OXFORD CAMBRIDGE AND RSA EXAMINATIONS

AS GCE

4751

MATHEMATICS (MEI)

Introduction to Advanced Mathematics (C1)

QUESTION PAPER

FRIDAY 13 JANUARY 2012: Morning
DURATION: 1 hour 30 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

Candidates answer on the Printed Answer Book, or any suitable paper provided by the centre. The Printed Answer Book may be enlarged by the centre.

OCR SUPPLIED MATERIALS:

Printed Answer Book 4751
Insert for question 7 (inserted)
MEI Examination Formulae and Tables (MF2)

OTHER MATERIALS REQUIRED:

None

READ INSTRUCTIONS OVERLEAF

DC (LEO/SW) 12MEP01014 55371/1

INSTRUCTIONS TO CANDIDATES

- **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.**
- **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

- **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.**

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 $\dfrac{(4x^4)^3 y^2}{2x^2 y^5}$. [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 $\sqrt{54} + \dfrac{12}{\sqrt{6}}$. [2]

5 Solve the following inequality.

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

6 Rearrange the following equation to make h the subject.

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

7 The following diagram is Fig. 7.

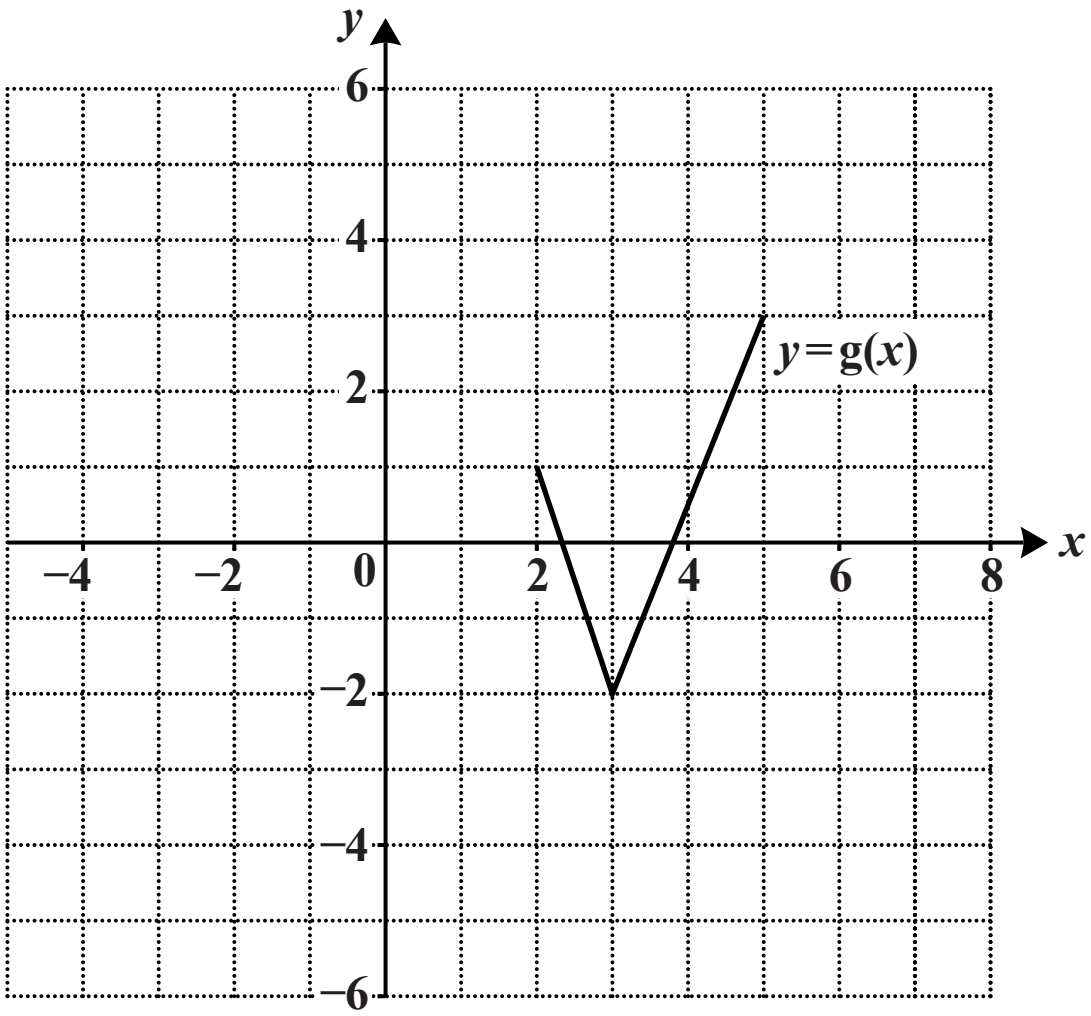

Fig. 7

Fig. 7 shows the graph of $y = g(x)$. Draw the graphs of the following. [You may use the insert provided.]

(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° 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]