RECOGNISING ACHIEVEMENT

## ADVANCED SUBSIDIARY GCE

Core Mathematics 1
WEDNESDAY 9 JANUARY 2008

Afternoon
Time: 1 hour 30 minutes

Additional materials: Answer Booklet (8 pages) List of Formulae (MF1)

## INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the spaces provided on the answer booklet.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Answer all the questions.
- Give non-exact numerical answers correct to 3 significant figures unless a different degree of accuracy is specified in the question or is clearly appropriate.
- You are not permitted to use a calculator in this paper.


## INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is 72 .
- You are reminded of the need for clear presentation in your answers.



## WARNING

You are not allowed to use a calculator in this paper.

1 Express $\frac{4}{3-\sqrt{7}}$ in the form $a+b \sqrt{7}$, where $a$ and $b$ are integers.

2 (i) Write down the equation of the circle with centre $(0,0)$ and radius 7 .
(ii) A circle with centre $(3,5)$ has equation $x^{2}+y^{2}-6 x-10 y-30=0$. Find the radius of the circle.

3 Given that $3 x^{2}+b x+10=a(x+3)^{2}+c$ for all values of $x$, find the values of the constants $a, b$ and $c$.

4 Solve the equations
(i) $10^{p}=0.1$,
(ii) $\left(25 k^{2}\right)^{\frac{1}{2}}=15$,
(iii) $t^{-\frac{1}{3}}=\frac{1}{2}$.

5 (i) Sketch the curve $y=x^{3}+2$.
(ii) Sketch the curve $y=2 \sqrt{x}$.
(iii) Describe a transformation that transforms the curve $y=2 \sqrt{x}$ to the curve $y=3 \sqrt{x}$.

6 (i) Solve the equation $x^{2}+8 x+10=0$, giving your answers in simplified surd form.
(ii) Sketch the curve $y=x^{2}+8 x+10$, giving the coordinates of the point where the curve crosses the $y$-axis.
(iii) Solve the inequality $x^{2}+8 x+10 \geqslant 0$.

7 (i) Find the gradient of the line $l$ which has equation $x+2 y=4$.
(ii) Find the equation of the line parallel to $l$ which passes through the point $(6,5)$, giving your answer in the form $a x+b y+c=0$, where $a, b$ and $c$ are integers.
(iii) Solve the simultaneous equations

$$
\begin{equation*}
y=x^{2}+x+1 \quad \text { and } \quad x+2 y=4 \tag{4}
\end{equation*}
$$

8 (i) Find the coordinates of the stationary points on the curve $y=x^{3}+x^{2}-x+3$.
(ii) Determine whether each stationary point is a maximum point or a minimum point.
(iii) For what values of $x$ does $x^{3}+x^{2}-x+3$ decrease as $x$ increases?

9 The points $A$ and $B$ have coordinates ( $-5,-2$ ) and (3, 1) respectively.
(i) Find the equation of the line $A B$, giving your answer in the form $a x+b y+c=0$.
(ii) Find the coordinates of the mid-point of $A B$.

The point $C$ has coordinates $(-3,4)$.
(iii) Calculate the length of $A C$, giving your answer in simplified surd form.
(iv) Determine whether the line $A C$ is perpendicular to the line $B C$, showing all your working.

10 Given that $\mathrm{f}(x)=8 x^{3}+\frac{1}{x^{3}}$,
(i) find $\mathrm{f}^{\prime \prime}(x)$,
(ii) solve the equation $\mathrm{f}(x)=-9$.

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