## ADVANCED SUBSIDIARY GCE <br> MATHEMATICS

Core Mathematics 1

Candidates answer on the Answer Booklet
OCR Supplied Materials:

- 8 page Answer Booklet
- List of Formulae (MF1)

Other Materials Required:
None

Wednesday 20 May 2009
Afternoon
Duration: 1 hour 30 minutes


## INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the spaces provided on the Answer Booklet.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer all the questions.
- Do not write in the bar codes.
- 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.
- You are reminded of the need for clear presentation in your answers.
- The total number of marks for this paper is 72.
- This document consists of 4 pages. Any blank pages are indicated.

1 Given that $y=x^{5}+\frac{1}{x^{2}}$, find
(i) $\frac{\mathrm{d} y}{\mathrm{~d} x}$,
(ii) $\frac{\mathrm{d}^{2} y}{\mathrm{~d} x^{2}}$.
[2]

2 Express $\frac{8+\sqrt{7}}{2+\sqrt{7}}$ in the form $a+b \sqrt{7}$, where $a$ and $b$ are integers.

3 Express each of the following in the form $3^{n}$ :
(i) $\frac{1}{9}$,
(ii) $\sqrt[3]{3}$,
(iii) $3^{10} \times 9^{15}$.

4 Solve the simultaneous equations

$$
\begin{equation*}
4 x^{2}+y^{2}=10, \quad 2 x-y=4 \tag{6}
\end{equation*}
$$

$5 \quad$ (i) Expand and simplify $(2 x+1)(x-3)(x+4)$.
(ii) Find the coefficient of $x^{4}$ in the expansion of

$$
\begin{equation*}
x\left(x^{2}+2 x+3\right)\left(x^{2}+7 x-2\right) \tag{2}
\end{equation*}
$$

6 (i) Sketch the curve $y=-\sqrt{x}$.
(ii) Describe fully a transformation that transforms the curve $y=-\sqrt{x}$ to the curve $y=5-\sqrt{x}$.
(iii) The curve $y=-\sqrt{x}$ is stretched by a scale factor of 2 parallel to the $x$-axis. State the equation of the curve after it has been stretched.

7 (i) Express $x^{2}-5 x+\frac{1}{4}$ in the form $(x-a)^{2}-b$.
(ii) Find the centre and radius of the circle with equation $x^{2}+y^{2}-5 x+\frac{1}{4}=0$.

8 Solve the inequalities
(i) $-35<6 x+7<1$,
(ii) $3 x^{2}>48$.
$9 \quad A$ is the point $(4,-3)$ and $B$ is the point $(-1,9)$.
(i) Calculate the length of $A B$.
(ii) Find the coordinates of the mid-point of $A B$.
(iii) Find the equation of the line through $(1,3)$ which is parallel to $A B$, giving your answer in the form $a x+b y+c=0$, where $a, b$ and $c$ are integers.

10 (i) Solve the equation $9 x^{2}+18 x-7=0$.
(ii) Find the coordinates of the stationary point on the curve $y=9 x^{2}+18 x-7$.
(iii) Sketch the curve $y=9 x^{2}+18 x-7$, giving the coordinates of all intercepts with the axes.
(iv) For what values of $x$ does $9 x^{2}+18 x-7$ increase as $x$ increases?

11 The point $P$ on the curve $y=k \sqrt{x}$ has $x$-coordinate 4. The normal to the curve at $P$ is parallel to the line $2 x+3 y=0$.
(i) Find the value of $k$.
(ii) This normal meets the $x$-axis at the point $Q$. Calculate the area of the triangle $O P Q$, where $O$ is the point $(0,0)$.

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