

Q.1 Four possible answers to each statement are given below. Tick (ü) the correct answer

(i) The property used in $4 + 9 = 9 + 4$

(a) Commutative property w.r.t. multiplication

(b) Commutative property w.r.t. addition

(c) Associative property w.r.t. addition

(d) Associative property w.r.t. multiplication

(ii) $(7, 9) + (3, -5)$

(a) $(7, 9)$

(b) $(3, -5)$

(c) $(10, 4)$

(d) $(4, 10)$

(iii) The converse of $\sim p \rightarrow q =$

(a) $q \rightarrow \sim p$

(b) $p \rightarrow q$

(c) $q \rightarrow p$

(d) $p \rightarrow \sim q$

(iv) The set $\mathbb{N}$ w.r.t addition is a

(a) Group

(b) Monoid

(c) Null set

(d) Semi group

(v) $(AB)^t =$

(a) A^t

(b) B^t

(c) $B^t A^t$

(d) $A^t B^t$

(vi) $1 + \omega + \omega^2 =$

(a) 1

(b) ω

(c) ω^2

(d) 0

(vii) The partial fraction of $\frac{9x-7}{(x^2+1)(x+3)}$ are of the form

(a) $\frac{Ax+B}{(x^2+1)} + \frac{C}{(x+3)}$

(b) $\frac{A}{(x^2+1)} + \frac{C}{(x+3)}$

(c) $\frac{A}{(x^2+1)}$

(d) $\frac{B}{x+3}$

(viii) A.M. between $x-3$ and $x+5 =$

(a) $x+1$

(b) $x-1$

(c) $x-3$

(d) $x+5$

(ix) The sum of the series $1^3 + 2^3 + 3^3 + \dots$ up to n terms =

(a) $\frac{n(n+1)}{2}$

(b) $\left[\frac{n(n+1)}{2} \right]^2$

(c) $\frac{n(n+1)(2n+1)}{6}$

(d) $\frac{n(n+1)}{3}$

(x) Factorial form of $n(n-1)(n-2) =$

(a) $\frac{n!}{(n-1)!}$

(b) $\frac{n!}{(n-2)!}$

(c) $\frac{n!}{(n-3)!}$

(d) $\frac{n!}{(n+3)!}$

(xi) If a coin is tossed the probability of head is

- (a) 1 (b) 2 (c) 3 (d) $\frac{1}{2}$

(xii) The inequality $4^n > 3^n + 4$ is true for n equal to

- (a) 2 (b) 1 (c) -1 (d) -2

(xiii) The number of terms in the expansion of $(x-3)^{10} =$

- (a) 10 (b) 11 (c) 12 (d) 13

(xiv) The expansion of $(1-2x)^{\frac{1}{3}}$ is valid only if

- (a) $|x| < 2$ (b) $|x| < 3$ (c) $|x| < \frac{1}{2}$ (d) $|x| = \frac{1}{2}$

(xv) π radians =

- (a) 180^0 (b) $180'$ (c) 360^0 (d) $360'$

(xvi) $\sin(-\theta) =$

- (a) $\sin \theta$ (b) $-\sin \theta$ (c) $\cos \theta$ (d) $-\cos \theta$

(xvii) The domain of $\sin x$ is

- (a) $[-1, 1]$ (b) $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ (c) R (d) Q

(xviii) The value of $R =$

- (a) $\frac{\Delta}{s}$ (b) $\frac{a}{\sin \alpha}$ (c) $\frac{b}{\sin \beta}$ (d) $\frac{c}{2 \sin \gamma}$

(xix) The value of $\sin\left(\cos^{-1}\frac{\sqrt{3}}{2}\right) =$

- (a) $\frac{1}{2}$ (b) $\frac{1}{\sqrt{2}}$ (c) $\frac{1}{\sqrt{3}}$ (d) $\sqrt{3}$

(xx) $\cos x = \frac{1}{2}$ has a solution

- (a) $\frac{\pi}{2}$ (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{6}$

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Section – I

Note: Out of Q.No.1, 2, 3 and 4 write any Twenty-Five (25) short answers. While writing answer write Q. No. and its part carefully. Each part carries two marks. 50

Q # 1:

- (i) Define rational and irrational numbers.
- (ii) Separate into real and imaginary parts $\frac{2 - 7i}{4 + 5i}$.
- (iii) $\forall z \in C$, show that $z \cdot \bar{z} = |z|^2$.
- (iv) Define the term, equal and equivalent set.
- (v) What is meant by tautology?
- (vi) Let $A = \{1, 2, 3, 4\}$ then find relation $\{(x, y) | x + y < 5\}$.
- (vii) Let $a, b \in G$ solve $ax = b$ and $xa = b$.
- (viii) Define the term unit matrix or identity matrix with example.
- (ix) If $A = \begin{bmatrix} 1 & 2 & -3 \\ 0 & -2 & 0 \\ -2 & -2 & 1 \end{bmatrix}$ find A_{12} and A_{22} .

