

MATHEMATICS (M020)

Maximum Marks: 64

Time allowed: 120 minutes

Answers to this Paper must be written on the paper provided separately.

*You will **not** be allowed to write during first 10 minutes.*

This time is to be spent in reading the question paper.

The time given at the head of this Paper is the time allowed for writing the answers

*Attempt **all** questions from **Section A** and **any three** questions from **Section B**.*

All working, including rough work, must be clearly shown, and must be done on the same sheet as the rest of the answer.

Omission of essential working will result in loss of marks.

The intended marks for questions or parts of questions are given in brackets []

Mathematical tables and graph papers are provided

SECTION A (34 marks)

*(Attempt **all** questions from this **Section**)*

Question 1

Choose the correct answers to the questions from the given options. [14]

(Do not copy the questions, write the correct answers only.)

- (i) Mohit opened a recurring deposit account in a bank for 2 years. He deposited ₹ 1,000 every month and received ₹ 25,500 on maturity. The interest he earned in 2 years is:

(a) ₹ 13,500

(c) ₹ 24,000

(b) ₹ 3,000

(d) ₹ 1,500

(ii) Which of the following quadratic equation has 2 and 3 as its roots?

(a) $x^2 - 5x + 6 = 0$

(c) $x^2 - 5x - 6 = 0$

(b) $x^2 + 5x + 6 = 0$

(d) $x^2 + 5x - 6 = 0$

(iii) The solution set of the inequation: $x - 3 \geq -5$, $x \in \mathbb{R}$ is:

(a) $[x : x > -2, x \in \mathbb{R}]$

(c) $[x : x \geq -2, x \in \mathbb{R}]$

(b) $[x : x \leq -2, x \in \mathbb{R}]$

(d) $[-2, -1, 0, 1, 2]$

(iv) Polynomial $x^3 - 2x^2 + ax + 12$ when divided by $(x + 1)$ leaves a remainder 20, then a is:

(a) -31

(c) 11

(b) 9

(d) -11

(v) If $\begin{bmatrix} 1 & 2 \\ 2 & 9 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 20 \\ 90 \end{bmatrix}$, then the values of x and y are respectively:

(a) 0, 10

(c) 6, 4

(b) 5, 5

(d) 10, 0

(vi) Shefali opened a recurring deposit account in a bank and deposited ₹ 800 per month for $1\frac{1}{2}$ years. Then, the total money deposited in the account is:

(a) ₹ 11,400

(c) ₹ 13,680

(b) ₹ 14,400

(d) None of these.

(vii) If the mean and median of a set of numbers are 9 and 10 respectively, then mode will be:

(a) 14

(c) 12

(b) 10

(d) 15

(viii) The remainder when $p(x) = 5x^3 - 3x^2 - 4x + 1$ is divided by $g(x) = x - \sqrt{3}$ is:

(a) $26 - 11\sqrt{3}$

(c) $-26 - 11\sqrt{3}$

(b) $11\sqrt{3} - 8$

(d) $26 + 11\sqrt{3}$

(ix) The solution set of the inequation $2y - 5 \leq 5y + 4 \leq 11$ where $y \in \mathbb{I}$ is:

- (a) $[1, 2, 3, 4, 5]$ (c) $[-3, -2, -1, 0, 1]$
(b) $[0, 1, 2, 3, 4, 5]$ (d) None of these

(x) For what values of k , $x^2 + kx - 1 = 0$ has real and unequal roots?

- (a) 0 (c) 2
(b) -1 (d) Any real number

(xi) If the two numbers differ by 3 and the sum of their squares is 117, then the numbers are:

- (a) 5, 8 (c) 7, 10
(b) 6, 9 (d) 4, 7

(xii) Solve the inequation $\frac{2x+1}{2} + 2(3-x) \geq 7, x \in \mathbb{R}$

- (a) $x \leq -\frac{1}{2}$ (c) $-1\frac{1}{2} < x < -\frac{3}{2}$
(b) $x \geq -\frac{1}{2}$ (d) None of these

