OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE

MATHEMATICS (MEI)

4751

Introduction to Advanced Mathematics (C1)

QUESTION PAPER

Candidates answer on the printed answer book.

OCR supplied materials:
- Printed answer book 4751
- MEI Examination Formulae and Tables (MF2)

Other materials required:
None

Wednesday 18 May 2011
Morning

Duration: 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES
These instructions are the same on the printed answer book and the question paper.

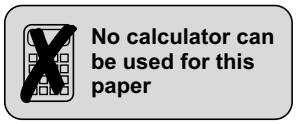
- The question paper will be found in the centre of the printed answer book.
- Write your name, centre number and candidate number in the spaces provided on the printed answer book. Please write clearly and in capital letters.
- **Write your answer to each question in the space provided in the printed answer book.** Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- 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
This information is the same on the printed answer book and the question paper.

- The number of marks is given in brackets **[ ]** at the end of each question or part question on the question paper.
- 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**.
- The printed answer book consists of **12** pages. The question paper consists of **4** pages. Any blank pages are indicated.

INSTRUCTION TO EXAMS OFFICER / INVIGILATOR

- Do not send this question paper for marking; it should be retained in the centre or destroyed.



Section A (36 marks)

1 Solve the inequality $6(x + 3) > 2x + 5$. **[3]**

2 A line has gradient 3 and passes through the point (1, −5). The point (5, k) is on this line. Find the value of k. **[2]**

3 **(i)** Evaluate $\left(\frac{9}{16}\right)^{-\frac{1}{2}}$. **[2]**

(ii) Simplify $\dfrac{(2ac^2)^3 \times 9a^2c}{36a^4c^{12}}$. **[3]**

4 The point P (5, 4) is on the curve $y = \mathrm{f}(x)$. State the coordinates of the image of P when the graph of $y = \mathrm{f}(x)$ is transformed to the graph of

(i) $y = \mathrm{f}(x - 5)$, **[2]**

(ii) $y = \mathrm{f}(x) + 7$. **[2]**

5 Find the coefficient of x^4 in the binomial expansion of $(5 + 2x)^6$. **[4]**

6 Expand $(2x + 5)(x - 1)(x + 3)$, simplifying your answer. **[3]**

7 Find the discriminant of $3x^2 + 5x + 2$. Hence state the number of distinct real roots of the equation $3x^2 + 5x + 2 = 0$. **[3]**

8 Make x the subject of the formula $y = \dfrac{1 - 2x}{x + 3}$. **[4]**

9 A line L is parallel to the line $x + 2y = 6$ and passes through the point (10, 1). Find the area of the region bounded by the line L and the axes. **[5]**

10 Factorise $n^3 + 3n^2 + 2n$. Hence prove that, when n is a positive integer, $n^3 + 3n^2 + 2n$ is always divisible by 6. **[3]**

Section B (36 marks)

11 **(i)** Find algebraically the coordinates of the points of intersection of the curve $y = 4x^2 + 24x + 31$ and the line $x + y = 10$. **[5]**

(ii) Express $4x^2 + 24x + 31$ in the form $a(x + b)^2 + c$. **[4]**

(iii) For the curve $y = 4x^2 + 24x + 31$,

(*A*) write down the equation of the line of symmetry, **[1]**

(*B*) write down the minimum y-value on the curve. **[1]**

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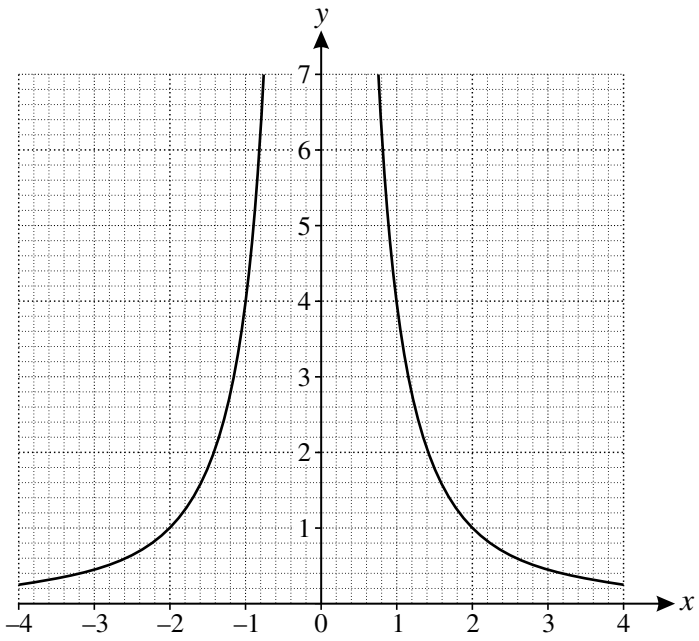

Fig. 12

Fig. 12 shows the graph of $y = \frac{4}{x^2}$.

(i) On the copy of Fig. 12, draw accurately the line $y = 2x + 5$ and hence find graphically the three roots of the equation $\frac{4}{x^2} = 2x + 5$. **[3]**

(ii) Show that the equation you have solved in part **(i)** may be written as $2x^3 + 5x^2 - 4 = 0$. Verify that $x = -2$ is a root of this equation and hence find, in exact form, the other two roots. **[6]**

(iii) By drawing a suitable line on the copy of Fig. 12, find the number of real roots of the equation $x^3 + 2x^2 - 4 = 0$. **[3]**

[Question 13 is printed overleaf.]

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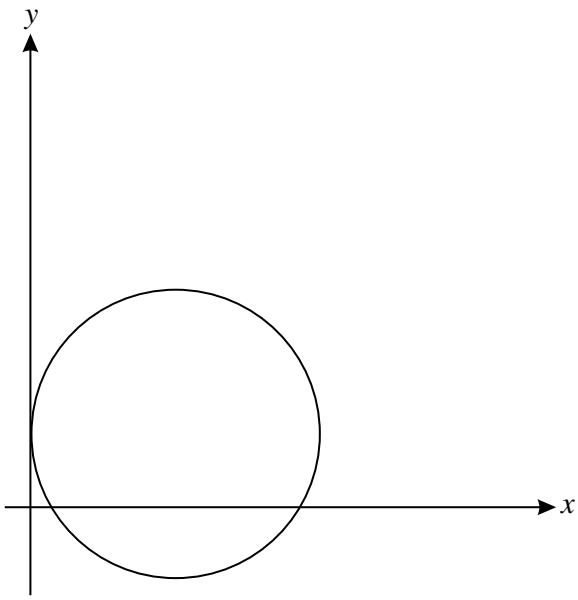

Fig. 13

Fig. 13 shows the circle with equation $(x-4)^2 + (y-2)^2 = 16$.

(i) Write down the radius of the circle and the coordinates of its centre. **[2]**

(ii) Find the x-coordinates of the points where the circle crosses the x-axis. Give your answers in surd form. **[4]**

(iii) Show that the point A $\left(4 + 2\sqrt{2},\ 2 + 2\sqrt{2}\right)$ lies on the circle and mark point A on the copy of Fig. 13.

Sketch the tangent to the circle at A and the other tangent that is parallel to it.

Find the equations of both these tangents. **[7]**