



GCE AS/A level

973/01

MATHEMATICS C1

Pure Mathematics

P.M. MONDAY, 24 May 2010

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, D have coordinates $(-6, 4), (9, -1), (3, 16), (-7, 11)$ respectively.

(a) (i) Find the gradient of AC .

(ii) Show that the equation of AC is

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

(iii) Show that BD is perpendicular to AC .

(iv) Find the equation of BD . [9]

(b) The lines AC and BD intersect at the point E .

(i) Show that E has coordinates $(-3, 8)$.

(ii) Calculate the length of BE . [4]

2. Simplify

(a) $\frac{5\sqrt{7} - \sqrt{3}}{\sqrt{7} - \sqrt{3}}$, [4]

(b) $(\sqrt{15} \times \sqrt{20}) - \sqrt{75} - \frac{\sqrt{60}}{\sqrt{5}}$. [4]

3. The curve C has equation $y = x^2 - 8x + 10$.

(a) The point P has coordinates $(3, -5)$ and lies on C . Find the equation of the **normal** to C at P . [5]

(b) The point Q lies on C and is such that the **tangent** to C at Q has equation

$$y = 4x + c,$$

where c is a constant. Find the coordinates of Q and the value of c . [4]

4. (a) Write down the expansion of $(1 + x)^6$ in ascending powers of x up to and including the term in x^3 . [2]

(b) By substituting an appropriate value for x in your expansion in (a), find an approximate value for 0.99^6 . **Show all your working** and give your answer correct to four decimal places. [3]

5. (a) Express $2x^2 + 12x - 7$ in the form $a(x + b)^2 + c$, where the values of the constants a, b and c are to be found. [3]

(b) Use your answer to part (a) to find the least value of $6x^2 + 36x - 17$. [2]

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

$$2x^2 + kx + 18 = 0$$

has no real roots. [4]

- (b) Solve the inequality $10x^2 - x - 3 \geq 0$. [3]

7. (a) Given that $y = -x^2 + 5x - 9$, find $\frac{dy}{dx}$ from first principles. [5]

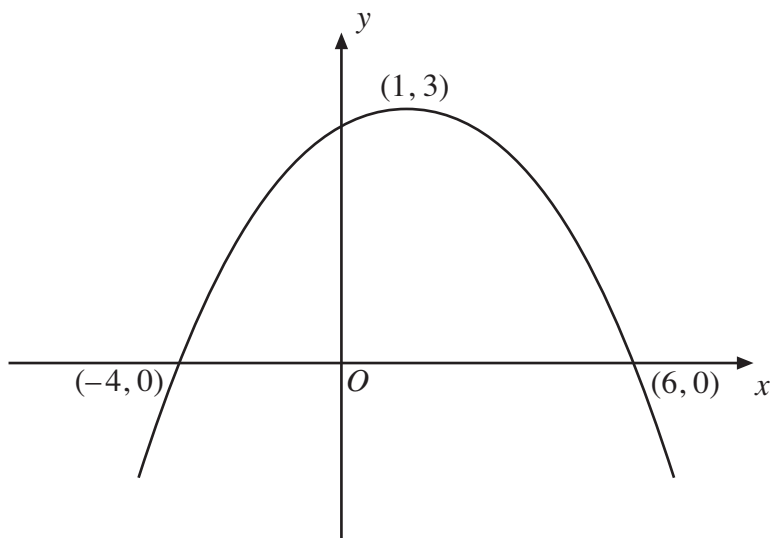
- (b) Given that $y = \frac{3}{4}x^{\frac{1}{3}} + \frac{12}{x^2}$, find the value of $\frac{dy}{dx}$ when $x = 8$. [4]

8. (a) Given that $x + 2$ is a factor of $12x^3 + kx^2 - 13x - 6$, write down an equation satisfied by k . Hence show that $k = 19$. [2]

- (b) Factorise $12x^3 + 19x^2 - 13x - 6$. [3]

- (c) Find the remainder when $12x^3 + 19x^2 - 13x - 6$ is divided by $2x - 1$. [2]

9. The diagram shows a sketch of the graph of $y = f(x)$. The graph passes through the points $(-4, 0)$ and $(6, 0)$ and has a maximum point at $(1, 3)$.



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

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

10. The curve C has equation

$$y = \frac{1}{2}x^3 - 6x + 3.$$

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