GCE AS/A Level – LEGACY

0973/01

S18-0973-01

MATHEMATICS – C1
Pure Mathematics

WEDNESDAY, 16 MAY 2018 – MORNING

1 hour 30 minutes

ADDITIONAL MATERIALS

In addition to this examination paper, you will need:

- a WJEC pink 16-page answer booklet;
- 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*, *B*, *C* and *D* have coordinates (–2, 7), (2, –1), (5, 3) and (3, 7) respectively.

(a) (i) Show that *AB* and *DC* are parallel.

(ii) Find the equation of *AB*. [5]

(b) The line *L* has equation $x - 2y + 11 = 0$ and intersects *AB* at the point *E*.

(i) Giving a reason, determine whether or not *L* is perpendicular to *AB*.

(ii) Show that *E* has coordinates (–1, 5).

(iii) Calculate the length of *EF*, where *F* denotes the midpoint of *AB*. [8]

(c) **Write down** the geometrical name for the quadrilateral *ABCD*. [1]

2. Simplify $\sqrt{500} + \left(\sqrt{12} \times \sqrt{15}\right) - \dfrac{7\sqrt{60}}{\sqrt{3}}$. [4]

3. The curve *C* has equation $y = x^2 - 6x + 7$. The point *P*, whose x-coordinate is 2, lies on *C*.

(a) Show that the equation of the **normal** to *C* at *P* is $y = \dfrac{1}{2}x - 2$. [6]

(b) The normal to *C* at *P* intersects *C* again at the point *Q*. Find the coordinates of *Q*. [4]

4. *(a)* Express $4x^2 + 40x - 69$ in the form $a(x + b)^2 + c$, where the values of the constants a, b and c are to be found. [3]

(b) **Using your answer to part *(a)***, solve the equation

$$4x^2 + 40x - 69 = 0.$$ [3]

5. *(a)* Using the binomial theorem, write down and simplify the first four terms in the expansion of $\left(1 - \dfrac{x}{2}\right)^7$ in ascending powers of x. [4]

(b) The coefficient of x^2 in the expansion of $(1 + 4x)^n$ is 3360. Given that n is a positive integer, find the value of n. [3]

6. Find the range of values of x satisfying the inequality

$$9x^2 + 16x - 4 > 0.$$ [3]

7. *(a)* Given that $y = 9x^2 - 7x - 8$, find $\frac{dy}{dx}$ from first principles. [5]

(b) Given that $y = \frac{k}{x} + 14\sqrt{x}$ and that $\frac{dy}{dx} = 2$ when $x = 9$, find the value of the constant k. [4]

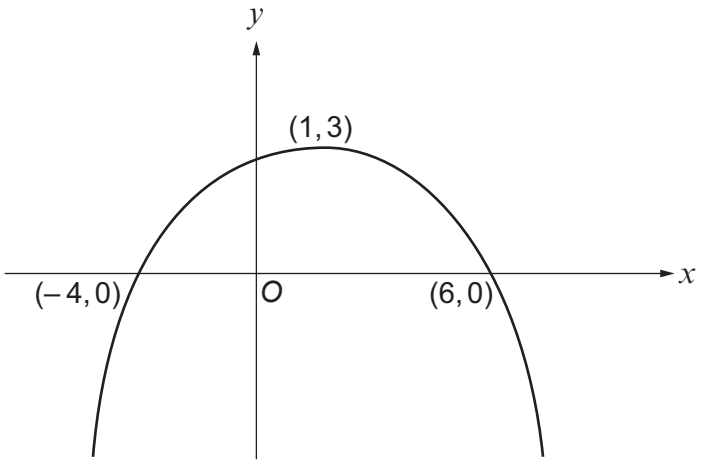
8. *(a)* (i) Find one real root of the equation $8x^3 + 7x^2 - 13x + 10 = 0$.

(ii) Show that the root you have found is the only real root of the equation

$$8x^3 + 7x^2 - 13x + 10 = 0.$$ [7]

(b) When $x^3 - 80$ is divided by $x - a$, the remainder is 45. Find the value of the constant a. [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).

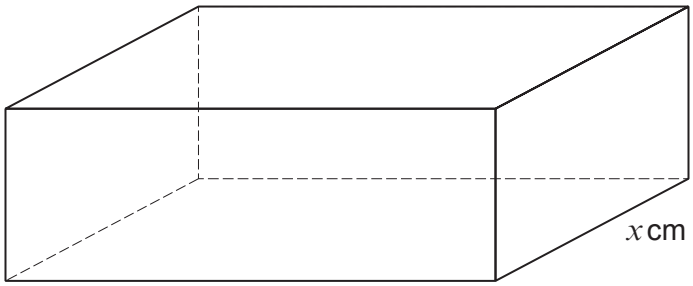


(a) Sketch the graph of $y = f(x + 3)$, indicating the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x-axis. [3]

(b) Gwen is asked by her teacher to draw the graph of $y = f(ax)$ for various values of the constant a. Two of Gwen's graphs pass through the point (2, 0).
Find the value of a corresponding to each of these two graphs. [2]

TURN OVER

10. A closed box, in the form of a cuboid, is such that the length of its base is three times the width of its base. The volume of the box is 6000 cm^3. The total length of the twelve edges of the box is denoted by L cm.



(a) Show that $L = 16x + \frac{8000}{x^2}$, where x cm denotes the width of the base. [3]

(b) Find the minimum value of L, showing that the value you have found is a minimum value. [5]

END OF PAPER

