OCR
Oxford Cambridge and RSA

Wednesday 13 May 2015 – Morning

AS GCE MATHEMATICS (MEI)

4751/01   Introduction to Advanced Mathematics (C1)

QUESTION PAPER

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 **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.

No calculator can be used for this paper

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Turn over

Section A (36 marks)

1 Make r the subject of the formula $A = \pi r^2(x+y)$, where $r > 0$. **[2]**

2 A line L is parallel to $y = 4x + 5$ and passes through the point $(-1, 6)$. Find the equation of the line L in the form $y = ax + b$. Find also the coordinates of its intersections with the axes. **[5]**

3 Evaluate the following.

   (i) 200^0 **[1]**

   (ii) $\left(\dfrac{25}{9}\right)^{-\frac{1}{2}}$ **[3]**

4 Solve the inequality $\dfrac{4x-5}{7} > 2x + 1$. **[3]**

5 Find the coordinates of the point of intersection of the lines $y = 5x - 2$ and $x + 3y = 8$. **[4]**

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

   (ii) Express $\sqrt{72} + \dfrac{32}{\sqrt{2}}$ in the form $a\sqrt{b}$, where a and b are integers and b is as small as possible. **[2]**

7 Find and simplify the binomial expansion of $(3x - 2)^4$. **[4]**

8 Fig. 8 shows a right-angled triangle with base $2x + 1$, height h and hypotenuse $3x$.
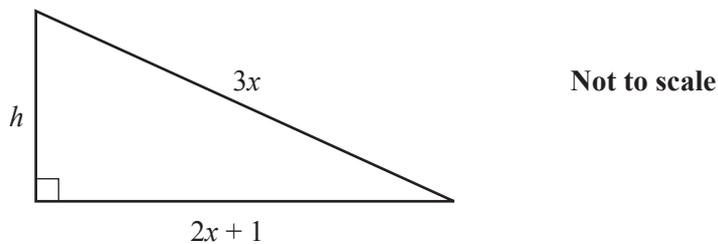
Fig. 8

   (i) Show that $h^2 = 5x^2 - 4x - 1$. **[2]**

   (ii) Given that $h = \sqrt{7}$, find the value of x, giving your answer in surd form. **[3]**

9 Explain why each of the following statements is false. State in each case which of the symbols $\Rightarrow$, $\Leftarrow$ or $\Leftrightarrow$ would make the statement true.

   (i) ABCD is a square $\Leftrightarrow$ the diagonals of quadrilateral ABCD intersect at $90°$ **[2]**

   (ii) x^2 is an integer $\Rightarrow x$ is an integer **[2]**

Section B (36 marks)

10 You are given that $f(x) = (x+3)(x-2)(x-5)$.

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

    (ii) Show that $f(x)$ may be written as $x^3 - 4x^2 - 11x + 30$. **[2]**

    (iii) Describe fully the transformation that maps the graph of $y = f(x)$ onto the graph of $y = g(x)$, where $g(x) = x^3 - 4x^2 - 11x - 6$. **[2]**

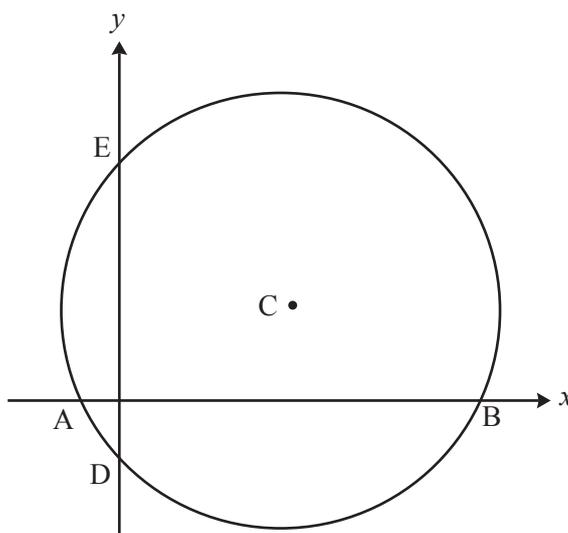   **(iv)** Show that $g(-1) = 0$. Hence factorise $g(x)$ completely. **[5]**

11

Fig. 11

Fig. 11 shows a sketch of the circle with equation $(x-10)^2 + (y-2)^2 = 125$ and centre C. The points A, B, D and E are the intersections of the circle with the axes.

    (i) Write down the radius of the circle and the coordinates of C. **[2]**

    (ii) Verify that B is the point (21, 0) and find the coordinates of A, D and E. **[4]**

    (iii) Find the equation of the perpendicular bisector of BE and verify that this line passes through C. **[6]**

12   **(i)** Find the set of values of k for which the line $y = 2x + k$ intersects the curve $y = 3x^2 + 12x + 13$ at two distinct points. **[5]**

    (ii) Express $3x^2 + 12x + 13$ in the form $a(x+b)^2 + c$. Hence show that the curve $y = 3x^2 + 12x + 13$ lies completely above the x-axis. **[5]**

    (iii) Find the value of k for which the line $y = 2x + k$ passes through the minimum point of the curve $y = 3x^2 + 12x + 13$. **[2]**

END OF QUESTION PAPER