Monday 19 May 2014 – Morning

AS GCE MATHEMATICS (MEI)

4751/01 Introduction to Advanced Mathematics (C1)

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:
- Printed Answer Book 4751/01
- MEI Examination Formulae and Tables (MF2)

Other materials required:
None

Duration: 1 hour 30 minutes

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INSTRUCTIONS TO CANDIDATES

These instructions are the same on the Printed Answer Book and the Question Paper.

- The Question Paper will be found inside 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. HB 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 **8** 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 recycled. Please contact OCR Copyright should you wish to re-use this document.

No calculator can be used for this paper

Section A (36 marks)

1 **(i)** Evaluate $\left(\frac{1}{27}\right)^{\frac{2}{3}}$. **[2]**

(ii) Simplify $\frac{(4a^2c)^3}{32a^4c^7}$. **[3]**

2 A is the point (1, 5) and B is the point (6, −1). M is the midpoint of AB. Determine whether the line with equation $y = 2x - 5$ passes through M. **[3]**

3

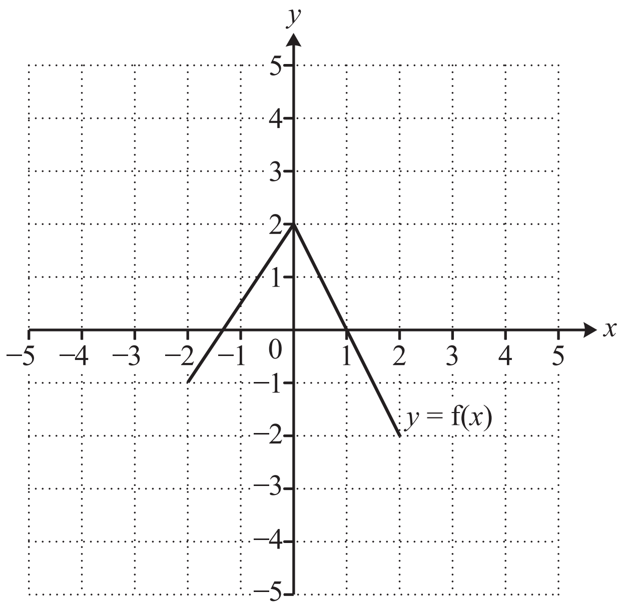

Fig. 3

Fig. 3 shows the graph of $y = \mathrm{f}(x)$. Draw the graphs of the following.

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

(ii) $y = \mathrm{f}(x - 3)$ **[2]**

4 **(i)** Expand and simplify $(7 - 2\sqrt{3})^2$. **[3]**

(ii) Express $\frac{20\sqrt{6}}{\sqrt{50}}$ in the form $a\sqrt{b}$, where a and b are integers and b is as small as possible. **[2]**

5 Make a the subject of $3(a+4) = ac + 5f$. **[4]**

6 Solve the inequality $3x^2 + 10x + 3 > 0$. **[3]**

7 Find the coefficient of x^4 in the binomial expansion of $(5+2x)^7$. **[4]**

8 You are given that $f(x) = 4x^3 + kx + 6$, where k is a constant. When $f(x)$ is divided by $(x-2)$, the remainder is 42. Use the remainder theorem to find the value of k. Hence find a root of $f(x) = 0$. **[4]**

9 You are given that n, $n + 1$ and $n + 2$ are three consecutive integers.

(i) Expand and simplify $n^2 + (n+1)^2 + (n+2)^2$. **[2]**

(ii) For what values of n will the sum of the squares of these three consecutive integers be an even number? Give a reason for your answer. **[2]**

Section B (36 marks)

10 Fig. 10 shows a sketch of a circle with centre C(4, 2). The circle intersects the x-axis at A(1, 0) and at B.

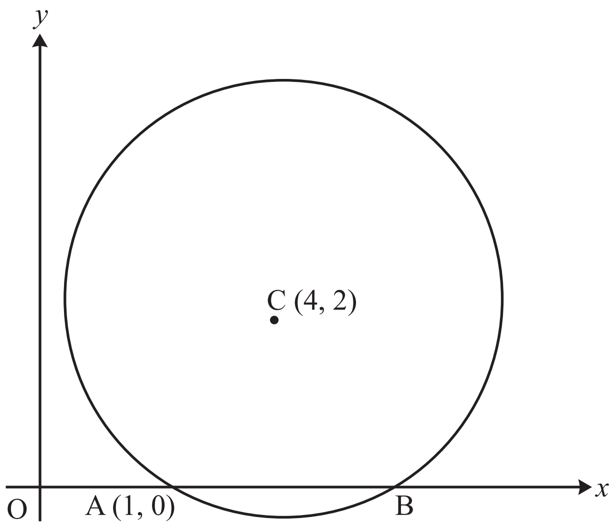

Fig. 10

(i) Write down the coordinates of B. **[1]**

(ii) Find the radius of the circle and hence write down the equation of the circle. **[4]**

