# GCE AS/A Level

0973/01

S17-0973-01

# MATHEMATICS – C1
## Pure Mathematics

WEDNESDAY, 17 MAY 2017 – 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.

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**1.** The points $A$ and $B$ have coordinates $(-2, 3)$ and $(4, 5)$ respectively.
The line $L_1$ passes through the point $B$ and is **perpendicular** to $AB$.

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

(ii) Find the equation of $L_1$. [5]

The line $L_2$ has equation $x + 2y + 1 = 0$.
The lines $L_1$ and $L_2$ intersect at the point $C$.

*(b)* (i) Show that $C$ has coordinates $(7, -4)$.

(ii) Show that the value of $\cos B\hat{C}A$ may be expressed in the form $\frac{3}{\sqrt{a}}$, where $a$ is an integer whose value is to be found. [7]

*(c)* The line $CB$ is extended to the point $D$ so that $B$ is the mid-point of $CD$.

(i) Find the coordinates of $D$.

(ii) **Write down** the geometrical name for the triangle $ACD$. [3]

**2.** Simplify

*(a)* $\dfrac{5\sqrt{5}-9}{3+2\sqrt{5}}$, [4]

*(b)* $\left(2\sqrt{13}\right)^2 - \left(3\sqrt{7}\times\sqrt{28}\right) - \dfrac{5\sqrt{99}}{\sqrt{11}}$. [4]

**3.** The curve $C$ has equation $y = \frac{3}{4}x^2 - 4x - 10$.

*(a)* The point $P$ has coordinates $(6, -7)$ and lies on the curve $C$. Find the equation of the **tangent** to $C$ at $P$. [4]

*(b)* The point $Q$ lies on $C$ and is such that the gradient of the **normal** to $C$ at $Q$ is $-2$.
Find the $x$–coordinate of $Q$. [3]

**4.** *(a)* Express $-2x^2 - 20x + 35$ in the form $a(x + b)^2 + c$, where the values of the constants $a$, $b$ and $c$ are to be found. [3]

*(b)* **Without carrying out any further calculation**, write down the stationary value of $y = -2x^2 - 20x + 35$ and state whether this stationary value is a maximum or a minimum. [2]

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**5.** *(a)* Use the binomial theorem to expand $\left(x+\frac{2}{x}\right)^4$, simplifying each term of the expansion. [4]

*(b)* In the binomial expansion of $(a + 2x)^6$, where $a \neq 0$, the coefficient of the term in $x^2$ is equal to the coefficient of the term in $x$. Find the value of $a$. [4]

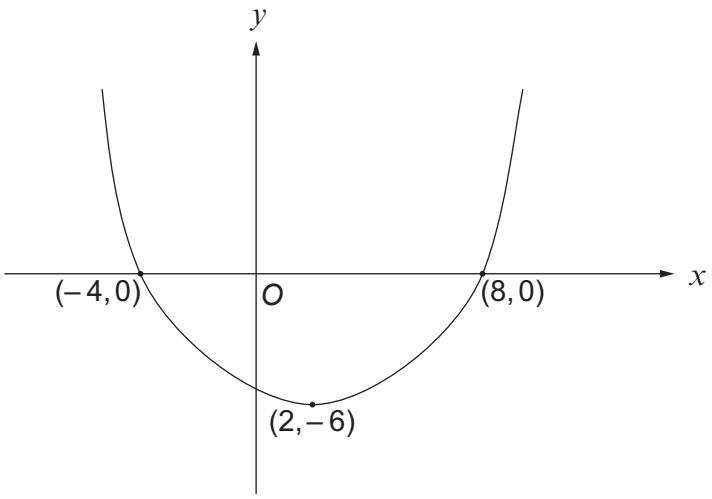
**6.** Solve the inequality $2x^2 + 11x + 12 \geqslant 0$. [3]

**7.** *(a)* Given that $x - 2$ is a factor of $kx^3 + 2x^2 - 41x + 10$, write down an equation satisfied by $k$. Hence show that $k = 8$. [2]

*(b)* Factorise $8x^3 + 2x^2 - 41x + 10$. [3]

*(c)* Find the remainder when $8x^3 + 2x^2 - 41x + 10$ is divided by $2x + 1$. [2]

**8.** The diagram shows a sketch of the graph of $y = f(x)$. The graph passes through the points $(-4, 0)$ and $(8, 0)$ and has a minimum point at $(2, -6)$.




*(a)* Sketch the graph of $y = -\frac{1}{2}f(x)$, indicating the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the $x$-axis. [3]

*(b)* Siân is asked by her teacher to draw the graph of $y = f(ax)$ for various non-zero values of the constant $a$. Write down two facts about the stationary point on Siân's graph which will always be true whatever her choice of $a$. [2]

**TURN OVER**

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**9.** *(a)* Given that $y = -5x^2 - 7x + 13$, find $\frac{dy}{dx}$ from first principles. [5]

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

**10.** The curve *C* has equation

$$y = x^3 - 9x^2 + 15x + 10.$$

*(a)* (i) Find the coordinates of each of the stationary points of *C*.

(ii) Determine the nature of each of these stationary points. [6]

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

*(c)* Given that the equation

$$x^3 - 9x^2 + 15x + 10 = k$$

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

**END OF PAPER**

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