

Friday 13 January 2012 – Morning

AS 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

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. 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.

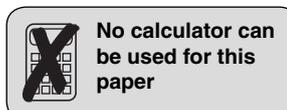
INFORMATION FOR CANDIDATES

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 **4** pages. Any blank pages are indicated.

INSTRUCTION TO EXAMS OFFICER/INVIGILATOR

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**No calculator can
be used for this
paper**

Section A (36 marks)

- 1 Find the equation of the line which is perpendicular to the line $y = 5x + 2$ and which passes through the point $(1, 6)$. Give your answer in the form $y = ax + b$. [3]

2 (i) Evaluate $9^{-\frac{1}{2}}$. [2]

(ii) Simplify $\frac{(4x^4)^3 y^2}{2x^2 y^5}$. [3]

3 Expand and simplify $(n + 2)^3 - n^3$. [3]

4 (i) Expand and simplify $(7 + 3\sqrt{2})(5 - 2\sqrt{2})$. [3]

(ii) Simplify $\sqrt{54} + \frac{12}{\sqrt{6}}$. [2]

- 5 Solve the following inequality.

$$\frac{2x + 1}{5} < \frac{3x + 4}{6} \quad [4]$$

- 6 Rearrange the following equation to make h the subject.

$$4h + 5 = 9a - ha^2 \quad [3]$$

7

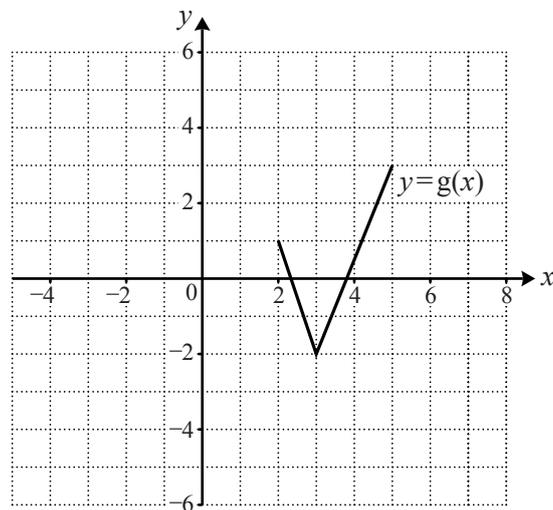


Fig. 7

Fig. 7 shows the graph of $y = g(x)$. Draw the graphs of the following.

(i) $y = g(x) + 3$ [2]

(ii) $y = g(x + 2)$ [2]

8 Express $5x^2 + 15x + 12$ in the form $a(x + b)^2 + c$.

Hence state the minimum value of y on the curve $y = 5x^2 + 15x + 12$. [5]

9 Complete each of the following by putting the best connecting symbol (\Leftrightarrow , \Leftarrow or \Rightarrow) in the box. Explain your choice, giving full reasons.

(i) $n^3 + 1$ is an odd integer n is an even integer [2]

(ii) $(x - 3)(x - 2) > 0$ $x > 3$ [2]

Section B (36 marks)

10 Point A has coordinates (4, 7) and point B has coordinates (2, 1).

(i) Find the equation of the line through A and B. [3]

(ii) Point C has coordinates (-1, 2). Show that angle $ABC = 90^\circ$ and calculate the area of triangle ABC. [5]

(iii) Find the coordinates of D, the midpoint of AC.

Explain also how you can tell, without having to work it out, that A, B and C are all the same distance from D. [3]

11 You are given that $f(x) = 2x^3 - 3x^2 - 23x + 12$.

(i) Show that $x = -3$ is a root of $f(x) = 0$ and hence factorise $f(x)$ fully. [6]

(ii) Sketch the curve $y = f(x)$. [3]

(iii) Find the x -coordinates of the points where the line $y = 4x + 12$ intersects $y = f(x)$. [4]

12 A circle has equation $(x - 2)^2 + y^2 = 20$.

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

(ii) Find the points of intersection of the circle with the y -axis and sketch the circle. [3]

(iii) Show that, where the line $y = 2x + k$ intersects the circle,

$$5x^2 + (4k - 4)x + k^2 - 16 = 0. \quad [3]$$

(iv) Hence find the values of k for which the line $y = 2x + k$ is a tangent to the circle. [4]

THERE ARE NO QUESTIONS WRITTEN ON THIS PAGE.



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