GCE AS/A level

0973/01

MATHEMATICS – C1
Pure Mathematics

A.M. MONDAY, 19 May 2014

1 hour 30 minutes

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* and *B* have coordinates (–2, 10) and (12, 3) respectively.

(a) (i) Find the gradient of *AB*.

(ii) Find the equation of *AB*. [4]

(b) The line *L* is perpendicular to *AB* and intersects the y-axis at the point *C*(0, –1). The lines *AB* and *L* intersect at the point *D*.

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

(ii) Show that *D* has coordinates (4, 7).

(iii) Find the length of *AD* and the length of *BD*. [7]

(c) The line *CD* is extended to the point *E* so that *D* is the mid-point of *CE*.

(i) Find the coordinates of *E*.

(ii) **Write down** the geometrical name for the quadrilateral *ACBE*. [3]

2. Simplify

(a) $\dfrac{3\sqrt{3}+1}{5\sqrt{3}-7}$, [4]

(b) $\left(\sqrt{12}\times\sqrt{24}\right)+\dfrac{\sqrt{150}}{\sqrt{3}}-\dfrac{36}{\sqrt{2}}$. [4]

3. The curve *C* has equation $y = x^2 - 8x + 14$.

(a) The point *P* has coordinates (6, 2) and lies on the curve *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

$$y = 2x + c,$$

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) **Showing all your working**, substitute an appropriate value for x in your expansion in part *(a)* to find an approximate value for $1{\cdot}1^6$. [3]

5. *(a)* Express $4x^2 - 8x + 11$ 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 $\dfrac{1}{4x^2 - 8x + 29}$. [2]

6. Given that the quadratic equation

$$(k-1)x^2 + 2kx + (7k-4) = 0$$

has no real roots, show that

$$6k^2 - 11k + 4 > 0.$$

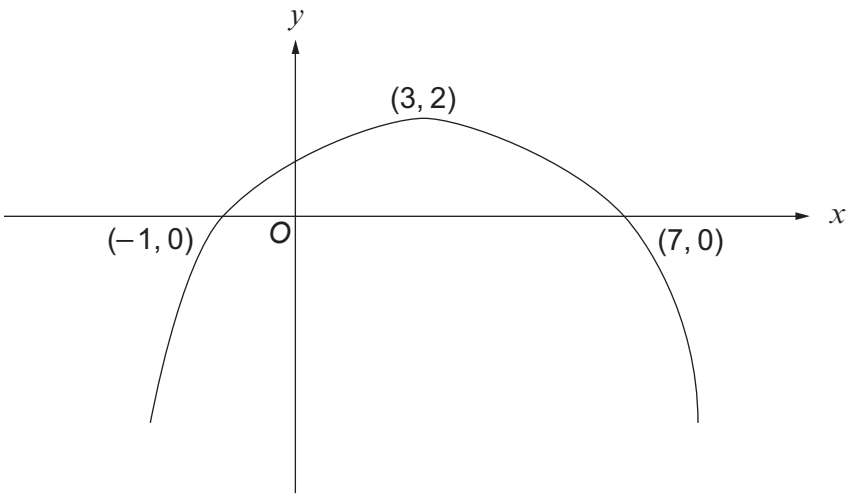
Find the range of values of k satisfying this inequality. [7]

7. *(a)* Given that $y = -3x^2 + 8x - 7$, find $\frac{dy}{dx}$ from first principles. [5]

(b) Differentiate $9x^{\frac{5}{4}} - \frac{8}{\sqrt[3]{x}}$ with respect to x. [2]

8. Solve the equation $6x^3 - 13x^2 + 4 = 0$. [6]

9. The diagram shows a sketch of the graph of $y = f(x)$. The graph passes through the points $(-1, 0)$ and $(7, 0)$ and has a maximum point at $(3, 2)$.



(a) 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.

(i) $y = f(x + 4)$

(ii) $y = -2f(x)$ [6]

(b) Hence write down one root of the equation

$$f(x + 4) = -2f(x) + 4.$$ [1]

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10. The curve C has equation

$$y = x^3 + 9x^2 + 27x + 31.$$

(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]

(c) Sketch the graph of C, indicating the coordinates of its stationary point. [1]

END OF PAPER