ADVANCED SUBSIDIARY GCE

MATHEMATICS (MEI) 4751

Introduction to Advanced Mathematics (C1)

Candidates answer on the Answer Booklet

OCR Supplied Materials:
- 8 page Answer Booklet
- Insert for Question 13 (inserted)
- MEI Examination Formulae and Tables (MF2)

Other Materials Required:
None

Friday 9 January 2009
Morning

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.
- There is an **insert** for use in Question **13**.
- You are **not** permitted to use a calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.
- The total number of marks for this paper is **72**.
- This document consists of **4** pages. Any blank pages are indicated.

No calculator can be used for this paper

Section A (36 marks)

1 State the value of each of the following.

(i) 2^{-3} **[1]**

(ii) 9^0 **[1]**

2 Find the equation of the line passing through $(-1, -9)$ and $(3, 11)$. Give your answer in the form $y = mx + c$. **[3]**

3 Solve the inequality $7 - x < 5x - 2$. **[3]**

4 You are given that $\mathrm{f}(x) = x^4 + ax - 6$ and that $x - 2$ is a factor of $\mathrm{f}(x)$.

Find the value of a. **[3]**

5 **(i)** Find the coefficient of x^3 in the expansion of $(x^2 - 3)(x^3 + 7x + 1)$. **[2]**

(ii) Find the coefficient of x^2 in the binomial expansion of $(1 + 2x)^7$. **[3]**

6 Solve the equation $\dfrac{3x + 1}{2x} = 4$. **[3]**

7 **(i)** Express $125\sqrt{5}$ in the form 5^k. **[2]**

(ii) Simplify $\left(4a^3b^5\right)^2$. **[2]**

8 Find the range of values of k for which the equation $2x^2 + kx + 18 = 0$ does not have real roots. **[4]**

9 Rearrange $y + 5 = x(y + 2)$ to make y the subject of the formula. **[4]**

10 **(i)** Express $\sqrt{75} + \sqrt{48}$ in the form $a\sqrt{3}$. **[2]**

(ii) Express $\dfrac{14}{3 - \sqrt{2}}$ in the form $b + c\sqrt{d}$. **[3]**

Section B (36 marks)

11

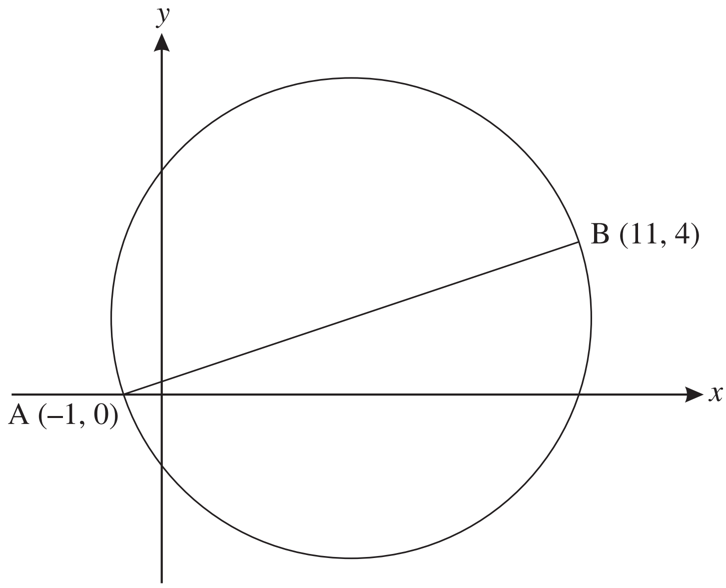

Fig. 11

Fig. 11 shows the points A and B, which have coordinates (−1, 0) and (11, 4) respectively.

(i) Show that the equation of the circle with AB as diameter may be written as

$$(x-5)^2 + (y-2)^2 = 40.$$ **[4]**

(ii) Find the coordinates of the points of intersection of this circle with the y-axis. Give your answer in the form $a \pm \sqrt{b}$. **[4]**

(iii) Find the equation of the tangent to the circle at B. Hence find the coordinates of the points of intersection of this tangent with the axes. **[6]**

12 **(i)** Find algebraically the coordinates of the points of intersection of the curve $y = 3x^2 + 6x + 10$ and the line $y = 2 - 4x$. **[5]**

(ii) Write $3x^2 + 6x + 10$ in the form $a(x+b)^2 + c$. **[4]**

(iii) Hence or otherwise, show that the graph of $y = 3x^2 + 6x + 10$ is always above the x-axis. **[2]**

[Question 13 is printed overleaf.]

13 Answer part (i) of this question on the insert provided.

The insert shows the graph of $y = \frac{1}{x}$.

(i) **On the insert**, on the same axes, plot the graph of $y = x^2 - 5x + 5$ for $0 \leqslant x \leqslant 5$. **[4]**

(ii) Show algebraically that the x-coordinates of the points of intersection of the curves $y = \frac{1}{x}$ and $y = x^2 - 5x + 5$ satisfy the equation $x^3 - 5x^2 + 5x - 1 = 0$. **[2]**

(iii) Given that $x = 1$ at one of the points of intersection of the curves, factorise $x^3 - 5x^2 + 5x - 1$ into a linear and a quadratic factor.

Show that only one of the three roots of $x^3 - 5x^2 + 5x - 1 = 0$ is rational. **[5]**

