Paper Code: P-489

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ESKP-xi1901
MATHEMATICS – Part I

Time: 3 hours

Marks: 100

Note: There are THREE Sections in this paper i.e. A, B & C. Attempt Section-A and return it to the Superintendent within the given time. No marks will be awarded for cutting, erasing and overwriting. Mobile Phones are strictly prohibited in Examination Hall.

Time: 20 minutes — **Section-A** — **Marks: 20**

QNo.1 Select the correct option and shade (A,B,C,D) in the given Bubble Answer Sheet.

i. If $i^2 = -1$, then $\sum_{j=1}^{3} i^j =$ _____

A- 1 B- i C- -1 D- $-i$

ii. $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ is a _____ matrix.

A- Identity B- Scalar C- Diagonal D- None

iii. The multiplicative inverse of the complex number (0, -1) is _____

A- (1, 0) B- (-1, 0) C- (0, 1) D- (0, -1)

iv. If A is a skew symmetric matrix, then A^T is _____

A- Diagonal B- Triangular C- Symmetric D- Skew-symmetric

v. The reciprocals of the terms of a geometric series is _____

A- A.S B- H.S C- G.S D- None

vi. The projection of vector $\vec{a}$ on vector $\vec{b}$ is _____

A- $\frac{\vec{a}.\vec{b}}{|\vec{b}|}$ B- $\frac{\vec{a}.\vec{b}}{|\vec{a}|}$ C- $\vec{a}.\vec{b}$ D- None

vii. The 10^{th} term of the sequence -8, -3, 2, 7, is _____

A- 5 B- 45 C- 37 D- -37

viii. $\sum_{k=0}^{2} \frac{2^k}{k+1} =$ _____

A- $\frac{3}{10}$ B- $\frac{10}{3}$ C- $\frac{2}{13}$ D- $\frac{11}{3}$

ix. If n(S) = 20 and n(E) = 2, then P(E) = _____

A- $\frac{1}{10}$ B- 10 C- 1 D- 40

x. The inverse function of f(x) = 2x – 3 is _____

A- $\frac{x-3}{2}$ B- $\frac{x+3}{2}$ C- $\frac{x-2}{3}$ D- $\frac{x+2}{3}$

xi. $\text{Cos}\theta\left(Cos\theta - \frac{\sin^2\theta}{\cos\theta}\right) =$ _____

A- cot2θ B- 0 C- 1 D- cos2θ

xii. Number of terms in the expansion of $(a + 2x)^{-13}$ is _____

A- -12 B- 12 C- 14 D- None

xiii. If $f(x) = \frac{x-1}{x^2-1}$, then f(-1) is _____

A- 1 B- 0 C- Not defined D- ∞

xiv. $\text{Cos}^{-1}(-x) =$ _____

A- $\cos^{-1}x$ B- $-\cos^{-1}x$ C- $\sin^{-1}x$ D- $\pi - \cos^{-1}x$

xv. In usual notations, the in-radius r = _____

A- $\frac{abc}{\Delta}$ B- $\frac{\Delta}{S}$ C- $\frac{S}{\Delta}$ D- $\frac{4\Delta}{abc}$

xvi. The unit vector in the direction of $\vec{u}$ and of magnitude 3 is _____

A- $3\vec{u}$ B- $3i$ C- $3\hat{u}$ D- $\hat{u}$

xvii. $\binom{8}{4,2,2} =$ _____

A- 840 B- 402 C- 420 D- 204

xviii. The even function is symmetric about _____

A- y = x B- x = 0 C- y = 0 D- (0, 0)

xix. Which of the following inequalities contain origin (0, 0) in its solution region?

A- $x \leq -3$ B- $x \geq 4$ C- $x < 0$ D- $x \leq 5$

xx. Maximum value of $y = 4 + 3\cos(2x + 1)$ is _____

A- 7 B- -7 C- 3 D- 1

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MATHEMATICS – Part I

Note: Time allowed 2:40 hours **Marks: 50**

SECTION – B

Q2: Answer any NINE parts. Each part carles equal marks.

i. Determine whether $1 + 2i$ is a solution of $Z^2 - 4Z + 7 = 0$.

ii. Show that value of the determinant $\begin{vmatrix} \gamma\cos\theta & 0 & \gamma\sin\theta \\ 1 & 1 & 0 \\ -\sin\theta & 0 & \cos\theta \end{vmatrix} = \gamma$

iii. Find ran of the matrix $\begin{bmatrix} 1 & 0 & -2 \\ 2 & 2 & 1 \\ -1 & 2 & 3 \end{bmatrix}$

iv. Solve the triangle for which $a = 9, b = 7, c = 5$.

v. Find the area of parallelogram whose diagonals are $\vec{a} = 4\hat{i} + \hat{j} - 2\hat{k}$, $\vec{b} = -2\hat{i} + 3\hat{j} + 4\hat{k}$

vi. Insert three arithmetic means between 6 and 41.

vii. Find the indicated tefm of the sequence $\frac{1}{2}, \frac{1}{5}, \frac{1}{8}, \ldots\ldots$ 9^{th} term.

viii. Find the sum of n-terms of the series. $1.2^2 + 2.3 + 3.4^2 + \ldots\ldots$

ix. A student finds that the probability of passing an algebra tests is $\frac{8}{9}$. What is the probability of failing the test?

x. Prove that $2^n > n \;\forall\; n \in N$

xi. Find (without graphing) the vertex, intercepts and axis of $f(x) = x^2 + 2x - 3$.

xii. Prove the identity $\frac{\cos(75^\circ) + \cos(15^\circ)}{\sin(75^\circ) - \sin(15^\circ)} = \sqrt{3}$

xiii. Show that $\sin^{-1}x + \cos^{-1}x = \frac{\pi}{2}$

SECTION – C

Marks: 30

Note: Attempt any THREE of the following. All questions carry equal marks.

Q3: a) For a ΔABC, show that $r_1r_2 + r_2r_3 + r_3r_1 = S^2$.

b) A mosque minar 84 meters high casts a shadow 62 meters long. Find the angle of elevation of the sun at that moment.

Q4: a) Use mathematical induction to establish that $\frac{1}{3} + \frac{1}{9} + \frac{1}{27} + \ldots\ldots + \frac{1}{3n} = \frac{1}{2}\left[1 - \frac{1}{3n}\right]$

b) If 'x' is so small that x^2 and higher powers may be neglected, then show that $\frac{\sqrt{1-3x}}{\sqrt{1+4x}} = 1 - \frac{7x}{2}$

Q5: a) Insert five arithmetic means between 5 and 8 and show that their sum is five times the arithmetic mean between 5 and 8.

b) If $y = \frac{x}{3} + \frac{x^2}{3^2} + \frac{x^3}{3^3} + \ldots\ldots$ where $0 < x < 3$. Then show that $x = \frac{3y}{1+y}$

Q6: a) Use Cramer's rule to solve: $x - 2y = -4, 3x + y = -5, 2x + z = -1$

b) Find the angle between the vectors: $\vec{r_1} = \hat{i} + 2\hat{j} - \hat{k}$, $\vec{r_2} = \hat{i} + \hat{j} - 2\hat{k}$