MATHEMATICS (M006)

Maximum Marks: 40

Time allowed: ***60 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 two*** *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 (20 marks)

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

Question 1

Choose the correct answers to the questions from the given options. [7]
(Do not copy the questions, write the correct answers only.)

(i) If $(2x^2 - 5y^2) : xy = 1 : 3$, then $x : y$ is:

(a) 3:2

(b) -5:3

(c) 5:3

(d) -3:2

(ii) If $A = \begin{bmatrix} 7 & 3 \\ 5 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 5 \\ 4 & 5 \end{bmatrix}$, then the matrix C such that $2A + 3C = 8B$, is:

(a) $\begin{bmatrix} 2 & 24 \\ 22 & 36 \end{bmatrix}$

(b) $\begin{bmatrix} \frac{2}{3} & \frac{34}{3} \\ \frac{22}{3} & \frac{36}{3} \end{bmatrix}$

(c) $\begin{bmatrix} \frac{2}{3} & \frac{22}{3} \\ \frac{36}{3} & \frac{34}{3} \end{bmatrix}$

(d) $\begin{bmatrix} 1 & 17 \\ 11 & 18 \end{bmatrix}$

(iii) Using the remainder theorem, the factors of the polynomial $x^3 + x^2 - 4x - 4$ are:

(a) $(x+1), (x-2), (x-2)$

(b) $(x-1), (x+1), (x+2)$

(c) $(x+1), (x+1), (x-2)$

(d) $(x+1), (x+2), (x-2)$

(iv) The set of values of x, satisfying both $7x + 3 \geq 3x - 5$ and $\frac{x}{4} - 5 \leq \frac{5}{4} - x, x \in \mathbb{N}$ is:

(a) { -2, -1, 0, 1, 2, 3, 4, 5 }

(b) { 1, 2, 3, 4, 5 }

(c) { 0, 1, 2, 3, 4, 5 }

(d) None of the above

(v) If $(x+1)(2x+8) = (x+7)(x+3)$, the using factorisation method, the value of x are:

(a) $\sqrt{12}, \sqrt{13}$

(b) $-\sqrt{13}, -\sqrt{13}$

(c) $\pm\sqrt{13}$

(d) $\sqrt{13}, \sqrt{13}$

(vi) Evaluate: $\dfrac{\sec A}{\sec A - 1} + \dfrac{\sec A}{\sec A + 1}$

(a) $(1 + \text{cosec } A)$

(b) $(2 + \sec A)$

(c) $3 \sec A$

(d) $2 \text{ cosec}^2 A$

(vii) Following is the distribution of monthly wages of 200 employees in a factory:

Wages (₹)	No. of workers
80 – 100	20
100 – 120	30
120 – 140	20
140 – 160	40
160 – 180	90

Calculate the average income of the employees:

(a) 150

(c) 140

(b) 145

(d) 135

Question 2

(i) Prove that [4]

$$\frac{\sin\theta - 2\sin^3\theta}{2\cos^3\theta - \cos\theta} = \tan\theta$$

(ii) Given [4]

$$A = \begin{bmatrix} 2 & -6 \\ 2 & 0 \end{bmatrix}, B = \begin{bmatrix} -3 & 2 \\ 4 & 0 \end{bmatrix}, C = \begin{bmatrix} 4 & 0 \\ 0 & 2 \end{bmatrix}$$

Determine the matrix X, such that

$$A + 2X = 2B + C$$

(iii) The expression $2x^3 + ax^2 + bx - 2$ leaves the remainder 7 and 0 when divided by $(2x - 3)$ and $(x + 2)$ respectively.

Calculate the value of a, and b.

With these values of a and b, factorise the expression completely. [5]

SECTION B (20 marks)

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

Question 3

(i) Solve the following inequalities: [3]

$$-\frac{x}{3} - 4 \leq \frac{x}{2} - \frac{7}{3} < -\frac{7}{6}, x \in \mathbb{R}$$

Represent the solution set on a number line.

(ii) Solve for x: [3]

$$9^{x+2} - 6.3^{x+1} + 1 = 0$$

(iii) Given: [4]

$$\frac{x^3 + 12x}{6x^2 + 8} = \frac{y^3 + 27y}{9y^2 + 27}$$

Using componendo and dividendo find $x : y$.

Question 4

(i) The matured value of a RD account is ₹ 16,176. If the monthly installment is ₹ 400 and the rate of interest is 8% p.a., what is the time period of this R.D. account? [3]

(ii) If $\cos\theta + \sin\theta = \sqrt{2}\cos\theta$, show that: [3]

$$\cos\theta - \sin\theta = \sqrt{2}\sin\theta$$

(iii) Solve and graph the solution on a number line: [4]

$$\frac{3x}{5} - \frac{2x-1}{3} > 1, x \in \mathbb{W}$$

Question 5

(i) Solve the following ineqation and represent the solution set on the number line: [4]

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

(ii) Using the step deviation method, find the arithmetic mean of the distribution: [6]

Variate (x)	5	10	15	20	25	30	35	40	45	50
Frequenty (f)	20	43	75	67	72	45	39	9	8	6