MATHEMATICS (M013)

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

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) Evaluate:

$$\frac{\cos^3\theta + \sin^3\theta}{\cos\theta + \sin\theta} + \frac{\cos^3\theta - \sin^3\theta}{\cos\theta - \sin\theta}$$

(a) 0

(b) 1

(c) 2

(d) 3

(ii) A rectangular sheet of size 12 cm by 8 cm is folded along one of its edges to form a cylinder with height 8 cm. The volue of the cylinder so formed is:

(a) 91.6 cm^3

(c) 78.6 cm^3

(b) 85.4 cm^3

(d) 42.6 cm^3

(iii) The 72^{nd} term of the A.P. $7\frac{3}{4}$, $9\frac{1}{2}$, $11\frac{1}{4}$,... is:

(a) 128

(c) 132

(b) $124\frac{1}{4}$

(d) $133\frac{3}{4}$

(iv) The possible values of x for which the value of the polynomial $f(x) = 3x^3 + 2x^2 - 19x + 6$ is zero, are:

(a) $-3, 2, \frac{1}{3}$

(c) $3, 2, \frac{1}{3}$

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

(d) $-3, -2, \frac{1}{3}$

(v) If $A = \begin{bmatrix} 5 & -1 \\ 6 & 7 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix}$, then which of the following is correct?

(a) $AB = \begin{bmatrix} 7 & -1 \\ 9 & 22 \end{bmatrix}$

(c) $AB = BA$

(d) $AB \neq BA$

(b) $BA = \begin{bmatrix} 16 & -5 \\ 39 & 25 \end{bmatrix}$

(vi) If one root of a quadratic equation $6x^2 - x - k = 0$ is $\frac{2}{3}$, then the value of k is:

(a) 2

(c) $\frac{8}{3}$

(b) $\frac{1}{9}$

(d) 1

(vii) The n^{th} term of the A.P. $\frac{1}{m}, \frac{1+m}{m}, \frac{1+2m}{m}, \ldots$ is:

(a) $\frac{1+n}{m}$

(c) $\frac{1+mn}{m}$

(b) $\frac{1+m(n+1)}{m}$

(d) $\frac{1+m(n-1)}{m}$

Question 2

(i) From a window A, 10m above the ground, angle of elevation of the top C of a tower is $x°$, where $\tan x° = \frac{5}{4}$ and the angle of depression of the foot of the tower is $y°$, where $\tan y° = \frac{1}{4}$. Calculate the height CD of the tower in metres. [4]

(ii) Determine the matrices X and Y, if [4]

$$X + Y = \begin{bmatrix} 5 & 2 \\ 0 & 9 \end{bmatrix} \text{ and } X - Y = \begin{bmatrix} 3 & 6 \\ 0 & -1 \end{bmatrix}$$

(iii) Solve the following equation and give your answer up to two decimal places: [5]

$$x^2 - 5x - 10 = 0$$

SECTION B (20 marks)

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

Question 3

(i) Factorize $x^4 - 10x^2 + 9$ [3]

(ii) Prove that: [3]

$$\frac{\tan^2\theta}{(\sec\theta - 1)^2} = \frac{1 + \cos\theta}{1 - \cos\theta}$$

(iii) If $2x$ articles cost ₹$(5x + 54)$ and $(x + 2)$ similar articles cost ₹$(10x - 4)$, then the value of x is? [4]

Question 4

(i) Find a common factor of the following quadratic polynomials: [3]

$$3x^2 - x - 10 \text{ and } 2x^2 - x - 6$$

(ii) The sum of two numbers and their reciprocals is 15 and $\frac{3}{10}$ respectively. Find the numbers. [3]

(iii) Choose the right option: [4]

Assertion: The number of terms to be taken in the A.P. 9, 17, 25, ... so as to make a sum of 636 is 13.

Reason: The sum of first n terms of an A.P. is given by $\frac{n}{2}[2a + (n - 1)d]$.

a. Both assertion and reason are correct and reason is the correct explanation of assertion.

b. Both assertion and reason are correct but reason is not the correct explanation of assertion.

c. Assertion is correct but reason is not correct.

d. Assertion is incorrect but reason is correct.

Question 5

(i) Using componendo and dividendo, find the ratio of $x : y$ if: [4]

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

(ii) Find the mean of the following distribution by step-deviationn method: [6]

Class	Frequency (f)
20 – 30	10
30 – 40	6
40 – 50	8
50 – 60	12
60 – 70	5
70 – 80	9