

**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.

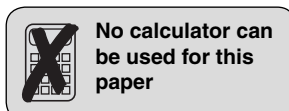
**INFORMATION FOR CANDIDATES**

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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## 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

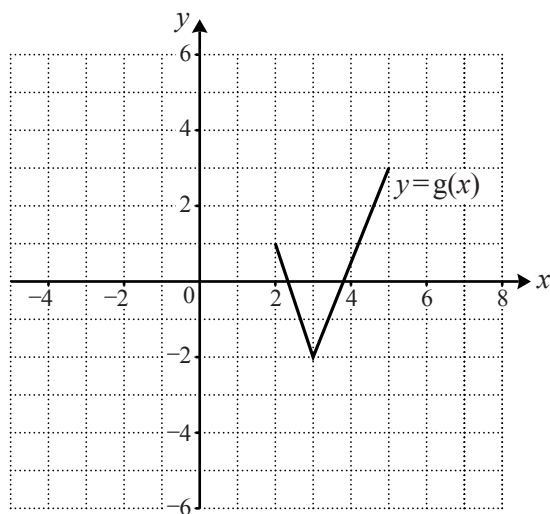


Fig. 7

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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