ADVANCED SUBSIDIARY 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

Monday 10 January 2011
Morning

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. 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 destroyed.

No calculator can be used for this paper

Turn over

2
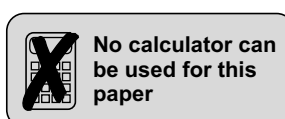
Section A (36 marks)

1 Find the equation of the line which is parallel to $y = 5x - 4$ and which passes through the point (2, 13). Give your answer in the form $y = ax + b$. **[3]**

2 **(i)** Write down the value of each of the following.

      (*A*) 4^{-2} **[1]**

      (*B*) 9^0 **[1]**

  (ii) Find the value of $\left(\dfrac{64}{125}\right)^{\frac{4}{3}}$. **[2]**

3 Simplify $\dfrac{(3xy^4)^3}{6x^5y^2}$. **[3]**

4 Solve the inequality $5 - 2x < 0$. **[2]**

5 The volume V of a cone with base radius r and slant height l is given by the formula

$$V = \tfrac{1}{3}\pi r^2\sqrt{l^2 - r^2}.$$

Rearrange this formula to make l the subject. **[4]**

6 Find the first 3 terms, in ascending powers of x, of the binomial expansion of $(2 - 3x)^5$, simplifying each term. **[4]**

7 **(i)** Express $\dfrac{81}{\sqrt{3}}$ in the form 3^k. **[2]**

  (ii) Express $\dfrac{5 + \sqrt{3}}{5 - \sqrt{3}}$ in the form $\dfrac{a + b\sqrt{3}}{c}$, where a, b and c are integers. **[3]**

8 Find the coordinates of the point of intersection of the lines $x + 2y = 5$ and $y = 5x - 1$. **[3]**

9 Fig. 9 shows a trapezium ABCD, with the lengths in centimetres of three of its sides.
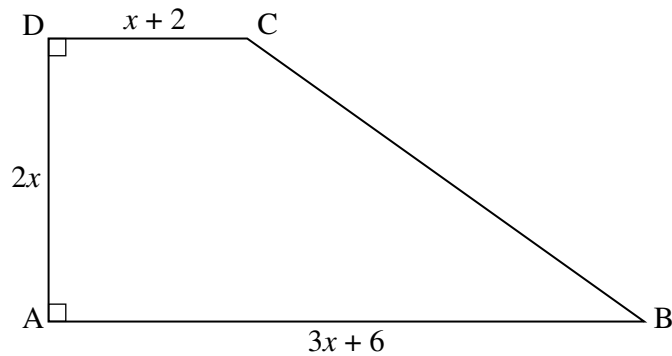

Fig. 9

This trapezium has area $140 \, \text{cm}^2$.

   (i) Show that $x^2 + 2x - 35 = 0$. **[2]**

   (ii) Hence find the length of side AB of the trapezium. **[3]**

10 Select the best statement from

     $P \Rightarrow Q$
     $P \Leftarrow Q$
     $P \Leftrightarrow Q$
     none of the above

to describe the relationship between P and Q in each of the following cases.

   (i) P : WXYZ is a quadrilateral with 4 equal sides
       Q : WXYZ is a square

   (ii) P : n is an odd integer
       Q : $(n + 1)^2$ is an odd integer

   (iii) P : n is greater than 1 and n is a prime number
       Q : $\sqrt{n}$ is not an integer **[3]**

Section B (36 marks)

11 The points A $(-1, 6)$, B $(1, 0)$ and C $(13, 4)$ are joined by straight lines.

   (i) Prove that the lines AB and BC are perpendicular. **[3]**

   (ii) Find the area of triangle ABC. **[3]**

   (iii) A circle passes through the points A, B and C. Justify the statement that AC is a diameter of this circle. Find the equation of this circle. **[6]**

   (iv) Find the coordinates of the point on this circle that is furthest from B. **[1]**

12 **(i)** You are given that $f(x) = (2x-5)(x-1)(x-4)$.

      (A) Sketch the graph of $y = f(x)$.   **[3]**

      (B) Show that $f(x) = 2x^3 - 15x^2 + 33x - 20$.   **[2]**

  (ii) You are given that $g(x) = 2x^3 - 15x^2 + 33x - 40$.

      (A) Show that $g(5) = 0$.   **[1]**

      (B) Express $g(x)$ as the product of a linear and quadratic factor.   **[3]**

      (C) Hence show that the equation $g(x) = 0$ has only one real root.   **[2]**

  (iii) Describe fully the transformation that maps $y = f(x)$ onto $y = g(x)$.   **[2]**

13
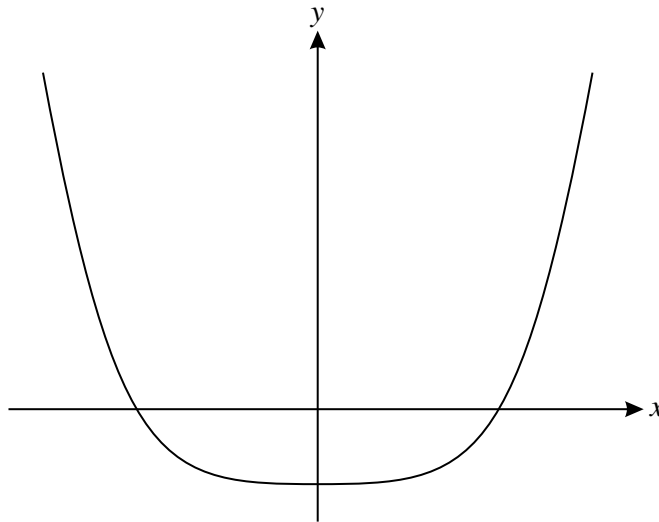
Fig. 13

Fig. 13 shows the curve $y = x^4 - 2$.

  (i) Find the exact coordinates of the points of intersection of this curve with the axes.   **[3]**

  (ii) Find the exact coordinates of the points of intersection of the curve $y = x^4 - 2$ with the curve $y = x^2$.   **[5]**

  (iii) Show that the curves $y = x^4 - 2$ and $y = kx^2$ intersect for all values of k.   **[2]**