(b) Solve the inequality $2x^2 - x - 6 > 0$. [3]

6. *(a)* Given that $y = 3x^2 - 7x - 5$, find $\frac{dy}{dx}$ from first principles. [5]

(b) Given that $y = ax^{\frac{5}{2}}$ and $\frac{dy}{dx} = -2$ when $x = 4$, find the value of the constant a. [3]

7. In the binomial expansion of $(a + 3x)^5$, the coefficient of the term in x^2 is eight times the coefficient of the term in x. Find the value of the constant a. [4]

8. The polynomial $f(x)$ is defined by

$$f(x) = 2x^3 + 11x^2 + 4x - 5.$$

(a) (i) Evaluate $f(-2)$.

(ii) **Using your answer to part (i)**, write down **one** fact which you can deduce about $f(x)$. [2]

(b) Solve the equation $f(x) = 0$. [6]

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TURN OVER.

9. Figure 1 shows a sketch of the graph of $y = f(x)$. The graph has a maximum point at (2, 5) and intersects the x-axis at the points (–2, 0) and (6, 0).

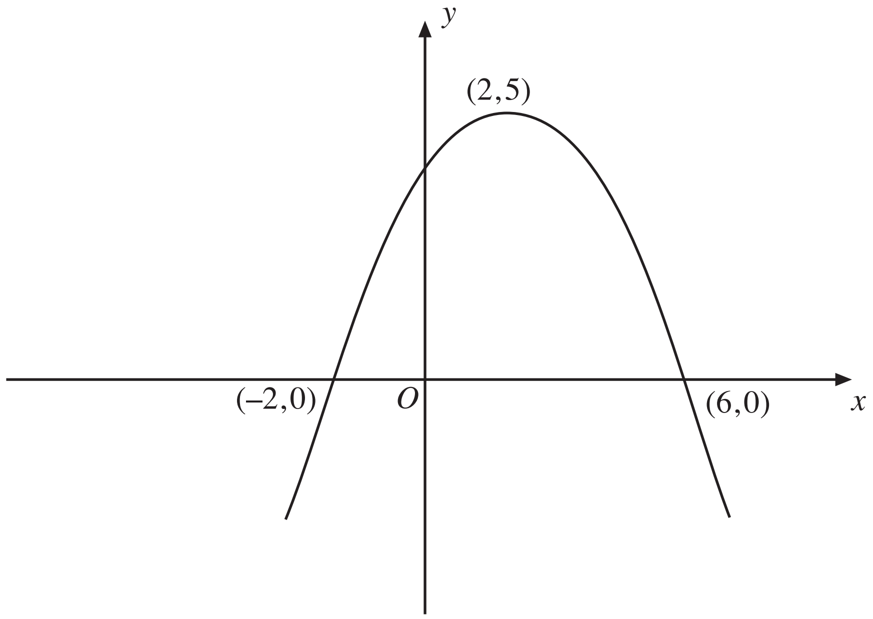

Figure 1

(a) Sketch the graph of $y = f\left(\frac{x}{2}\right)$, indicating the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x-axis. [3]

(b) Figure 2 shows a sketch of the graph having **one** of the following equations with an appropriate value of either p, q or r.

$y = f(x + p)$, where p is a constant
$y = f(x) + q$, where q is a constant
$y = rf(x)$, where r is a constant

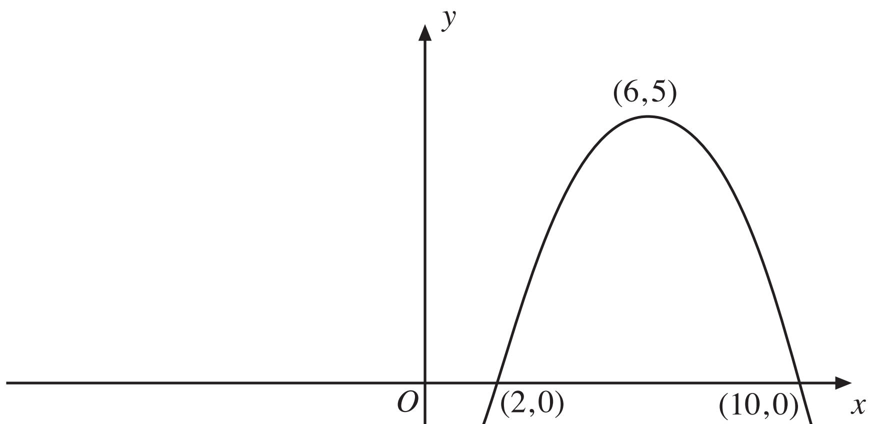

Figure 2

Write down the equation of the graph sketched in Figure 2, together with the value of the corresponding constant. [2]

10. The curve C has equation

$$y = x^3 - 6x^2 + 20.$$

(a) Find the coordinates and the nature of each of the stationary points of C. [6]

(b) Sketch C, indicating the coordinates of each of the stationary points. [2]

(c) Given that the equation

$$x^3 - 6x^2 + 20 = k$$

has three **distinct** real roots, find the range of possible values for k. [2]