

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.

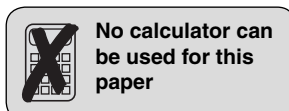
INFORMATION FOR CANDIDATES

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

- 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.



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

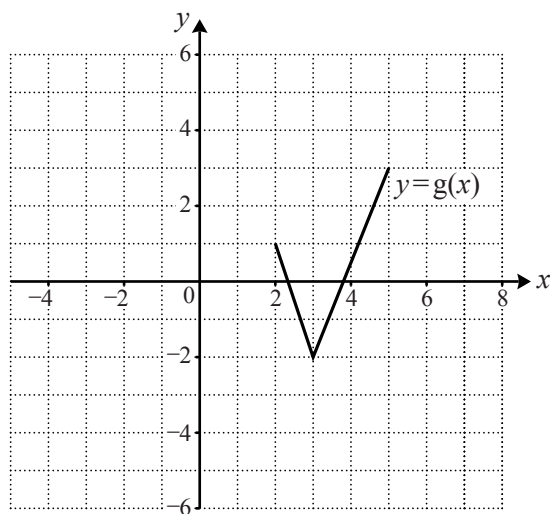


Fig. 7

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,

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

(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.



Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series. If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.