QB365 Student Learing Managemnet System
Exam Name: Pre Quarterly - Practice
Std: 12th Standard - Maths
Chapter: Applications of Matrices and Determinants, Discrete Mathematics, Inverse Trigonometric Functions, Two Dimensional Analytical Geometry-II, Applications of Vector Algebra, Theory of Equations, Complex Numbers

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Questions:

Answer all

1. If $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$, verify that A(adj A) = (adj A)A = $|A| I_3$.
2. Find the equation of the circle passing through the points (1, 1), (2, -1) and (3, 2) .
3. By vector method, prove that cos(α + β) = cos α cos β - sin α sin β
4. If z_1, z_2, and z_3 are three complex numbers such that $|z_1| = 1$, $|z_2| = 2|z_3| = 3$ and $|z_1 + z_2 + z_3| = 1$, show that $|9z_1z_2 + 4z_1z_3 + z_2z_3| = 6$
5. If $A = \begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{bmatrix}$, find the products AB and BA and hence solve the system of equations x - y + z = 4, x - 2y - 2z = 9, 2x + y + 3z = 1.
6. If z = x + iy and $\arg\left(\frac{z-i}{z+2}\right) = \frac{\pi}{4}$, then show that $x^2 + y^2 + 3x - 3y + 2 = 0$
7. Solve the equation $6x^4 - 5x^3 - 38x^2 - 5x + 6 = 0$ if it is known that $\frac{1}{3}$ is a solution.
8. A fish tank can be filled in 10 minutes using both pumps A and B simultaneously. However, pump B can pump water in or out at the same rate. If pump B is inadvertently run in reverse, then the tank will be filled in 30 minutes. How long would it take each pump to fill the tank by itself ? (Use Cramer's rule to solve the problem).
9. If $a_1, a_2, a_3, \ldots$ an is an arithmetic progression with common difference d, prove that $\tan\left[tan^{-1}\left(\frac{d}{1+a_1a_2}\right) + tan^{-1}\left(\frac{d}{1+a_2a_3}\right) + \ldots tan^{-1}\left(\frac{d}{1+a_na_{n-1}}\right)\right] = \frac{a_n - a_1}{1+a_1a_n}$
10. On lighting a rocket cracker it gets projected in a parabolic path and reaches a maximum height of 4 m when it is 6 m away from the point of projection. Finally it reaches the ground 12 m away from the starting point. Find the angle of projection.
11. Find the non-parametric form of vector equation, and Cartesian equation of the plane passing through the point (0, 1, -5) and parallel to the straight lines $\vec{r} = (\hat{i} + 2\hat{j} - 4\hat{k}) + s(\hat{i} + 3\hat{j} + 6\hat{k})$ and $\hat{r} = (\hat{i} - 3\hat{j} + 5\hat{k}) + t(\hat{i} + \hat{j} - \hat{k})$
12. Verify
    (i) closure property
    (ii) commutative property
    (iii) associative property
    (iv) existence of identity and
    (v) existence of inverse for the operation ×11 on a subset A = {1, 3, 4, 5, 9} of the set of remainders {0,1, 2, 3, 4, 5, 6, 7, 8, 9,10}
13. Verify whether the following compound propositions are tautologies or contradictions or contingency
    (p ∧ q) ∧ ¬ (p ∨ q)
14. Prove that p→(¬q V r) ≡ ¬pV(¬qVr) using truth table.

Answer any-7

15. Find the monic polynomial equation of minimum degree with real coefficients having 2 -$\sqrt{3}$i as a root.
16. If |z| = 2 show that $3 \leq |z + 3 + 4i| \leq 7$
17. Solve the following system of linear equations, using matrix inversion method:
    5x + 2y = 3, 3x + 2y = 5.
18. If $\vec{a}, \vec{b}, \vec{c}$ are three vectors, prove that $[\vec{a} + \vec{c}, \vec{a} + \vec{b}, \vec{a} + \vec{b} + \vec{c}] = [\vec{a}, \vec{b}, \vec{c}]$
19. If $2cos\alpha = x + \frac{1}{x}$ and $2cos\,\beta = y + \frac{1}{y}$, show that $x^m y^n + \frac{1}{x^m y^n} = 2cos(m\alpha + n\beta)$
20. Find the angle between the line $\vec{r} = (2\hat{i} - \hat{j} + \hat{k}) + t(\hat{i} + 2\hat{j} - 2\hat{k})$ and the plane $\vec{r} = (6\hat{i} + 3\hat{j} + 2\hat{k}) = 8$
21. Find the value of $cot^{-1}(1) + sin^{-1}\left(-\frac{\sqrt{3}}{2}\right) - sec^{-1}(-\sqrt{2})$
22. Construct the truth table for the following statements.
    ¬(p ∧ ¬q)
23. Construct the truth table for the following statements.
    (p V q) V ¬q
24. Construct the truth table for the following statements.
    (¬p ⟶ r) ∧ (p ↔ q)

