12th Standard

Maths

Reg.No. :

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Time : 02:30:00 Hrs Total Marks : 90

20 x 1 = 20

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

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

2) 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 (d) B^T

3) If $A\begin{bmatrix} 1 & -2 \\ 1 & 4 \end{bmatrix} = \begin{bmatrix} 6 & 0 \\ 0 & 6 \end{bmatrix}$, then A =

(a) $\begin{bmatrix} 1 & -2 \\ 1 & 4 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 2 \\ -1 & 4 \end{bmatrix}$ (c) $\begin{bmatrix} 4 & 2 \\ -1 & 1 \end{bmatrix}$ (d) $\begin{bmatrix} 4 & -1 \\ 2 & 1 \end{bmatrix}$

4) If $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$, then adj(adj A) is

(a) $\begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 6 & -6 & 8 \\ 4 & -6 & 8 \\ 0 & -2 & 2 \end{bmatrix}$ (c) $\begin{bmatrix} -3 & 3 & 4 \\ -2 & 3 & -4 \\ 0 & 1 & -1 \end{bmatrix}$ (d) $\begin{bmatrix} 3 & -3 & 4 \\ 0 & -1 & 1 \\ 2 & -3 & 4 \end{bmatrix}$

5) If ρ (A) - ρ ([AIB]), then the system is

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

6) $i^n+i^{n+1}+i^{n+2}+i^{n+3}$ is

(a) 0 (b) 1 (c) -1 (d) i

7) 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) $2|z|^2$

8) If $z = \frac{(\sqrt{3}+i)^3(3 \quad +4)^2}{(8 \quad 6i)^2}$, then |z| is equal to

(a) 0 (b) 1 (c) 2 (d) 3

9) A zero of $x^3 + 64$ is

(a) 0 (b) 4 (c) 4i (d) -4

10) A polynomial equation in x of degree n always has

(a) n distinct roots (b) n real roots (c) n imaginary roots (d) at most one root

11) If α,β and γ are the roots of x^3+px^2+qx+r, then $\Sigma\frac{1}{\alpha}$ is

(a) $-\frac{q}{r}$ (b) $\frac{p}{r}$ (c) $\frac{q}{r}$ (d) $-\frac{q}{p}$

12)

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

13) If $\sin^{-1}x = 2\sin^{-1}\alpha$ has a solution, then

(a) $|\alpha| \le \frac{1}{\sqrt{2}}$ (b) $|\alpha| \ge \frac{1}{\sqrt{2}}$ (c) $|\alpha| < \frac{1}{\sqrt{2}}$ (d) $|\alpha| > \frac{1}{\sqrt{2}}$

14) If $\sin^{-1} x+\sin^{-1} y+\sin^{-1} z=\frac{3\pi}{2}$, the value of $x^{2017}+y^{2018}+z^{2019}-\frac{9}{x^{101}+y^{101}+z^{101}}$ is

(a) 0 (b) 1 (c) 2 (d) 3

15) The equation of the circle passing through(1,5) and (4,1) and touching y -axis is $x^2+y^2-5x-6y+9+(4x+3y-19)=0$ whereλ is equal to

(a) $0, -\frac{40}{9}$ (b) 0 (c) $\frac{40}{9}$ (d) $\frac{-40}{9}$

16) 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) $-35< m < 15$

17) The radius of the circle$3x^2+by^2+4bx-6by+b^2 =0$ is

(a) 1 (b) 3 (c) $\sqrt{10}$ (d) $\sqrt{11}$

18) If $\vec{a}$ and $\vec{b}$ are parallel vectors, then $[\vec{a}, \vec{c}, \vec{b}]$ is equal to

(a) 2 (b) -1 (c) 1 (d) 0

19) $\vec{a}\ \vec{b} = \vec{b}.\vec{c} = \vec{c}.\vec{a} = 0$, then the value of $[\vec{a}, \vec{b}, \vec{c}]$ is

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

20) If $\vec{a}, \vec{b}, \vec{c}$ are three unit vectors such that $\vec{a}$ is perpendicular to $\vec{b}$ and is parallel to $\vec{c}$ then $\vec{a} \times (\vec{b} \times \vec{c})$ is equal to

(a) $\vec{a}$ (b) $\vec{b}$ (c) $\vec{c}$ (d) $\vec{0}$

7X2 =14

21) If adj A = $\begin{bmatrix} -1 & 2 & 2 \\ 1 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$, find A^{-1}.

