

11181  
**MATHEMATICS**  
**PART-I**

(A) 201

**NOTE:** Attempt all questions of Section-A by filling the corresponding bubble on the MCQ ANSWER SHEET and return it to the Superintendent within given time, even if you have not attempted any question.

**SECTION-A**

Time: 20 Minutes

Marks: 20

- The product  $(2-i)$  and  $i$  is .....  A)  $1+2i$ , B)  $2+i$ , C)  $2+i^2$ , D) none of these
- If  $z = -2+2i$ , then  $\bar{z} = \dots\dots\dots$   A)  $-2-2i$ , B)  $+2-2i$ , C)  $2-2i$ , D)  $-2+2i$
- If the matrix A and B are comfortable for multiplication then  $(AB)^t = \dots\dots\dots$  A) AB, B) BA, C)  $A^tB^t$ ,  D)  $B^tA^t$
- $\begin{vmatrix} 1 & x \\ 0 & 1 \end{vmatrix} = \dots\dots\dots$  A)  $-1$ ,  B)  $1$ , C)  $0$ , D)  $1-x$
- If  $\vec{u} = 3\hat{i} + 4\hat{j}$ ,  $\vec{v} = 4\hat{i} - 5\hat{j}$  then  $\vec{u} - \vec{v} = \dots\dots\dots$  A)  $\hat{i} - 9\hat{j}$ , B)  $-\hat{i} - 9\hat{j}$ , C)  $7\hat{i} - \hat{j}$ ,  D) none of these
- $\vec{a} \times \vec{b} = \dots\dots\dots$  A)  $\vec{b} \times \vec{a}$ , B)  $\vec{b} \cdot \vec{a}$ ,  C)  $-\vec{b} \times \vec{a}$ , D) none of these
- A.M between a and b is .....  A)  $\frac{a+b}{2}$ , B)  $\sqrt{ab}$ , C)  $\frac{2ab}{a+b}$ , D)  $\frac{2ab}{a-b}$
- Which of the following is true? A)  $A > H > G$ ,  B)  $A > G > H$ , C)  $A < G < H$ , D)  $H > A > G$
- $\sum_{j=1}^n j^2 = \dots\dots\dots$  A)  $\left(\frac{n(n+1)}{2}\right)^2$ , B)  $\frac{n(n+1)(n+2)}{6}$ ,  C)  $\frac{n(n+1)(2n+1)}{6}$ , D) none of these
- $\frac{4!}{2!} = \dots\dots\dots$  A)  $4!$ , B)  $24$ ,  C)  $12$ , D)  $3!$
- For events A and B,  $P(A/B) = \dots\dots\dots$   A)  $\frac{P(A \cap B)}{P(B)}$ , B)  $\frac{P(A \cap B)}{P(A)}$ , C)  $P(A) + P(B)$ , D)  $\frac{P(A \cup B)}{P(B)}$
- $5+10+15+\dots\dots\dots+5n = \dots\dots\dots$  A)  $\frac{5n(n+1)}{4}$ ,  B)  $\frac{5n(n+1)}{2}$ , C)  $\frac{n(n+1)}{2}$ , D) none of these
- The number of terms in the expansion of  $(a+b)^n$  is ..... A)  $n$ ,  B)  $n+1$ , C)  $2n+1$ , D)  $n-1$
- $|x| = \dots\dots\dots$ , if  $x < 0$  A)  $x$ ,  B)  $-x$ , C)  $\pm x$ , D) all of these
- $\cos(\pi + \theta) = \dots\dots\dots$   A)  $-\cos\theta$ , B)  $\cos\theta$ , C)  $\sin\theta$ , D)  $-\sin\theta$
- In any triangle ABC,  $b^2 + c^2 - 2bc \cos\alpha = \dots\dots\dots$  A)  $b^2$ ,  B)  $a^2$ , C)  $c^2$ , D) none of these
- In any triangle ABC, area of a  $\Delta = \dots\dots\dots$  A)  $\frac{1}{2}b^2 \frac{\sin\alpha \sin\beta}{\sin\gamma}$ ,  B)  $\frac{1}{2}b^2 \frac{\sin\alpha \sin\gamma}{\sin\beta}$ , C)  $\frac{1}{2}b^2 \sin\alpha$ , D)  $\frac{1}{2}b^2 \frac{\sin\beta \sin\gamma}{\sin\alpha}$
- Range of  $\cos 2x$  is ..... A) R,  B)  $[-1, 1]$ , C)  $\{-1, 1\}$ , D) none of these
- Period of  $\cos x$  is ..... A)  $\frac{\pi}{2}$ , B)  $\pi$ ,  C)  $2\pi$ , D)  $\frac{2\pi}{3}$
- Domain of principal tangent function is ..... A)  $-\frac{\pi}{2} \leq x \leq \frac{\pi}{2}$ ,  B)  $-\frac{\pi}{2} < x < \frac{\pi}{2}$ , C)  $-\pi \leq x \leq \pi$ , D)  $0 \leq x \leq \pi$

