## GCE AS/A level

WJEC CBAC

0973/01

## MATHEMATICS Cl Pure Mathematics

A.M. FRIDAY, 13 Jonuary 2012
$11 / 2$ hours

## 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 $A, B, C, D$ have coordinates $(-5,14),(1,2),(5,4),(3,8)$ respectively.
(a) (i) Show that $A B$ and $C D$ are parallel.
(ii) Find the equation of $A B$.
(iii) The line $L$ passes through the point $D$ and is perpendicular to $A B$. Show that $L$ has equation

$$
\begin{equation*}
x-2 y+13=0 . \tag{8}
\end{equation*}
$$

(b) The lines $L$ and $A B$ intersect at the point $E$.
(i) Find the coordinates of $E$.
(ii) Calculate the length of $E F$, where $F$ denotes the mid-point of $A B$.
2. Simplify
(a) $\frac{9+4 \sqrt{2}}{5+3 \sqrt{2}}$,
(b) $(\sqrt{8} \times \sqrt{10})+\frac{\sqrt{90}}{\sqrt{2}}-\frac{30}{\sqrt{5}}$.
3. The curve $C$ has equation $y=2 x^{2}-8 x+13$. The point $P$, whose $x$-coordinate is 3 , lies on the curve $C$. Find the equation of the normal to $C$ at $P$.
4. (a) Use the binomial theorem to expand $\left(x+\frac{3}{x}\right)^{4}$, simplifying each term of the expansion.
(b) The coefficient of $x^{2}$ in the expansion of $(1+2 x)^{n}$ is 760 . Given that $n$ is a positive integer, find the value of $n$.
5. (a) Express $3 x^{2}-6 x+5$ in the form $a(x+b)^{2}+c$, where $a, b$ and $c$ are constants whose values are to be found.
(b) Use your answer to part (a) to find the greatest value of

$$
\begin{equation*}
\frac{1}{3 x^{2}-6 x+11} . \tag{2}
\end{equation*}
$$

6. Given that the quadratic equation

$$
(k+6) x^{2}+4 x+(k+3)=0
$$

has no real roots, show that

$$
k^{2}+9 k+14>0
$$

Find the range of values of $k$ satisfying this inequality.
7. (a) Given that $y=8 x^{2}-5 x-6$, find $\frac{\mathrm{d} y}{\mathrm{~d} x}$ from first principles.
(b) Given that $y=\frac{a}{x}+10 \sqrt{x}$ and that $\frac{\mathrm{d} y}{\mathrm{~d} x}=3$ when $x=4$,
find the value of the constant $a$.
8. (a) When $a x^{3}-21 x-10$ is divided by $x-3$, the remainder is 35 .

Write down an equation satisfied by $a$ and hence show that $a=4$.
(b) Factorise $4 x^{3}-21 x-10$.

## TURN OVER

9. The diagram shows a sketch of the graph of $y=f(x)$. The graph has a maximum point at $(1,3)$ and intersects the $x$-axis at the points $(-2,0)$ and $(4,0)$.

(a) Sketch the graph of $y=f(2 x)$, indicating the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the $x$-axis.
(b) (i) Sketch the graph of $y=f(x)-5$, indicating the coordinates of the stationary point.
(ii) Given that $f$ is a quadratic function, use the graph you have drawn in part (i) to write down the number of real roots of the equation

$$
\begin{equation*}
f(x)-5=0 . \tag{3}
\end{equation*}
$$

10. The curve $C$ has equation

$$
y=x^{3}-6 x^{2}+12 x-9
$$

(a) Show that $C$ has only one stationary point. Find the coordinates of this point.
(b) Verify that this stationary point is a point of inflection.

