

Section-A

1. Select the correct Answer:

(i) If z_1 and z_2 are any two complex numbers, then:

- (a) $|z_1 + z_2| < |z_1| + |z_2|$ (b) $|z_1 + z_2| \leq |z_1| + |z_2|$
 (c) $|z_1 - z_2| < |z_1| - |z_2|$ (d) $|z_1 + z_2| \geq |z_1| + |z_2|$

(ii) If $z = 3i - 4$, then $z + \bar{z} =$ _____

- (a) 8 (b) $-3i$ (c) -8 (d) $(3i - 8)$

(iii) If $a > 0$ and $b < 0$, then _____

- (a) $ab > 0$ (b) $ab < 0$ (c) $ab = 0$ (d) all of them

(iv) If a matrix A has m row and n column, then order of A is:

- (a) $m \times n$ (b) $n \times m$ (c) mn (d) m^n

(v) Any matrix of order $m \times 1$ is called:

- (a) Row matrix (b) Column matrix
 (c) square matrix (d) zero matrix

(vi) A square matrix A is skew symmetric if:

- (a) $A^t = A$ (b) $A^t = -A$ (c) $(A^t)^t = A$ (d) None

(vii) A square matrix A is Hermitian matrix if:

- (a) $A^t = A$ (b) $A^t = -A$ (c) $(A^t)^t = A$ (d) $(A^t)^t = -A$

(viii) Each diagonal element of main diagonal of a skew Hermitian matrix must be:

- (a) 1 (b) 0 (c) Any non-zero number (d) Any complex number

(ix) If $\begin{vmatrix} a & b \\ 0 & 7 \end{vmatrix} = \begin{vmatrix} 2 & 3 \\ 0 & -9 \end{vmatrix}$ = then _____

- (a) $a = -3$ (b) $a = b$ (c) $a = \frac{1}{3}$ (d) $a = -31$

(x) The magnitude of $\vec{a} \times \vec{b}$ represents the _____ of a parallelogram with adjacent sides $\vec{a}$ and $\vec{b}$.

- (a) Opposite sides volume (b) diagonal (c) area (d)

(xi) The volume of tetrahedron determined by vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ is:

- (a) $[\vec{a}, \vec{b}, \vec{c}]$ (b) $\frac{1}{3}[\vec{a}, \vec{b}, \vec{c}]$ (c) $\frac{1}{6}[\vec{a}, \vec{b}, \vec{c}]$ (d) None

(xii) $\vec{a}, (\vec{b}, \vec{c}) =$ _____

- (a) $\vec{a} \cdot \vec{b}, \vec{c}$ (b) $\vec{a} \times \vec{b} \cdot \vec{c}$ (c) $\vec{b} \cdot (\vec{a} \times \vec{c})$ (d) $(\vec{a} \times \vec{b}) \cdot \vec{c}$

(xiii) If $a_n - a_{n-1} = n + 1$ and $a_4 = 14$ then $a_5 =$

- (a) 3 (b) 5 (c) 14 (d) 20

(xiv) A sequence $\{a_n\}$ in which $a_{n+1} - a_n$ is the same number for all $n \in \mathbb{N}$ is called:

- (a) A.P (b) G.P (c) H.P (d) None of these

(xv) If a_{n-1}, a_n, a_{n+1} are in A.P, then a_n is called.:

- (a) A.M (b) G.M (c) H.M (d) Mid-point

(xvi) $\tan^{-1}(-x) =$ _____

- (a) $-\tan^{-1} x$ (b) $\pi - \tan^{-1} x$ (c) $\cot^{-1} x$ (d) $\tan^{-1} x$

(xvii) $\tan^{-1}(-1) =$ _____

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

(xviii) The product of two conjugate complex number is:

- (a) A real number (b) An imaginary number
(c) Always zero (d) Not defined

Section-B

Q.2 Show that $z = 1 \pm i$ satisfies the equation $z^2 - 2z + 2 = 0$

Q.3 Evaluate: (i) $i^{10} + (-i)^{12}$ (ii) $(-1)^{16} - (-1)^8$ (iii) $(i)^{11} \cdot (-i)^{14}$

Q.4 Expand by means of the binomial theorem:

(i) $(2x - 3y)^4$ (ii) $(3x^2 - 2y^3)^5$

Q.5 Prove that:

(i) $3 + 6 + 9 + \dots + 3n = \frac{3}{2} n(n + 1)$

(ii) $2 + 6 + 18 + \dots + 2 \cdot 3^{n-1} = 3^n - 1$

Q.6 Expand by means of the binomial theorem:

(i) $(2x - 3y)^4$ (ii) $(3x^2 - 2y^3)^5$

Q.7 Specify the type of each of the following:

(i) $\begin{bmatrix} 0 & i \\ i & 0 \end{bmatrix}$ (ii) $\begin{bmatrix} \sqrt{3} \\ 4 \\ 7 \end{bmatrix}$

Q.8 Classify the following:

(i) Velocity (ii) Mass (iii) Acceleration

Q.9 Simplify the following:

(i) $(-6, 3) + (4, -2)$ (ii) $(8, -4) + ((-2, 2)$ (iii) $(2, 3) + (4, 5)$

Q.10 Find the sum of n terms of series:

(i) $3n^2 + n + 1$ (ii) $n^2 + 4n + 1$

Q.11 solve the following quadratic equation:

(i) $z^2 + 4z + 5 = 0$ (ii) $34x^2 + 6z = -1$ (iii) $z^2 + 64 = 1$

Q.12 Find the transpose of each of the following matrices:

(i) $\begin{bmatrix} -4 & 3 & 6 \end{bmatrix}$ (ii) $\begin{bmatrix} 2i & 5i & -3i \\ 0 & -6i & 2i \end{bmatrix}$

Q.13 Let $A = \begin{bmatrix} 3 & -4 & 1 \\ 4 & 5 & 7 \\ -2 & -3 & 8 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 4 & -1 \\ 2 & -3 & 5 \end{bmatrix}$ and $C = \begin{bmatrix} -5 & 5 \\ 6 & -3 \\ 2 & 7 \end{bmatrix}$

Q.14 Classify the following quantities are scalars or vectors

(i) Force (ii) Speed (iii) Velocity (iv) Area

(v) Work (vi) Volume (vii) weight (viii) Mass

Section-C

Q.15 If $A = \begin{bmatrix} -2 & 1 & 0 \\ -1 & 4 & 3 \\ 0 & 8 & 5 \end{bmatrix}$ then find, $A^2 - 5A + 4I$.

Q.16 If $f(x) = x^3$, find the values of:

(i) $f(2)$ (ii) $f(-10)$ (c) $f\left(\frac{1}{2}\right)$

Q.17 Solve the graph of the following:

(i) $3x - y \leq 5$ (ii) $x - 3y \geq 5$

Q.18 Sketch the graph of the following functions:

(i) $y = 5x + 2$ (ii) $y = x^2 - 5$ (iii) $y = x^5$