Answer any-7

25. If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ is non-singular, find A^{-1}.
26. Find the principal value of
    $Sin^{-1}\left(\frac{1}{\sqrt{2}}\right)$
27. Prove that $\begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$ is orthogonal.
28. Show that $\left(2 + i\sqrt{3}\right)^{10} - \left(2 - i\sqrt{3}\right)^{10}$ is purely imaginary
29. Obtain the equation of the circle for which (3, 4) and (2, -7) are the ends of a diameter.
30. If |z| = 3, show that $7 \leq |z + 6 - 8i| \leq 13$.

31. If $2\hat{i}-\hat{j}+3\hat{k}, 3\hat{i}+2\hat{j}+\hat{k}, \hat{i}+m\hat{j}+4\hat{k}$ are coplanar, find the value of m.

32. Find the acute angle between the following lines
$\vec{r}=(4\hat{i}-\hat{j})+t(\hat{i}+2\hat{j}-2\hat{k}), \hat{r}=(\hat{i}+2\hat{j}-2\hat{k})+s(\hat{-i}-2\hat{j}+2\hat{k})$

33. Prove the following properties
$Re\,(z)=\frac{z+\bar{z}}{2}$ and Im$(z)=\frac{z-\bar{z}}{2i}$

34. Find $\tan^{-1}(tan\frac{3\pi}{5})$

Answer all

35. The conjugate of a complex number is $\frac{1}{i-2}$. Then the complex number is
(a) $\frac{1}{i+2}$ (b) $\frac{-1}{i+2}$ (c) $\frac{-1}{i-2}$ (d) $\frac{1}{i-2}$

36. If |z - 2 + i | ≤ 2, then the greatest value of |z| is
(a) $\sqrt{3}-2$ (b) $\sqrt{3}+2$ (c) $\sqrt{5}-2$ (d) $\sqrt{5}+2$

37. The solution of the equation |z| - z = 1 + 2i is
(a) $\frac{3}{2}-2i$ (b) $-\frac{3}{2}+2i$ (c) $2-\frac{3}{2}i$ (d) $2+\frac{3}{2}i$

38. A polynomial equation in x of degree n always has
(a) n distinct roots (b) n real roots (c) n complex roots (d) at most one root

39. The number of positive zeros of the polynomial $\sum_{j=0}^{n} n_{C_r}(-1)^r x^r$ is
(a) 0 (b) n (c) < n (d) r

40. The principal argument of the complex number $\frac{\left(1+i\sqrt{3}\right)^2}{4i\left(1-i\sqrt{3}\right)}$ is
(a) $\frac{2\pi}{3}$ (b) $\frac{\pi}{6}$ (c) $\frac{5\pi}{6}$ (d) $\frac{\pi}{2}$

41. If $\omega=cis\frac{2\pi}{3}$, then the number of distinct roots of $\begin{vmatrix} z+1 & \omega & \omega^2 \\ \omega & z+\omega^2 & 1 \\ \omega^2 & 1 & z+\omega \end{vmatrix}$ =0
(a) 1 (b) 2 (c) 3 (d) 4

42. The value of $\sin^{-1}$ (cos x), $0 \le x \le \pi$ is
(a) $\pi-x$ (b) $x-\frac{\pi}{2}$ (c) $\frac{\pi}{2}-x$ (d) $x-\pi$

