

MONDAY, 16 JUNE - MORNING, 9.30 to 12.00

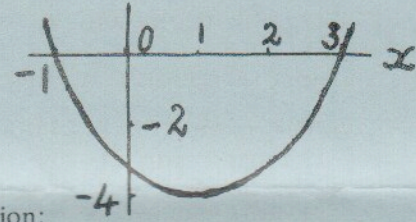
Attempt **QUESTION 1** and **FOUR** other questions

1. (i) Express 0.75 as a percentage of 3.75.
 (ii) Calculate the sum of the first 50 terms of the arithmetical sequence 1, 2, 3, 4,
 (iii) Taking 1 as the first term write out the first three terms of the binomial expansion of $(1 + 0.01)^{10}$ and calculate their sum.
 (iv) Two people *A* and *B* scored marks as shown

Subjects		English	Irish	Mathematics
Marks	<i>A</i>	40	74	90
	<i>B</i>	50	60	90

If weights of 4, 3, 3, respectively, are assigned to English, Irish and Mathematics, find which of *A* or *B* scored higher overall.

- (v) $x + 1$ is a factor of $x^3 - 3x^2 + kx - 1$. Find the value of k .
 (vi) Part of the graph of $x \rightarrow (x - 1)^2 - 4$ is shown. State the range of values of x for which $(x - 1)^2 \leq 4$



- (vii) Draw a histogram to represent the frequency distribution:

Class	0 - 5	5 - 15	15 - 20	20 - 30
Frequency	5	20	10	10

- (viii) Factorise $27x^3 - 1$.
 (ix) For what values of x does the slope of the tangent to $y = 4 - (x - 1)^2$ have values greater than zero?
 (x) f and g are two functions defined on \mathbf{R} . $f : x \rightarrow x^2 - 1$
 $g : x \rightarrow 1 - x^2$
 Write the composite function fg in terms of x .

(100 marks)

2. (a) (i) Verify that $z_1 = 2 + 3i$ is a root of $z^2 - 4z + 13 = 0$.
 (ii) Find the value of $|z_1|$.
 (iii) On an Argand diagram illustrate z_1 and the image of z_1 under the central symmetry in the origin.
 (b) If $a + ib = \frac{5}{1 + 2i}$, where $a, b \in \mathbf{R}$, calculate the value of a and the value of b .

(40 marks)

3. (a) Solve

$$\frac{x}{x - 1} + \frac{1}{(x - 1)(x - 2)} = \frac{3x}{x - 2} \quad \text{where } x \notin \{1, 2\}.$$

- (b) Solve the simultaneous equations

$$\begin{aligned} x + 3y &= 8 \\ y - 2z &= 1 \\ z - x &= 0 \end{aligned}$$

and test your solutions.

4. The function $f : x \rightarrow 2x^3 - 3x^2 - 6x + 2$ is defined on the domain $-2 \leq x \leq 3$ for $x \in \mathbb{R}$.

- (i) Draw the graph of f and from the graph estimate the values of x for which $f(x) = 0$.
- (ii) Use the graph to estimate the least value of $f(x)$ in $0 \leq x \leq 3$.
- (iii) If $g : x \rightarrow f(x) + k$, find the value of k when the x -axis is a tangent to the graph of g in $0 \leq x \leq 3$.

(50 marks)

5. Assuming the data can be taken at the mid-interval values, calculate the mean and the standard deviation of the following grouped frequency distribution:

Class interval	0 - 4	4 - 8	8 - 12	12 - 16	16 - 20
frequency	2	6	12	6	2

[Note: 0 - 4 means ≥ 0 but less than 4, etc.]

(50 marks)

6. (a) Calculate the compound interest on £10 000 for 3 years at 20% per annum.

(b) (i) Calculate the sum of the first four terms of the Geometric series $1.2 + (1.2)^2 + \dots$

- (ii) A person deposited £1 000 in a bank on June 1st, each year, for 4 consecutive years. The bank rate of 20% per annum remained steady throughout. When the fourth £1 000 had remained at interest for a full year, the person withdrew all four deposits and their interests. How much was withdrawn?

(50 marks)

7. (i) Using the same axes and the same scales and taking $x, y \in \mathbb{R}$ graph the following inequalities:

$$P_1 : y \geq 0$$

$$P_2 : 9x + 5y \geq 1800$$

$$P_3 : 4x + 5y \leq 1000$$

(ii) Indicate the set of points $A = P_1 \cap P_2 \cap P_3$.

(iii) Calculate the coordinates of the vertex common to P_2 and P_3 .

(iv) Calculate the value of $100x + 75y$ for each vertex of A .

(50 marks)

8. (a) Differentiate $2x - x^2$ with respect to x from first principles.

(b) (i) Find $\frac{dy}{dx}$ for $y = \frac{1 + x^2}{1 - x^2}$, $x \neq \pm 1$ and calculate its value when $x = \frac{1}{2}$.

(ii) Find the slope of the tangent to the graph of

$$y = (3x^2 - 2x - 7)^2 \quad \text{at } x = -1.$$

(c) Find $\frac{dy}{dx}$ for $y = (x - 4)(x + 2)$ and hence find (x, y) , the coordinates of the local minimum.

Draw a rough sketch of $y = (x - 4)(x + 2)$.

(50 marks)