22) Find the rank of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & 4 \\ 3 & 0 & 5 \end{bmatrix}$ by reducing it to a row-echelon form.

23) Write $\frac{3 + 4i}{5 - 12i}$ in the x+iy form, hence find its real and imaginary parts.

24) Show that the following equations represent a circle, and, find its centre and radius|
$|z - 2 - i| = 3$

25) If α, β, γ and δ are the roots of the polynomial equation $2x^4+5x^3-7x^2+8=0$, find a quadratic equation with integer coefficients whose roots are $\alpha + \beta + \gamma + \delta$ and $\alpha\beta\gamma\delta$.

26) For what value of x does $\sin x=\sin^{-1}x$?

27) Simplify

$$\cos^{-1}\left(\cos\left(\frac{13\pi}{3}\right)\right)$$

28) Find the general equation of the circle whose diameter is the line segment joining the points (−4,−2)and (1,1)

29) If $y=4x+c$ is a tangent to the circle $x^2+y^2=9$, find c .

Dete mine whether the three vectors $2\hat{i} - 3\hat{j} + \hat{k}$, $\hat{i} - 2\hat{j} + 2\hat{k}$ and $3\hat{i} + \hat{j} + 2\hat{k}$ are coplanar.

7 x 3 = 21

31) If A = $\begin{bmatrix} 8 & -4 \\ -5 & 3 \end{bmatrix}$, verify that A(adj A) = $|A|I_2$.

32) If $\frac{z+3}{z-5i} = \frac{1+4i}{2}$, find the complex number z

33) If |z|=2 show that $3 \le |z + 3 + 4i| \le 7$

34) Find the sum of squares of roots of the equation $2x^4-8x+6x^2-3=0$.

35) Find the domain of $\cos^{-1}(\frac{2+sinx}{3})$

36) Prove that

$$sin^{-1}(\frac{3}{5}) - cos^{-1}(\frac{12}{13}) = sin^{-1}(\frac{16}{65})$$

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

$$\frac{x^2}{25} + \frac{y^2}{9} = 1$$

38) Find the vertex, focus, equation of directrix and length of the latus rectum of the following:

$y^2 = -8x$

39) In triangle, ABC the points, D, E, F are the midpoints of the sides, BC, CA and AB respectively. Using vecto method, show that the area of ΔDEF is equal to $\frac{1}{2}$ (area of ΔABC)

40) 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.

7 x 5 = 35FR

41) a) Find the foci, vertices and length of major and minor axis of the conic $4x^2+36y^2+40x-288y+532 = 0$.

(OR)

b) If $\vec{a} = \vec{i} - \vec{j}, \vec{b} = \hat{i} - \hat{j} - 4\hat{k}, \vec{c} = 3\hat{j} - \hat{k}$ and $\vec{d} = 2\hat{i} + 5\hat{j} + \hat{k}$

(i) $(\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d}) = [\vec{a}, \vec{b}, \vec{d}]\vec{c} - [\vec{a}, \vec{b}, \vec{c}]\vec{d}$

(ii) $(\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d}) = [\vec{a}, \vec{c}, \vec{d}]\vec{b} - [\vec{b}, \vec{c}, \vec{d}]\vec{a}$

42) a) If A = $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & 4 \\ 2 & -4 & 3 \end{bmatrix}$, verify thatA(adj A)=(adj A)A = $|A|\ I_3$.

(OR)

b) Show that $\left(2 + i\sqrt{3}\right)^{10} + \left(2 - i\sqrt{3}\right)^{10}$ is real ii) $\left(\frac{19+9i}{5-3i}\right)^{15} - \left(\frac{8+i}{I+2i}\right)^{15}$ is purely imaginary.