43. The domain of the function defined by $f(x)=\sin^{-1}\sqrt{x-1}$ is
(a) [1, 2] (b) [-1, 1] (c) [0, 1] (d) [-1, 0]

44. The eccentricity of the hyperbola whose latus rectum is 8 and conjugate axis is equal to half the distance between the foci is
(a) $\frac{4}{3}$ (b) $\frac{4}{\sqrt{3}}$ (c) $\frac{2}{\sqrt{3}}$ (d) $\frac{3}{2}$

45. The centre of the circle inscribed in a square formed by the lines $x^2 - 8x - 12 = 0$ and $y^2 - 14y + 45 = 0$ is
(a) (4, 7) (b) (7, 4) (c) (9, 4) (d) (4, 9)

46. The area of quadrilateral formed with foci of the hyperbolas $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ and $\frac{x^2}{a^2}-\frac{y^2}{b^2}=-1$
(a) $4(a^2+b^2)$ (b) $2(a^2+b^2)$ (c) a^2+b^2 (d) $\frac{1}{2}(a^2+b^2)$

47. Area of the greatest rectangle inscribed in the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is
(a) 2ab (b) ab (c) $\sqrt{ab}$ (d) $\frac{a}{b}$

48. If a vector $\vec{\alpha}$ lies in the plane of $\vec{\beta}$ and $\vec{\gamma}$, then
(a) $[\vec{\alpha},\vec{\beta},\vec{\gamma}]=1$ (b) $[\vec{\alpha},\vec{\beta},\vec{\gamma}]=-1$ (c) $[\vec{\alpha},\vec{\beta},\vec{\gamma}]=0$ (d) $[\vec{\alpha},\vec{\beta},\vec{\gamma}]=2$

49. If $\vec{a}$ and $\vec{b}$ are unit vectors such that $[\vec{a},\vec{b},\vec{a}\times\vec{b}]=\frac{1}{4}$, then the angle between $\vec{a}$ and $\vec{b}$ is
(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{2}$

50. Consider the vectors $\vec{a},\vec{b},\vec{c},\vec{d}$ such that $(\vec{a}\times\vec{b})\times(\vec{c}\times\vec{d})=\vec{0}$ Let P_1 and P_2 be the planes determined by the pairs of vectors $\vec{a},\vec{b}$ and $\vec{c},\vec{d}$ respectively. Then the angle between P_1 and P_2 is
(a) 0° (b) 45° (c) 60° (d) 90°

51. If A is a 3 × 3 non-singular matrix such that $AA^T = A^TA$ and $B = A^{-1}A^T$, then BB^T =
(a) A (b) B (c) I_3 (d) B^T

52. If A = $\begin{bmatrix} 3 & 1 & -1 \\ 2 & -2 & 0 \\ 1 & 2 & -1 \end{bmatrix}$ and A^{-1} = $\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$ then the value of a_{23} is
(a) 0 (b) -2 (c) -3 (d) -1

53. If $(AB)^{-1}$ = $\begin{bmatrix} 12 & -17 \\ -19 & 27 \end{bmatrix}$ and A^{-1} = $\begin{bmatrix} 1 & -1 \\ -2 & 3 \end{bmatrix}$, then B^{-1} =
(a) $\begin{bmatrix} 2 & -5 \\ -3 & 8 \end{bmatrix}$ (b) $\begin{bmatrix} 8 & 5 \\ 3 & 2 \end{bmatrix}$ (c) $\begin{bmatrix} 3 & 1 \\ 2 & 1 \end{bmatrix}$ (d) $\begin{bmatrix} 8 & -5 \\ -3 & 2 \end{bmatrix}$

54. If $x^a y^b = e^m$, $x^c y^d = e^n$, $\Delta_1 = \begin{vmatrix} m & b \\ n & d \end{vmatrix}$, $\Delta_2 = \begin{vmatrix} a & m \\ c & n \end{vmatrix}$, $\Delta_3 = \begin{vmatrix} a & b \\ c & d \end{vmatrix}$, then the values of x and y are respectively,
(a) $e^{(\Delta_2/\Delta_1)}, e^{(\Delta_3/\Delta_1)}$ (b) log (Δ_1/Δ_3), log (Δ_2/Δ_3) (c) log (Δ_2/Δ_1), log(Δ_3/Δ_1) (d) $e^{(\Delta_1/\Delta_3)}, e^{(\Delta_2/\Delta_3)}$

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