Centum team

QUARTERLY EXAMINATION - 2024-25

12th Standard

Maths

Date : 10-09-

Reg.No. : | | | | | | |

Exam Time : 03:00 Hrs

Total Marks : 1

I. CHOOSE THE CORRECT ANSWER

20 x 1 =

1) If $|\text{adj}(\text{adj } A)| = |A|^9$, then the order of the square matrix A is

(a) 3 (b) 4 (c) 2 (d) 5

2) If A, B and C are invertible matrices of some order, then which one of the following is not true?

(a) adj $A = |A|A^{-1}$ (b) adj(AB) = (adj A)(adj B) (c) det A^{-1} = (det A)$^{-1}$ (d) $(ABC)^{-1} = C^{-1}B^{-1}A^{-1}$

3) If ρ (A) = ρ([A| B]), then the system AX = B of linear equations is

(a) consistent and has a unique solution (b) consistent (c) consistent and has infinitely many solution (d) inconsistent

4) The area of the triangle formed by the complex numbers z, iz and z+iz in the Argand's diagram is

(a) $\frac{1}{2}|z|^2$ (b) $|z|^2$ (c) $\frac{3}{2}|z|^2$ (d) $2|z|^2$

5) If |z| = 1, then the value of $\frac{1+z}{1+\bar{z}}$ is

(a) z (b) $\bar{z}$ (c) $\frac{1}{z}$ (d) 1

6) If $\omega \neq 1$ is a cubic root of unity and $(1+\omega)^7 = A + B\omega$, then (A, B) equals

(a) (1, 0) (b) (−1, 1) (c) (0, 1) (d) (1, 1)

7) 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

8) The number of real numbers in $[0, 2\pi]$ satisfying $\sin^4 x - 2\sin^2 x + 1$ is

(a) 2 (b) 4 (c) 1 (d) ∞

9) $\sin^{-1}(\cos x) = \frac{\pi}{2} - x$ is valid for

(a) $-\pi \leq x \leq 0$ (b) $0 \leq x \leq \pi$ (c) $-\frac{\pi}{2} \leq x \leq \frac{\pi}{2}$ (d) $-\frac{\pi}{4} \leq x \leq \frac{3\pi}{4}$

10) The equation $\tan^{-1} x - \cot^{-1} x = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$ has

(a) no solution (b) unique solution (c) two solutions (d) infinite number of solutions

11) The circle $x^2 + y^2 = 4x + 8y + 5$ intersects the line 3x−4y = m at two distinct points if

(a) 15< m < 65 (b) 35< m < 85 (c) −85 < m < −35 (d) −35 < m < 15

12) If P(x, y) be any point on $16x^2 + 25y^2 = 400$ with foci F_1 (3, 0) and F_2 (-3, 0) then $PF_1 + PF_2$ is

(a) 8 (b) 6 (c) 10 (d) 12

13) If the two tangents drawn from a point P to the parabola $y^2 = 4x$ are at right angles then the locus of P is

(a) 2x + 1 = 0 (b) x = −1 (c) 2x −1 = 0 (d) x = 1

14) 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) $[\vec{\alpha},\vec{\beta},\vec{\gamma}]=2$

15) The angle between the line $\vec{r}=(\hat{i}+2\hat{j}-3\hat{k})+t(2\hat{i}+\hat{j}-2\hat{k})$ and the plane $\vec{r}.(\hat{i}+\hat{j})+4=0$ is

(a) 0° (b) 30° (c) 45° (d) 90°

16) If the length of the perpendicular from the origin to the plane $2x + 3y + \lambda z = 1$, $\lambda > 0$ is $\frac{1}{5}$, then the value of λ is

(a) $2\sqrt{3}$ (b) $3\sqrt{2}$ (c) 0 (d) 1

17) Cramer's rule is applicable only when _____

(a) $\Delta \neq 0$ (b) $\Delta = 0$ (c) $\Delta=0, \Delta_x=0$ (d) $\Delta_x = \Delta_y = \Delta_z = 0$

18) The value of $(1+i)^4 + (1-i)^4$ is _____

(a) 8 (b) 4 (c) -8 (d) -4

19) $tan^{-1}\left(tan\frac{9\pi}{8}\right)$

(a) $\frac{9\pi}{8}$ (b) $\frac{-9\pi}{8}$ (c) $\frac{\pi}{8}$ (d) $\frac{-\pi}{8}$

20) The equation of tangent at (1, 2) to the circle $x^2 + y^2 = 5$ is _____

(a) x + y = 3 (b) x + 2y = 3 (c) x- y = 5 (d) x - 2y = 5

II. ANSWER ANY SEVEN QUESTIONS 7 x 2 =
QUESTION NUMBER 30 IS COMPULSORY

21) If A is a non-singular matrix of odd order, prove that |adj A| is positive

22) Find the rank of the following matrices by minor method:

$$\begin{bmatrix} -1 & 3 \\ 4 & -7 \\ 3 & -4 \end{bmatrix}$$

23) Find the square roots of 4+3i

24) Show that the equation $2x^2 - 6x + 7 = 0$ cannot be satisfied by any real values of x.