Time: 2 Hours 40 Minutes

**SECTION-B**

Marks: 50

1. Attempt any ten of the following. All carry equal marks.
- Write  $\frac{(1+2i)^2}{1-3i}$  in the form of  $a+bi$ .
  - Find the value of  $\lambda$  if  $A = \begin{bmatrix} -\lambda & 1 & 0 \\ 1 & -\lambda & 1 \\ 0 & 1 & -\lambda \end{bmatrix}$  is singular.
  - Find the projection of the vector  $\vec{a} = \hat{i} - 2\hat{j} + \hat{k}$  on the vector  $\vec{b} = 4\hat{i} - 4\hat{j} + 7\hat{k}$ .
  - Given  $a_n = 201$ , for the arithmetic sequence 5, 9, 13, ..... Find  $n$ .
  - Insert four geometric mean between  $-8$  and  $\frac{1}{4}$ .
  - Find the sum of  $n$  terms of the series  $2^2 + 4^2 + 6^2 + \dots$
  - How many different words can be formed from the letters of the word "BOOKWORM" if the letters are taken all at a time.
  - Expand  $(3a - 4b)^4$
  - Find inverse of  $f(x) = 4 + \sqrt{2x}$
  - Maximize  $f(x, y) = 3x + 5y$ , subject to  $2x + 3y \leq 12$ ,  $3x + 2y \leq 12$ ,  $x + y \geq 2$ ,  $x \geq 0$ ,  $y \geq 0$
  - Show that  $\sin(\alpha + \beta) + \sin(\alpha - \beta) = 2\sin\alpha\cos\beta$
  - Use law of cosine to solve the triangle with dimension  $a = 120$ ,  $b = 240$  and  $\gamma = 32^\circ$
  - Show that  $\cos(2\sin^{-1}x) = 1 - 2x^2$ ,  $-1 \leq x \leq 1$

**SECTION-C**

Marks: 30

**NOTE:** Attempt any three of the following questions. All questions carry equal marks.

- Solve the simultaneous linear equation with complex co-efficients  $\begin{matrix} z - 4w = 3i \\ 2z + 3w = 11 - 5i \end{matrix}$
  - Let  $A = \begin{bmatrix} 3 & -1 \\ 4 & 2 \end{bmatrix}$ , show that  $|A^{-1}| = \frac{1}{|A|}$
- Find the direction cosines of the vector from  $P(4, 8, -3)$  to  $Q(-1, 6, 2)$
  - Find the value of  $n$ , if  $\frac{a^{n+1} + b^{n+1}}{a^n + b^n}$  be the harmonic mean between  $a$  and  $b$ .
- Expand  $\sqrt{\frac{1-x}{1+x}}$  upto  $x^3$
  - Express  $\sin\theta + \cos\theta$  in the form of  $r\sin(\theta + \phi)$  where the terminal ray of  $\theta$  and  $\phi$  are in first quadrant.
- Find  $R$ ,  $r$ ,  $r_1$ ,  $r_2$  and  $r_3$  for the triangle with measures of the sides 5, 12 and 13.
  - Draw graph of  $y = \sin\left(x + \frac{\pi}{2}\right)$ ;  $0 \leq x \leq 2\pi$