GCE AS/A Level – LEGACY

0973/01

S19-0973-01

MATHEMATICS – C1
Pure Mathematics

WEDNESDAY, 15 MAY 2019 – MORNING

1 hour 30 minutes

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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* and *B* have coordinates (– 2, 7) and (6, 13), respectively. The point *C* is the midpoint of *AB*. The line *L* is the perpendicular bisector of *AB*.

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

(ii) Find the equation of *L*. [7]

(b) The line *L* intersects the line $y = 2$ at the point *D*.

(i) Show that *D* has coordinates (8, 2).

(ii) Find the value of tan $B\hat{D}C$. [6]

2. Simplify

(a) $\dfrac{7-\sqrt{11}}{5+2\sqrt{11}}$, [4]

(b) $\dfrac{56}{\sqrt{2}} - \sqrt{450} - \left(\sqrt{2}\right)^7$. [4]

3. The curve *C* has equation $y = x^2 + 7x + 14$.

(a) The point *P* has coordinates (– 1, 8) 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

$$y = -3x + c,$$

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

4. **Use the binomial theorem** to express $\left(2-\sqrt{3}\right)^5$ in the form $a+b\sqrt{3}$, where a, b are integers whose values are to be found. [5]

5. *(a)* Express $-3x^2 + 24x - 55$ in the form $a(x + b)^2 + c$, where the values of the constants a, b, c are to be found. [3]

(b) **Hence, without any further calculation,** sketch the graph of $y = -3x^2 + 24x - 55$, indicating the coordinates of its stationary point. [2]

6. *(a)* Show that the equation

$$x^2 + (2k - 5)x + (k^2 - 5k + 8) = 0$$

has no real roots, whatever the value of the constant k. [4]

(b) Find the range of values of x satisfying the inequality

$$2x^2 + 13x - 24 < 0.$$ [3]

7. *(a)* Given that $y = -7x^2 - 8x + 11$, find $\frac{dy}{dx}$ from first principles. [5]

(b) Differentiate $9x^{\frac{3}{2}} - \frac{4}{x^{\frac{3}{5}}} + 6$ with respect to x. [2]

8. The polynomial $px^3 - 13x^2 + qx + 12$ has $x - 3$ as a factor. When the polynomial is divided by $x + 2$, the remainder is -50.

(a) Write down two equations satisfied by p and q. Hence, show that $p = 6$ and $q = -19$. [6]

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

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9. Figure 1 shows a sketch of the graph of $y = f(x)$. The graph has a minimum point at (–1, –4) and intersects the x-axis at the points (–3, 0) and (1, 0).

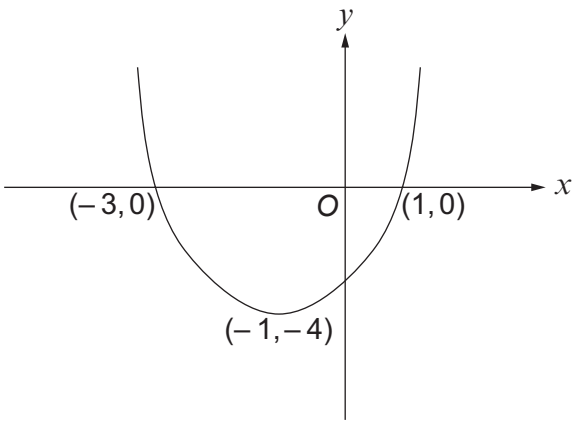

Figure 1

(a) Sketch the graph of $y = -\frac{3}{2} f(x)$, 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 p, q, r or s.

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

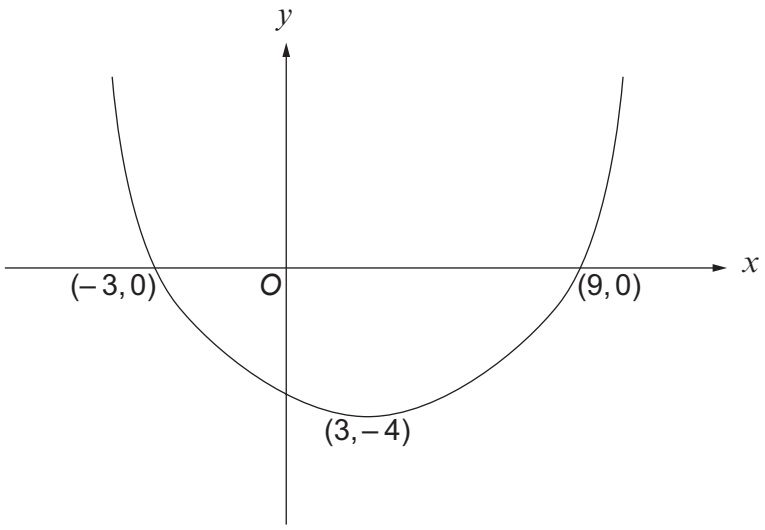

Figure 2

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

$$y = x^3 + kx^2 + 15x + 8,$$

where k is a constant. The two stationary points on the graph of *C* are denoted by *Q* and *R*. The x-coordinate of *Q* is 5.

(a) Find $\frac{\mathrm{d}y}{\mathrm{d}x}$ and hence show that $k = -9$. [3]

(b) Find the x-coordinate of *R*. [2]

(c) Determine the nature of each of the stationary points *Q* and *R*. [2]

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