43) a) Solve $tan^{-1}\left(\frac{x-1}{x-2}\right) + tan^{-1}\left(\frac{x\ \ 1}{x+2}\right) = \frac{\pi}{4}$

(OR)

b) A concrete bridge is designed as a parabolic arch. The road over bridge is 40m long and the maximum height of the arch is 15m Write the equation of the parabolic arch.

44) a) Solve the equation (x-2)(x-7)(x 3)(x+2)+19=0

b) Solve $\cos\left(\sin^{-1}\left(\frac{x}{\sqrt{1+x^2}}\right)\right) = \sin\left\{\cot^{-1}\left(\frac{3}{4}\right)\right\}$

45) a) If 2+i and $3-\sqrt{2}$ are roots of the equation $x^6-13x^5+62x^4-126x^3+65x^2+127x$ 140=0, find all roots.

(OR)

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

46) a) By using Gaussian elimination method, balance the chemical reaction equation: $C_5H_8 + O_2 \longrightarrow CO_2 + H_2O$. (The above is the reaction that is taking place in the burning of organic compound called isoprene.)

(OR)

b) 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 $|9z_1z_2+4z_1z_2+z_2z_3|=6$

47) a) Solve the fol owing system of equations, using matrix inversion method:

$2x_1 + 3x_2 + 3x_3 = 5,\ x_1 - 2x_2 + x_3 = -4,\ 3x_1 - x_2 - 2x_3 = 3.$

(OR)

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

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20 x 1 = 20

1) If A = $\begin{bmatrix} 7 & 3 \\ 4 & 2 \end{bmatrix}$, then 9I - A =

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

2) If P = $\begin{bmatrix} 1 & x & 0 \\ 1 & 3 & 0 \\ 2 & 4 & -2 \end{bmatrix}$ is the adjoint of 3 × 3 matrix A and |A| = 4, then x is

(a) 15 (b) 12 (c) 14 (d) 11

3) If A^TA^{-1} is symmetric, then A^2 =

(a) A^- (b) $(A^T)^2$ (c) A^T (d) $(A^{-1})^2$

4) In a homogeneous system if ρ (A) =ρ ([A|0]) < the number of unknouns then the system has ________

(a) trivial solution b) only non - trivial solution (c) no solution (d) trivial solution and infinitely many non - trivial solutions

5) If $|z_1|=1, |z_2|=2 |z_3|=3$ and $|9z_1z_2+4z_1z_3+z_2z_3|=12$ then the value of $|z_1+z_2+z_3|$ is

(a) 1 (b) 2 (c) 3 (d) 4

6) If z is a complex number such that $z\varepsilon C/R$ and $z+\frac{1}{z}\epsilon R$ then|z| is

(a) 0 (b) 1 (c) 2 (d) 3

7) If a=cosθ + i sinθ, then $\frac{1+a}{1-a}$ =

(a) $\cot\frac{\theta}{2}$ (b) cot θ (c) $i\cot\frac{\theta}{2}$ (d) $i\tan\frac{\theta}{2}$

8) According to the rational root theorem, which number is not possible rational root of $4x^7+2x^4-10x^3-5$?

(a) -1 (b) $\frac{5}{4}$ (c) $\frac{4}{5}$ (d) 5

9) The number of positive zeros of the polynomial $\Sigma_{j=0}^{n} {}^nC_r$ ( ) x^r is

(a) 0 (b) n (c) < n (d) r

10) The equation $\sqrt{x+1}-\sqrt{x-1}=\sqrt{4x-1}$ has

(a) no solution (b) one solution (c) two solution (d) more than one solution

11) If $\cot^{-1}2$ and $\cot^{-1}3$ are two angles of a triangle, then the third angle is

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

12) $sin^{-1}\left(tan\frac{\pi}{4}\right)-sin^{-1}\left(\sqrt{\frac{3}{x}}\right)=\frac{\pi}{6}$ Then x is a root of the equation

