# 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

**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**

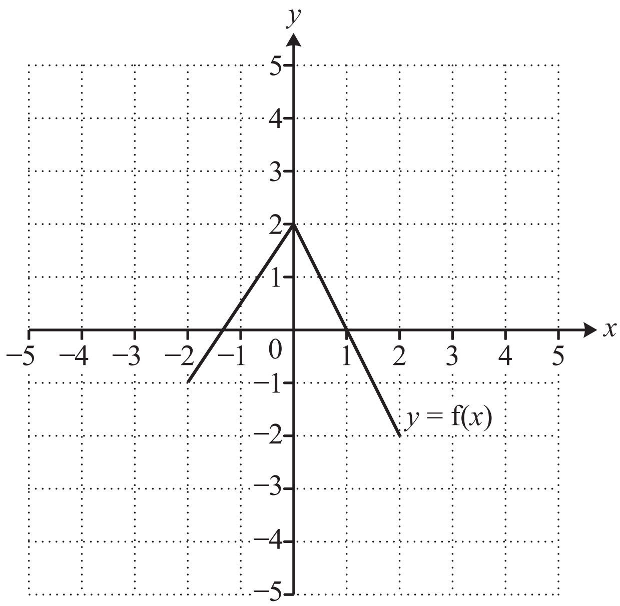


**Fig. 3**

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.

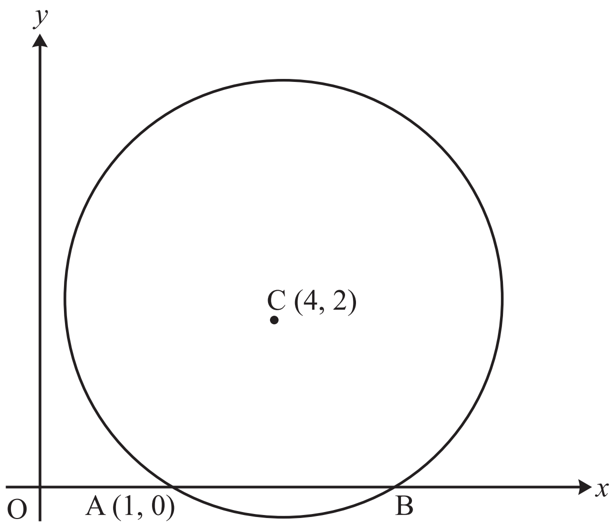


**Fig. 10**

**(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**

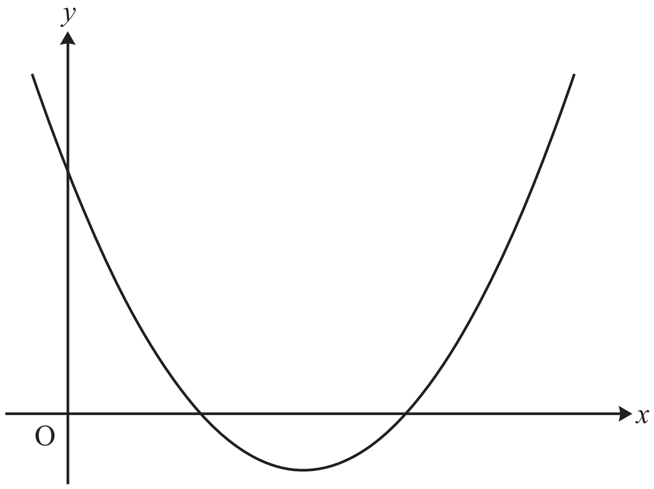


**Fig. 11**

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**

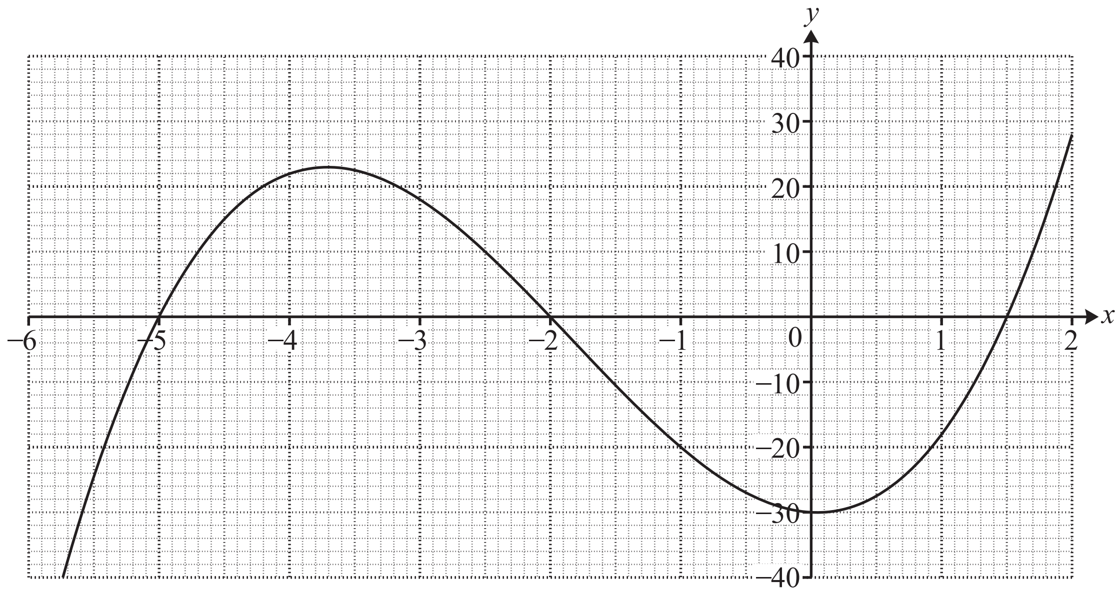


**Fig. 12**

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**