(iii) AD is a diameter of the circle. Find the coordinates of D. **[2]**

(iv) Find the equation of the tangent to the circle at D. Give your answer in the form $y = ax + b$. **[4]**

11

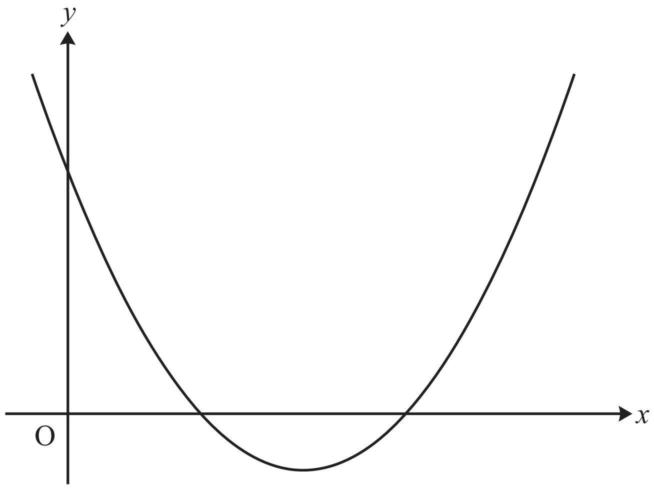

Fig. 11

Fig. 11 shows a sketch of the curve with equation $y = (x-4)^2 - 3$.

(i) Write down the equation of the line of symmetry of the curve and the coordinates of the minimum point. **[2]**

(ii) Find the coordinates of the points of intersection of the curve with the x-axis and the y-axis, using surds where necessary. **[4]**

(iii) The curve is translated by $\begin{pmatrix}2\\0\end{pmatrix}$. Show that the equation of the translated curve may be written as $y = x^2 - 12x + 33$. **[2]**

(iv) Show that the line $y = 8 - 2x$ meets the curve $y = x^2 - 12x + 33$ at just one point, and find the coordinates of this point. **[5]**

12

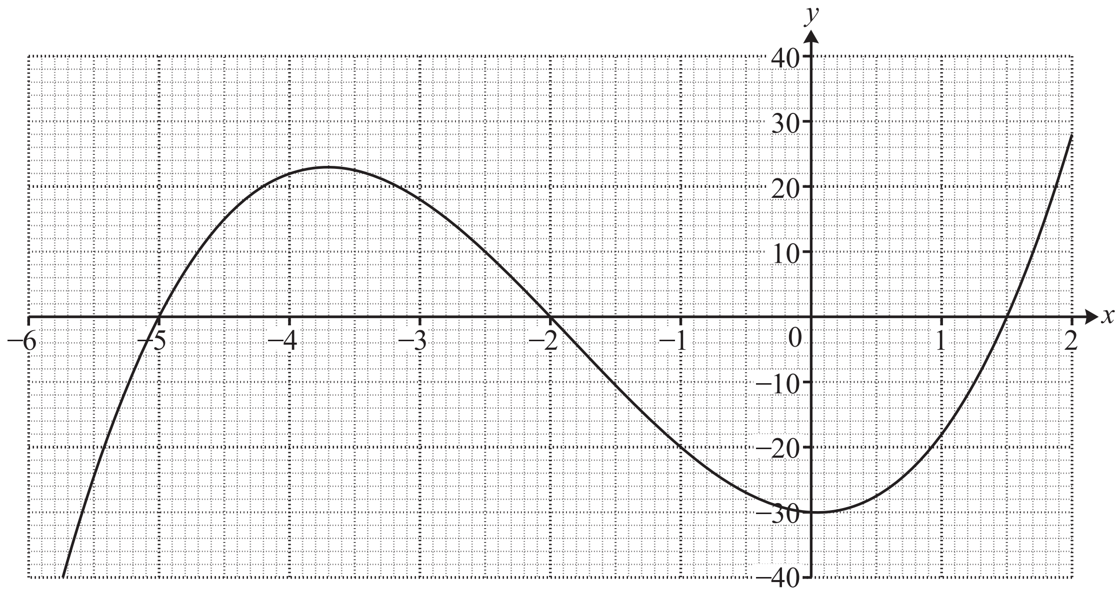

Fig. 12

Fig. 12 shows the graph of a cubic curve. It intersects the axes at (–5, 0), (–2, 0), (1.5, 0) and (0, –30).

(i) Use the intersections with both axes to express the equation of the curve in a factorised form. **[2]**

(ii) Hence show that the equation of the curve may be written as $y = 2x^3 + 11x^2 - x - 30$. **[2]**

(iii) Draw the line $y = 5x + 10$ accurately on the graph. The curve and this line intersect at (–2, 0); find graphically the x-coordinates of the other points of intersection. **[3]**

(iv) Show algebraically that the x-coordinates of the other points of intersection satisfy the equation

$$2x^2 + 7x - 20 = 0.$$

Hence find the exact values of the x-coordinates of the other points of intersection. **[5]**

END OF QUESTION PAPER