(a) $x^2-x-6=0$ (b) $x^2-x-12=0$ (c) $x^2+x-12=0$ (d) $x^2+x-6=0$

13) If $\sin^{-1}\frac{x}{5}+cosec^{-1}\frac{5}{4}=\frac{\pi}{2}$, then the value of x is

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

(a) 0 (b) 1 (c) 2 (d) infinte

15) 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) $-35< m < 15$

16) 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)

17) The radius of the circle passing through the point(6,2) two of whose diameter arex+y=6 and x+2y=4 is

(a) 10 (b) $2\sqrt{5}$ (c) 6 (d) 4

18) In an ellipse, the distance between its foci is 6 and its minor axis is 8, then e is

(a) $\frac{4}{5}$ (b) $\frac{1}{\sqrt{52}}$ (c) $\frac{3}{5}$ (d) $\frac{1}{2}$

19) If $\vec{a}, \vec{b}, \vec{c}$ are three unit vectors such that $\vec{a}$ is perpendicular to $\vec{b}$ and is parallel to $\vec{c}$ then $\vec{a} \times (\vec{b} \times \vec{c})$ is equal to

(a) $\vec{a}$ (b) $\vec{b}$ (c) $\vec{c}$ (d) $\vec{0}$

20) If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = \hat{i} + \hat{j}$, $\vec{c} = \hat{i}$ and $(\vec{a} \times \vec{b}) \times \vec{c} = \lambda\vec{a} + \mu\vec{b}$ then the value of $\lambda + \mu$ is

(a) 0 (b) 1 (c) 6 (d) 3

7 x 2 = 14

21) Solve the following system of homogenous equations.

$2x + 3y - z = 0$, $x \quad y - 2z = 0$, $3x + y + 3z = 0$

22) Find the square roots of 4+3i

23) Simplify the following

$\sum_{n=1}^{12} i^n$

24) Solve: $2\sqrt{\frac{x}{a}} + 3\sqrt{\frac{a}{x}} = \frac{b}{a} + \frac{6a}{b}$

25) Construct a cubic equation with roots 2,−2, and 4.

26) Solve $\tan^{-1}\left(\frac{1-x}{1+x}\right) = \frac{1}{2}\tan^{-1}$ x for x > 0

27) Prove that $\tan^{-1} x + \tan^{-1} z = \tan^{-1}\left[\frac{x+y+z-xyz}{1-xy \quad yz-zx}\right]$

28) Find centre and radius of the following circles.

$x_2 + (y+2^{)2} = 0$

29) Find the angle between the following lines.

$\vec{r} = (4\hat{i} - \hat{j}) + t(\hat{i} + 2\hat{j} - 2\hat{k})$, $\hat{r} = (\hat{i} + 2\hat{j} - 2\hat{k}) + s(-i - 2\hat{j} + 2\hat{k})$

30) Find the distance between the planes $\vec{r}.(2\hat{i} - \hat{j} - \hat{k}) = 6$ and $\vec{r}.(6\hat{i} - \hat{j} - 2\hat{k}) = 27$

7 x 3 = 21

31) $A = \begin{bmatrix} 1 & \tan x \\ -\tan x & 1 \end{bmatrix}$, show that $A^T A^{\;1} = \begin{bmatrix} \cos 2x & -\sin 2x \\ \sin 2x & \cos 2x \end{bmatrix}$

32)

Find the rank of the matrix $\begin{bmatrix} \dots \\ -3 & 4 & -2 & -1 \\ 6 & 2 & -1 & 7 \end{bmatrix}$ by reducing it to an echelon form.

33) Show that the points $1, \frac{-1}{2} + i\frac{\sqrt{3}}{2},$ and $\frac{-1}{2} - i\frac{\sqrt{3}}{2}$ are the vertices of an equ late al triangle.

34) If $cos\alpha + cos\beta + cos\gamma = sin\alpha + sin\beta + sin\gamma = 0$ then show that

(i) $cos3\alpha + cos3\beta + cos3\gamma = 3cos(\alpha + \beta + \gamma)$

(ii) $sin3\alpha + sin3\beta + sin3\gamma + sin3\gamma = 3sin(\alpha + \beta + \gamma)$

35) Form a polynomial equation with integer coefficients with $\sqrt{\frac{\sqrt{2}}{\sqrt{3}}}$ as a root.