Q # 2:

- (i) Solve $x(x + 7) = (2x - 1)(x + 4)$.
- (ii) Evaluate $(1 + \omega - \omega^2)^8$.
- (iii) If α, β are the roots of the equation $x^2 - px - p - c = 0$ prove that $(1 + \alpha)(1 + \beta) = 1 - c$.
- (iv) Solve the system of equation $x + y = 7$ and $x^2 - xy + y^2 = 13$.
- (v) Resolve $\frac{1}{x^2 - 1}$ into partial fraction.
- (vi) If 5, 8 are two A.M's between a and b then find a and b .
- (vii) Find 5th term of the sequence $1 + i, 2, \frac{4}{1 + i}, \dots$.
- (viii) Insert two G.M's between 2 and 16.
- (ix) If $y = 1 + \frac{x}{2} + \frac{x^2}{2} + \dots$ then show that $x = 2\left(\frac{y - 1}{y}\right)$.

Q # 3:

- (i) Prove ${}^nP_r = {}^{n-1}P_r + r \cdot {}^{n-1}P_{r-1}$.
- (ii) What is meant by mutually exclusive and equally likely events?
- (iii) Find the value of n if ${}^nC_{12} = {}^nC_6$.
- (iv) If $S = \{1, 2, 3, \dots, 9\}$, $A = \{2, 4, 6, 8\}$ and $B = \{1, 3, 5\}$ find $P(A \cup B)$.
- (v) Check divisibility of $n^2 + n$ by 2 for $n = 1, 2$.
- (vi) Write the formula for general term of binomial expansion of $(a + x)^n$.
- (vii) Calculate by binomial theorem $(2.02)^4$.
- (viii) Write the formula for expansion of $(1 + x)^n$, when n is a negative integer or fraction.
- (ix) Prove the binomial series $\sqrt[3]{30} \approx 3.107$.

Q # 4:

- (i) Define angle and angle in standard position.
- (ii) Find θ when $l = 1.5\text{ cm}$ and $r = 2.5\text{ cm}$.
- (iii) Without use of calculator / table find values of $\tan 1110^\circ$.
- (iv) Express $2\sin 7\theta \cos 3\theta$ as sum or difference.
- (v) Write the domain and range of $y = \sin x$.
- (vi) Find the period of $\tan \frac{x}{7}$.
- (vii) In right angle triangle ABC $\alpha = 62^\circ 40'$ $b = 796$ $\gamma = 90^\circ$, find α .
- (viii) Find the area of triangle ABC, when $b = 37$ $c = 45$ $\alpha = 30^\circ 50'$.
- (ix) Determine $\cos(\tan^{-1} 0)$.
- (x) Solve the equation $\sin x = \frac{1}{2}$ in $[0, 2\pi]$.

Section – II

Note: Attempt any THREE questions.

Q # 5 (a) Show that $\begin{vmatrix} x & 1 & 1 & 1 \\ 1 & x & 1 & 1 \\ 1 & 1 & x & 1 \\ 1 & 1 & 1 & x \end{vmatrix} = (x+3)(x-1)^3$. 5

(b) For what value of m will the roots of the equation $(m+1)x^2 + 2(m+3)x + m+8 = 0$ be equal. 5

Q # 6 (a) Resolve $\frac{x^2}{(x-2)(x-1)^2}$ into partial fraction 5

(b) If S_2, S_3, S_5 are the sums of $2n, 3n, 5n$ terms of an A.P. Show that $S_5 = 5(S_3 - S_2)$ 5

Q # 7 (a) Prove that ${}^nC_r + {}^nC_{r-1} = {}^{n+1}C_r$ 5

(b) If x is very nearly equal to 1, then prove that $px^p - qx^q = (p-q)x^{p+q}$ 5

Q # 8 (a) Prove that $\frac{1+\cos\theta}{1-\cos\theta} = (\operatorname{cosec}\theta + \cot\theta)^2$ 5

(b) Prove that (with out using Calculator) $\sin 10^\circ \sin 30^\circ \sin 50^\circ \sin 70^\circ = \frac{1}{16}$ 5

Q # 9 (a) Prove that $abc(\sin\alpha + \sin\beta + \sin\gamma) = 4\Delta S$ 5

(b) Prove that $\tan^{-1} \frac{1}{11} + \tan^{-1} \frac{5}{6} = \tan^{-1} \frac{1}{3} + \tan^{-1} \frac{1}{2}$ 5

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