

# MATHEMATICS (M003)

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*Maximum Marks: 40*

*Time allowed: 75 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*

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## 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  $2x - 5 \leq 5x + 4 \leq 11$  and  $x$  is a natural number ( $\mathbb{N}$ ), then the solution set of  $x$  is:

(a)  $\{ 1 \}$

(c)  $\{ -2, -1, 0, 1 \}$

(b)  $\{ -3, -2, -1, 0, 1 \}$

(d)  $\{ -2, -1, 0 \}$

(ii) If  $x : y = 5 : 3$ , then the value of  $(8x - 5y) : (6x + 7y)$  is:

(a)  $24 : 27$

(c)  $25 : 9$

(b)  $35 : 37$

(d)  $25 : 51$

(iii) Evaluate  $(\sec \theta - \tan \theta)^2$ :

(a)  $\frac{1 + \sin \theta}{\cos \theta}$

(c)  $\frac{1 - \sin \theta}{1 + \sin \theta}$

(b)  $\frac{\sin \theta}{1 - \sin \theta}$

(d) None of these

(iv) If  $A = \begin{bmatrix} 2 & 3 \\ 4 & 2 \end{bmatrix}$  and  $B = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ , then the matrix  $BA$  is:

(a)  $\begin{bmatrix} 11 & 16 \\ 10 & 16 \end{bmatrix}$

(c)  $\begin{bmatrix} 11 & 10 \\ 16 & 16 \end{bmatrix}$

(b)  $\begin{bmatrix} 10 & 22 \\ 7 & 17 \end{bmatrix}$

(d)  $\begin{bmatrix} 10 & 7 \\ 22 & 17 \end{bmatrix}$

(v) The other factors of the polynomial  $2x^3 - x^2 - 5x - 2$ , if one of its factor is  $(x - 2)$  are:

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

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

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

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

(vi) If the equation  $3x^2 - 6x + k = 0$  has real and distinct roots, then the value of  $k$  is:

(a)  $k \leq 3$

(c)  $k > 3$

(b)  $k = 3$

(d)  $k < 3$

(vii) Simran had a recurring deposit account in a bank and deposited ₹ 500 per month for  $2\frac{1}{2}$  years. If the rate of interest was 10% p.a., then the matured value of this account is:

(a) ₹ 16,397.50

(c) ₹ 16,793.50

(b) ₹ 16,937.50

(d) ₹ 16,973.50

## Question 2

- (i) Find the value of  $k$  for which the following equation has equal roots: [4]

$$x^2 + 4kx + (k^2 - k + 2) = 0$$

- (ii) If  $5 \tan \theta = 4$ , find the value of: [4]

$$\frac{5 \sin \theta + 3 \cos \theta}{5 \sin \theta + 2 \cos \theta}$$

- (iii) Using the properties of proportion, solve for  $x$ , given [5]

$$\frac{x^4 + 1}{2x^2} = \frac{17}{8}$$

## SECTION B (20 marks)

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

### Question 3

- (i) Mr. Sonu has a recurring deposit account and deposits ₹ 750 per month for 2 years. If he gets ₹ 19,125 at the time of maturity, find the rate of interest. [3]
- (ii) Prove that: [3]

$$(\operatorname{cosec} \theta - \sin \theta)(\sec \theta - \cos \theta)(\tan \theta + \cot \theta) = 1$$

- (iii) Determine the value of  $p$  and  $q$  if: [4]

$$\begin{bmatrix} 2p+1 & q^2-2 \\ 6 & 0 \end{bmatrix} = \begin{bmatrix} p+3 & 3q-4 \\ 5q-q^2 & 0 \end{bmatrix}$$

### Question 4

- (i) Determine the multiplication of the given matrices: [3]

$$\begin{bmatrix} 2 \sin 30^\circ & -2 \cos 60^\circ \\ -\cot 45^\circ & \sin 90^\circ \end{bmatrix} \begin{bmatrix} \tan 45^\circ & \sec 60^\circ \\ \operatorname{cosec} 30^\circ & \cos 0^\circ \end{bmatrix}$$

- (ii) If the mean of the following distribution is 7.5, find the missing frequency  $f$ . [3]

Variable (x)	5	6	7	8	9	10	11	12
Frequency (f)	20	17	$f$	10	8	6	7	6

- (iii) Use factor theorem to factorize  $6x^3 + 17x^2 + 4x - 12$  completely. [4]

### Question 5

- (i) Without solving the following quadratic equation, find the value of  $m$  for which the given equation has real and equal roots. [4]

$$x^2 + 2(m - 1)x + (m + 5) = 0$$

- (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.

Take the assumed mean as 45. Give your answer correct to 2 decimal places. [6]

Number of patients	Number of days
10 – 20	5
20 – 30	2
30 – 40	7
40 – 50	9
50 – 60	2
60 – 70	5