36) Find all real numbers satisfying 4^x-3(2^{x+2})+2^5=0

37) Prove that $tan^{-1}x + tan^{-1}\frac{2x}{1-x^2} = tan^{-1}\frac{3x-x^2}{1-3x^2}, |x| < \frac{1}{\sqrt{3}}$

38) Prove that

$2tan^{-1}\frac{1}{2} + tan^{-1}\frac{1}{7} = tan^{-1}\frac{31}{17}$

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

$\frac{(\ \ 1)^2}{100} + \frac{(y-2)^2}{64} = 1$

40) Find the equation of the plane passing through the intersection of the planes 2x+3y−z+7=0 and andx+y−2z+5=0 and is perpendicular to the planex+y−3z−5=0.

7 x 5 = 35

41) a) Provethat $tan^{-}\left(\frac{1-x}{1+x}\right) - tan^{-1}\left(\frac{1-y}{1+y}\right) = sin^{-1}\left(\frac{y-x}{\sqrt{1+x^2}\ \sqrt{1+y^2}}\right)$

(OR)

b) A tunnel through a mountain for a four lane highway is to have a elliptical opening. The total width of the highway (not the opening) s to be 16m, and the height at the edge of the road must be sufficient for a truck 4m high to clear if the highest point of the opening is to be 5m approximately . How wide must the opening be?

42) a) 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 productsAB and BAand hence solve the system of equations x - y + z = 4, x - 2y - 2z = 9, 2x + y + 3z = 1.

(OR)

b) If z=x+iy is a comp ex number such that Im $\left(\frac{2z+1}{iz\ \ 1}\right) = 0$ show that the locus of z is $2x^2$ $2y^2$+x-2y=0

43) a) Find the vertex, focus, equation of directrix and length of the latus rectum of the following: y^2−4y−8x+12=0

(OR)

b) Show that the lines $\frac{x\ \ 2}{1} = \frac{y-3}{1} = \frac{z-4}{3}$ and $\frac{x-2}{1} = \frac{y\ \ 3}{1} = \frac{z-4}{3}$ coplanar.Also, find the p ane containing these lines.

44) a) Test for consistency of the following system of linear equations and if possible solve:

x + 2y - z = 3, 3x - y + 2z = 1, x - 2y + 3z = 3, x - y + z + 1 = 0

(OR)

45) a) Investigate for what values of λ and μ the system of linear equations

$x + 2y + z = 7,\ x + y + \lambda z = \mu,\ x + 3y - 5z = 5$ has

(i) no solution

(ii) a unique solution

(iii) an infinite number of solutions

(OR)

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

46) a) Show that $\left(\frac{i+\sqrt{3}}{-i+\sqrt{3}}\right)^{2\omega} + \left(\frac{\sqrt{3}}{i+\sqrt{3}}\right)^{2\omega}$ =-1

(OR)

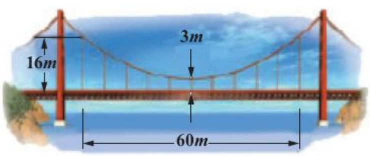
b) If $a_1, a_2, a_3, \ldots$ an is an arithmetic progression with common difference d, prove that tan

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a} \left[tan^{-1}\left(\frac{d}{1+a_1a_2}\right) + tan^{-1}\left(\frac{d}{+a_2a_3}\right) + \ldots . tan^{-1}\left(\frac{d}{1+a_na_{n-1}}\right)\right] = \frac{a_n - a_1}{1+a_1a_n}$$

47) a) Solve the equation (2x-)(6x-1)(3x-2)(x- 2 -7=0

(OR)

b) Parabolic cable of a 60m portion of the roadbed of a suspension bridge are positioned as shown below. Vertical Cables are to be spaced every 6m along this portion of the roadbed. Calculate the lengths of first two of these vertical cables from the vertex.



48) 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) Prove by vector method that $\sin(\alpha + \beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta$

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