General Certificate of Education
Advanced Subsidiary/Advanced

973/01

MATHEMATICS C1
Pure Mathematics

P.M.WEDNESDAY, 9 January 2008
(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.

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 $(-2, 3)$, $(10, -1)$, $(3, 8)$ respectively. The line through C perpendicular to AB intersects AB at the point D.

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

(b) Show that AB has equation

$$x + 3y - 7 = 0$$

and find the equation of CD. [5]

(c) Show that D has coordinates $(1, 2)$. [2]

(d) The mid-point of AB is denoted by E. Find the length of ED. [4]

2. Simplify the following.

(a) $\sqrt{20} + \dfrac{\sqrt{35}}{\sqrt{7}} - \dfrac{20}{\sqrt{5}}$ [4]

(b) $\dfrac{2 + \sqrt{3}}{5 + 2\sqrt{3}}$ [4]

3. The curve C has equation $y = 2x^2 - 10x + 16$. The point P has coordinates $(3, 4)$ and lies on C. Find the equation of the tangent to C at P. [4]

4. *(a)* Expand $(a + b)^5$. [2]

(b) (i) Write down the first four terms in the expansion of $\left(1 + \dfrac{x}{2}\right)^5$ in ascending powers of x.

(ii) By substituting an appropriate value for x in (i), find an approximate value for $1{\cdot}05^5$. Show all your working and give your answer correct to three decimal places. [5]

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

$$3x^2 + 2x - k = 0$$

has two distinct real roots. [4]

(b) Solve the inequality $x^2 - 5x - 14 \leqslant 0$. [3]

6. *(a)* Given that $y = 3x^2 - 4x + 7$, find $\dfrac{dy}{dx}$ from first principles. [5]

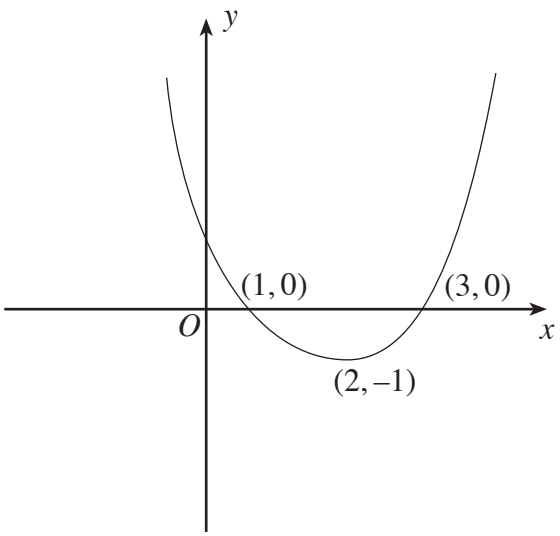
(b) Differentiate $5\sqrt{x} - \dfrac{3}{x^3}$ with respect to x. [2]

7. Show that $x^2 + 1{\cdot}8x - 3{\cdot}19$ may be expressed in the form $(x + p)^2 - 4$, where p is a constant whose value is to be found.
Hence solve the quadratic equation $x^2 + 1{\cdot}8x - 3{\cdot}19 = 0$. [5]

8. *(a)* When the polynomial $6x^3 + ax^2 - 3x - 2$ is divided by $x + 2$, the remainder is -24. Show that $a = 5$. [2]

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

9. The diagram shows the graph of $y = f(x)$. The graph has a minimum point at $(2, -1)$ and intersects the x-axis at the points $(1, 0)$ and $(3, 0)$.



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) $y = 3f(x)$ *(b)* $y = f(x + 5)$ [3], [3]

10. The curve C has equation

$$y = x^3 - 12x + 11.$$

(a) Find the coordinates and nature of each of the stationary points of C. [7]

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

(c) Given that the equation

$$x^3 - 12x + 11 = k$$

has only one real root, find the range of possible values for k. [2]