RECOGNISING ACHIEVEMENT

## ADVANCED SUBSIDIARY GCE UNIT MATHEMATICS

Core Mathematics 1
THURSDAY 7 JUNE 2007

Morning
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.
- 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 .


## ADVICE TO CANDIDATES

- Read each question carefully and make sure you know what you have to do before starting your answer.
- 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 Simplify $(2 x+5)^{2}-(x-3)^{2}$, giving your answer in the form $a x^{2}+b x+c$.

2 (a) On separate diagrams, sketch the graphs of
(i) $y=\frac{1}{x}$,
(ii) $y=x^{4}$.
(b) Describe a transformation that transforms the curve $y=x^{3}$ to the curve $y=8 x^{3}$.

3 Simplify the following, expressing each answer in the form $a \sqrt{5}$.
(i) $3 \sqrt{10} \times \sqrt{2}$
(ii) $\sqrt{500}+\sqrt{125}$

4 (i) Find the discriminant of $k x^{2}-4 x+k$ in terms of $k$.
(ii) The quadratic equation $k x^{2}-4 x+k=0$ has equal roots. Find the possible values of $k$.


The diagram shows a rectangular enclosure, with a wall forming one side. A rope, of length 20 metres, is used to form the remaining three sides. The width of the enclosure is $x$ metres.
(i) Show that the enclosed area, $A \mathrm{~m}^{2}$, is given by

$$
\begin{equation*}
A=20 x-2 x^{2} \tag{2}
\end{equation*}
$$

(ii) Use differentiation to find the maximum value of $A$.

6 By using the substitution $y=(x+2)^{2}$, find the real roots of the equation

$$
\begin{equation*}
(x+2)^{4}+5(x+2)^{2}-6=0 \tag{6}
\end{equation*}
$$

7 (a) Given that $\mathrm{f}(x)=x+\frac{3}{x}$, find $\mathrm{f}^{\prime}(x)$.
(b) Find the gradient of the curve $y=x^{\frac{5}{2}}$ at the point where $x=4$.

8 (i) Express $x^{2}+8 x+15$ in the form $(x+a)^{2}-b$.
(ii) Hence state the coordinates of the vertex of the curve $y=x^{2}+8 x+15$.
(iii) Solve the inequality $x^{2}+8 x+15>0$.

9 The circle with equation $x^{2}+y^{2}-6 x-k=0$ has radius 4 .
(i) Find the centre of the circle and the value of $k$.

The points $A(3, a)$ and $B(-1,0)$ lie on the circumference of the circle, with $a>0$.
(ii) Calculate the length of $A B$, giving your answer in simplified surd form.
(iii) Find an equation for the line $A B$.

10 (i) Solve the equation $3 x^{2}-14 x-5=0$.
A curve has equation $y=3 x^{2}-14 x-5$.
(ii) Sketch the curve, indicating the coordinates of all intercepts with the axes.
(iii) Find the value of $c$ for which the line $y=4 x+c$ is a tangent to the curve.

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