(xiii) If $\frac{x^3 + 12x}{6x^2 + 8} = \frac{y^3 + 27y}{9y^3 + 27}$, then using componendo, the ratio $x : y$ is equal to:

- (a) 2 : 3 (c) 1 : 3
(b) 12 : 27 (d) 3 : 4

(xiv) The solution set of the inequality $\frac{3x}{5} - \frac{(2x-1)}{3} > 1, x \in \mathbb{W}$ is:

- (a) $\{0, 1, 1\}$ (c) ϕ
(b) $\{3, 4\}$ (d) None of these

Question 2

(i) Given $A = \begin{bmatrix} x & 3 \\ y & 3 \end{bmatrix}$ If $A^2 = 3I$, find x and y . [3]

(ii) What number must be added to the polynomial $2x^3 - 3x^2 - 8x$, so that it leaves a remainder 10 when divided by $2x + 1$. [3]

(iii) Kashika needs ₹ 34,944.8 after 5 years. How much money should she deposit every month in a recurring deposit account to get required money at the end of 5 years, the rate of interest being 8% p.a.? [4]

Question 3

(i) In the following inequation, what is the minimum value of x ? [3]

$$\frac{1}{2} \left(\frac{3x}{2} + 4 \right) \geq \frac{1}{3}(x - 6), \quad x \in \mathbb{R}$$

(ii) What are the roots of the following quadratic equation: [3]

$$9x^2 - 6ax + a^2 - b^2 = 0$$

(iii) Find x from the following equation using the properties of proportions: [4]

$$\frac{x^2 - x + 1}{x^2 + x + 1} = \frac{14(x - 1)}{13(x + 1)}$$

SECTION B (30 marks)

(Attempt **any three** questions from this **Section**)

Question 4

- (i) Find the value of x and y if: [3]

$$2 \begin{bmatrix} x & 7 \\ 9 & y-5 \end{bmatrix} + \begin{bmatrix} 6 & -7 \\ 4 & 5 \end{bmatrix} = \begin{bmatrix} 10 & 7 \\ 22 & 15 \end{bmatrix}$$

- (ii) Rekha opened a recurring deposit account for 20 months. The rate of interest is 9% p.a. and Rekha receives ₹ 441 as interest at the time of maturity. Find the amount Rekha deposited each month. [3]

- (iii) Calculate the mean of the following frequency distribution: [4]

Interval	5-15	15-25	25-35	35-45	45-55
Frequency	2	6	4	8	4

Question 5

- (i) Solve for x : $\sqrt{13-3x} = x-3$ [3]

- (ii) Using properties of proportion solve for x : [3]

$$\frac{\sqrt{5x} + \sqrt{2x-6}}{\sqrt{5x} - \sqrt{2x-6}} = 4$$

- (iii) Solve the following inequation and represent the solution set on the number line. [4]

$$\frac{3x}{5} + 2 < x + 4 \leq \frac{x}{2} + 5, x \in \mathbb{R}$$

Question 6

- (i) A man deposited ₹ 200 per month in a recurring deposit account at 9% p.a. and earned a total interest of ₹ 1,764. How many installments did he pay? [3]
- (ii) If $3A = 5B = 6C$, then, find $A : B : C$. [3]
- (iii) The mean of the following distribution is 50. Find the unknown frequency. [4]

Class	Frequency
0-20	6
20-40	f
40-60	8
60-80	12
80-100	8

Question 7

- (i) Find a 2×2 matrix X which satisfies the equation: [4]

$$\begin{bmatrix} 3 & 7 \\ 2 & 4 \end{bmatrix} \begin{bmatrix} 0 & 2 \\ 5 & 3 \end{bmatrix} + 2X = \begin{bmatrix} 1 & -5 \\ -4 & 6 \end{bmatrix}$$

- (ii) The data on the number of patients attending a hospital in a month are given below. Find the average (mean) number of patients attending the hospital in a month by using the shortcut method. [6]

Take the assumed mean as 45. Give your answer correct to 2 decimal places.

No. of patients	No. of days
10-20	5
20-30	2
30-40	7
40-50	9
50-60	2
60-70	5