MEI

Mathematics in Education and Industry

MEI STRUCTURED MATHEMATICS

INTRODUCTION TO ADVANCED MATHEMATICS, C1

Practice Paper C1-A

Additional materials: Answer booklet/paper
Graph paper
MEI Examination formulae and tables (MF12)

TIME 1 hour 30 minutes

INSTRUCTIONS

- Write your Name on each sheet of paper used or the front of the booklet used.
- Answer **all** the questions.
- You are **not** permitted to use a graphical calculator in this paper.

INFORMATION

- The number of marks is given in brackets [] at the end of each question or part-question.
- 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.
- Final answers should be given to a degree of accuracy appropriate to the context.
- The total number of marks for this paper is **72**.

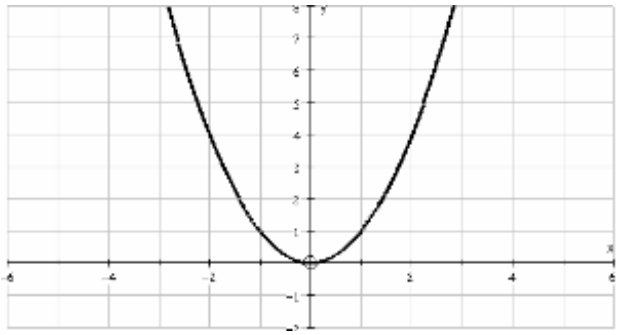
Section A (36 marks)

1 Find the equation of the line which passes through (1, 3) and (4, 9). [2]

2 Find the range of values of x for which $x^2 - 5x + 6 \leq 0$. [3]

3 Write $\left(\sqrt{3}-\sqrt{2}\right)^2$ in the form $a+b\sqrt{6}$ where a and b are integers to be determined. [4]

4



The graph shows a function $y = f(x)$.

On separate graphs, sketch the graphs of the following functions:

(i) $y = f(x) + 1$, **(ii)** $y = f(x+1)$. [4]

5 Make u the subject of the formula

$$\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$$ [4]

6 The equation of a circle is $x^2 + y^2 - 2x - 8 = 0$.
Find the centre and radius of the circle. [4]

7 Show that $(x - 2)$ is a factor of $f(x) = x^3 - x^2 - 4x + 4$.
Hence solve the equation $x^3 - x^2 - 4x + 4 = 0$. [5]

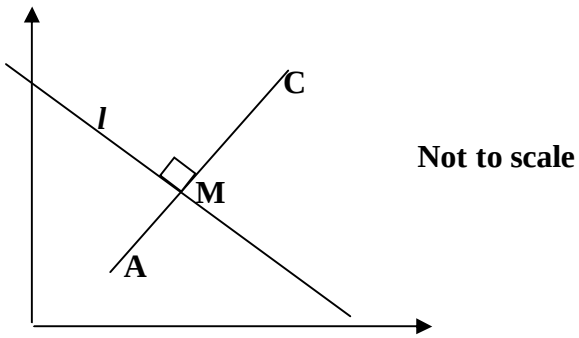
8 Find the points where the line $y = 2x - 3$ cuts the curve $y = x^2 - 4x + 5$. [5]

9 **(i)** Simplify $\dfrac{2^6}{8^{2\frac{1}{2}} \times 2^{-\frac{1}{2}}}$ [3]

(ii) Solve the equation $x^{-\frac{1}{3}} = 8$. [2]

Section B (36 marks)

10



Not to scale

Fig. 10

In Fig.10, A has coordinates (1, 1) and C has coordinates (3, 5). M is the mid-point of AC. The line *l* is perpendicular to AC.

(i) Find the coordinates of M.
Hence find the equation of *l*. [5]

(ii) The point B has coordinates (-2, 5).
Show that B lies on the line *l*.
Find the coordinates of the point D such that ABCD is a rhombus. [4]

(iii) Find the lengths MC and MB.
Hence calculate the area of the rhombus ABCD. [3]

11 **(i)** Multiply out $(x - p)(x - q)$. [1]

(ii) You are given that $p = 2 + \sqrt{3}$ and $q = 2 - \sqrt{3}$ are the roots of a quadratic equation. Find $p + q$ and pq and hence find the quadratic equation with roots $x = p$ and $x = q$. [4]

(iii) Solve the quadratic equation $x^2 + 5x - 7 = 0$ giving the roots exactly. [3]

(iv) Show that $x = 1$ is the only root of the equation $x^3 + 2x - 3 = 0$. [3]

(v) A quadratic equation $x^2 + rx + s = 0$, where r and s are integers, has two roots. One root is $x = 3 + \sqrt{5}$. Without finding r or s, write down the other root. [1]

12 **(i)** Expand $(1 + 2x)^6$, simplifying all the terms. [3]

(ii) Hence find an expression for $f(x) = (1 + 2x)^6 + (1 - 2x)^6$ in its simplest form. [3]

(iii) Substituting $x = 0.01$ into the first two terms of $f(x)$ gives an approximate value, z for $1.02^6 + 0.98^6$. Find z.

By considering the value of the third term, comment on the accuracy of z as an approximation for $1.02^6 + 0.98^6$. [6]