25) Find the principal value of $\sin^{-1}\left(-\frac{1}{2}\right)$ (in radians and degrees).

26) Find the general equation of the circle whose diameter is the line segment joining the points (−4, −2)and (1, 1) is $x^2+y^2+5x+3y+6=0$

27) Find the vertex, focus, equation of directrix and length of the latus rectum of the following:
$x^2 = 24y$

28) A particle is acted upon by the forces $(3\hat{i}-2\hat{j}+2\hat{k})$ and $(2\hat{i}+\hat{j}-\hat{k})$ is displaced from the point (1, 3, -1) to the point (4, -1, λ). If the work done by the forces is 16 units, find the value of λ.

29) 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 $\vec{r}=(6\hat{i}+3\hat{j}+2\hat{k})=8$

30) Find the value of the complex number $(i^{25})^3$.

III. ANSWER ANY SEVEN QUESTIONS 7 x 3 =
QUESTION NUMBER 40 IS COMPULSORY

31) If $A=\begin{bmatrix} 3 & 2 \\ 7 & 5 \end{bmatrix}$ and $B=\begin{bmatrix} -1 & -3 \\ 5 & 2 \end{bmatrix}$, verify that $(AB)^{-1} = B^{-1}A^{-1}$

32) Simplify $\left(\frac{1+i}{1-i}\right)^3 - \left(\frac{1-i}{1+i}\right)^3$ into rectangular form

33) Which one of the points 10 − 8i, 11+ 6i is closest to 1 + i.

34) If the sides of a cubic box are increased by 1, 2, 3 units respectively to form a cuboid, then the volume is increased by 52 cubic units. Find the volume of the cuboid.

35) If $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = \pi$ and $0 < x, y, z < 1$, show that $x^2 + y^2 + z^2 + 2xyz = 1$

36) Find the equation of the hyperbola with vertices $(0, \pm 4)$ and foci$(0, \pm 6)$.

37) The equation of the ellipse is $\frac{(x-11)^2}{484} + \frac{y^2}{64} = 1$. (x and y are measured in centimeters) where to the nearest centimeter, should the patient's kidney stone be placed so that the reflected sound hits the kidney stone?

38) Find the magnitude and the direction cosines of the torque about the point (2, 0, -1) of a force $(2\hat{i} + \hat{j} - \hat{k})$, whose line of action passes through the origin

39) Find the vector equation of a plane which is at a distance of 7 units from the origin having 3,−4, 5 as direction ratios of a normal to it.

40) Solve by matrix inversion method $x + y = 3$, $2x + 3y = 8$.

IV. ANSWER ALL THE QUESTIONS

7x 5 =

41) a) If $A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$, show that $A^{-1} = \frac{1}{2}(A^2 - 3I)$.

(OR)

b) Find the cube roots of unity.

42) a) A boy is walking along the path $y = ax^2 + bx + c$ through the points $(-6, 8)$, $(-2, -12)$ and $(3, 8)$. He wants to meet his friend at P(7, 60). Will he meet his friend? (Use Gaussian elimination method.)

(OR)

b) If $z = x + iy$ and $\arg\left(\frac{z-i}{z+2}\right) = \frac{\pi}{4}$, then show that $x^2 + y^2 + 3x - 3y + 2 = 0$

43) a) Solve the equation $6x^4 - 5x^3 - 38x^2 - 5x + 6 = 0$ if it is known that $\frac{1}{3}$ is a solution.

(OR)

b) Two coast guard stations are located 600 km apart at points A(0, 0) and B(0, 600). A distress signal from a ship at P is received at slightly different times by two stations. It is determined that the ship is 200 km farther from station A than it is from station B. Determine the equation of hyperbola that passes through the location of the ship.

44) a) Solve: $(x - 4)(x - 7)(x - 2)(x + 1) = 16$

(OR)

b) Find the non-parametric form of vector equation, and Cartesian equations of the plane passing through the points (2, 2, 1), (9, 3, 6) and perpendicular to the plane $2x + 6y + 6z = 9$

45) a) Find the domain of $f(x) = \sin^{-1}\left(\frac{|x|-2}{3}\right) + \cos^{-1}\left(\frac{1-|x|}{4}\right)$

(OR)

b) Find the equation of the plane passing through the line of intersection of the planes $x + 2y + 3z = 2$ and $x - y + z = 3$ and at a distance $\frac{2}{\sqrt{3}}$ from the point (3, 1 -1)

46) a) Find the value of $\tan\left[\frac{1}{2}\sin^{-1}\left(\frac{2a}{1+a^2}\right) + \frac{1}{2}\cos^{-1}\left(\frac{1-a^2}{1+a^2}\right)\right]$

(OR)

b) Find the equation of the circle passing through the points (1, 1), (2, -1) and (3, 2) .

47) a) Identify the type of conic and find centre, foci, vertices, and directrices of each of the following :

$18x^2+12y^2-144x+48y+120 = 0$

(OR)

b) Using vector method, prove that $\cos(\alpha - \beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$

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