

# MATHEMATICS (M020)

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*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*

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*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*

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## 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 ₹ 25,000 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  $x \in \mathbb{I}$  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)  $\phi$   
(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]

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

(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  $2 \times 2$  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