Tirunelveli District
Second Revision Test - February 2024

Standard - 12
MATHEMATICS

Time Allowed: 3.00 Hours Maximum Marks: 90

PART - A

Choose the correct answer: 20×1=20

1) If A^TA^{-1} is symmetric then A^2 = _____
   a) A^T b) $(A^{-1})^2$ c) $(A^T)^2$ d) A^{-1}
2) If A is a non-singular square matrix of order n then
   a) $|adj\ A| = |A|^{n-1}$ b) $(adj\ A)^T = adj\ A$
   c) $|adj\ A| = |A|$ d) $adj\ (\lambda A) = \lambda\ adj\ A$
3) If z is a non zero complex number, such that $2iz^2 = \bar{z}$ then $|z|$ is
   a) $\frac{1}{2}$ b) 1 c) 2 d) 3
4) Find the conjugate of $z_1 - z_2$ if $z_1 = 2+3i$, $z_2 = 5+2i$.
   a) $-3+i$ b) $3+i$ c) $-3-i$ d) $3-i$
5) The polynomial x^3+2x+3 has
   a) one negtive and two imaginary zeros
   b) one positive and two imaginary zeros
   c) three real zeros
   d) n zeros
6) If $\sin^{-1}x + \cot^{-1}\left(\frac{1}{2}\right) = \frac{\pi}{2}$ then x is equal to
   a) $\frac{1}{2}$ b) $\frac{1}{\sqrt{5}}$ c) $\frac{2}{\sqrt{5}}$ d) $\frac{\sqrt{3}}{2}$
7) 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) $x = 1$
8) If the conic is called a ellipse then the constant
   a) $e = 1$ b) $e > 1$ c) $e < 1$ d) $e = 0$
9) Distance from the orifin to the plane $3x-6y+2z+7 = 0$ is
   a) 1 b) 2 c) 0 d) 3
10) If $\vec{a}.\vec{b} = \vec{b}.\vec{c} = \vec{c}.\vec{a} = 0$ then the value of $\left[\vec{a}\ \vec{b}\ \vec{c}\right]$ is
   a) 1 b) $\frac{1}{3}|\vec{a}||\vec{b}||\vec{c}|$ c) -1 d) $|\vec{a}||\vec{b}||\vec{c}|$
11) The value of the limit $\lim_{x \to 0}\left(\cot x - \frac{1}{x}\right)$ is
   a) 0 b) 1 c) 2 d) ∞
12) The maximum value of the product of two positive numbers, when their sum of the squares is 200 is
   a) 100 b) $25\sqrt{7}$ c) 28 d) $24\sqrt{14}$
13) $f(x, y) = \frac{x^2 + 5xy - 10y^2}{3x + 7y}$ is a homogeneous function of degree _____
   a) 1 b) 2 c) 0 d) 3
14) If $g(x) = x^2+\sin x$ then $g''(x)$ is
   a) $2x + \cos x$ b) $2 - \sin x$ c) $2 + \sin x$ d) $2x - \cos x$

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15) If $\int_0^a \frac{1}{4+x^2}dx = \frac{\pi}{8}$ then a is

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

16) The value of $\int_{-1}^{2} |x|dx$ is

a) $\frac{1}{2}$ b) $\frac{3}{2}$ c) $\frac{5}{2}$ d) $\frac{7}{2}$

17) Find the integrating factor of $\frac{dy}{dx} + 2y = e^{-x}$ is

a) 2x b) e^{-2x} c) x d) e^{2x}

18) Let x have a Bernoulli distribution with mean 0.4 then the variance of (2X–3) is

a) 0.24 b) 0.48 c) 0.6 d) 0.96

19) Which one is the contrapositive of the statement $(p \vee q) \rightarrow r$?

a) $\neg r \rightarrow (\neg p \wedge \neg q)$ b) $\neg r \rightarrow (p \vee q)$ c) $r \rightarrow (p \wedge q)$ d) $p \rightarrow (q \vee r)$

20) Which one of the following is a binary operatin on N?

a) Multiplication b) Division c) Subtraction d) All the above

PART - B

Answer any seven questions. Question No. 30 is compulsory. **7×2=14**

21) Prove that $\begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$ is orthogonal.

22) Find the equation of the hyperbola if foci (±2, 0) eccentricity = $\frac{3}{2}$

23) Find the value of $\tan^{-1}\left(\tan\frac{5\pi}{4}\right)$

24) Show that the equation $z^3 + 2\bar{z} = 0$ has five solutions.

25) Find a polynomial equation of minimum degree with rational coefficients having $2-\sqrt{3}$ as a root.

26) $A = \begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ are any two boolean matrices. Find A∨B and A∧B

27) If $\lim_{\theta \to 0}\left(\frac{1-\cos m\theta}{1-\cos n\theta}\right) = 1$ then prove that $m = \pm n$

28) If $\omega(x, y, z) = x^2y+y^2z+z^2x$, $x, y, z \in R$ find the differential $d\omega$.

29) If x is the random with distribution function F(x) given by $F(x) = \begin{cases} 0 & x < 0 \\ x & 0 \le x < 1 \\ 1 & 1 \le x \end{cases}$

find $P(0.2 \le x \le 0.7)$

30) Evaluate $\int_0^1 [2x]dx$ where [0] is the greatest integer function

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PART - C

Answer any seven questions. Question No. 40 is compulsory. **7×3=21**

31) If adj A = $\begin{bmatrix} 0 & -2 & 0 \\ 6 & 2 & -6 \\ -3 & 0 & 6 \end{bmatrix}$ find A^{-1}.

32) Find the square root of $-5-12i$

33) Solve the equation $x^4-14x^2+45 = 0$

34) Find the angle between the straight line $\vec{r} = (2\vec{i} + 3\vec{j} + \vec{k}) + t(\vec{i} - \vec{j} + \vec{k})$ and the plane $2x-y+z = 5$

35) Evaluate $\int_0^1 (5x + 4)\,dx$ as the limit of a sum

36) Find the binomial distribution for five fair coins are tossed once and X denotes the number of heads.

37) Evaluate: $\lim_{x \to 0} x \log x$

38) Show that $x^2+y^2 = r^2$ where r is a constant is a solution of the differential equation $\frac{dy}{dx} = \frac{-x}{y}$

39) $\vec{a} = -3\vec{i} - \vec{j} + 5\vec{k}$, $\vec{b} = \vec{i} - 2\vec{j} + \vec{k}$, $\vec{c} = 4\vec{j} - 5\vec{k}$ find $\vec{a}.(\vec{b} \times \vec{c})$

40) $u(x, y, z) = \log (x^3+y^3+z^3)$ find $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z}$

PART - D

Answer all the questions: **7×5=35**

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

(OR)

b] Prove that the ellipse $x^2+4y^2 = 8$ and the hyperbola $x^2-2y^2 = 4$ intersect orthogonally

42) a] Solve using Gaussian Elimination method for the following system of linear equations. $2x-2y+3z = 2$; $x+2y-z = 3$; $3x-y+2z = 1$

(OR)

b] Find the area of the region bounded by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

43) a] Using vector method prove that $\cos(\alpha-\beta) = \cos\alpha \cos\beta + \sin\alpha \sin\beta$

(OR)

b] Prove $p \rightarrow (q \rightarrow r) \equiv (p \wedge q) \rightarrow r$ without using truth table.

44) a] Solve $6x^6-35x^5+56x^4-56x^2+35x-6 = 0$

(OR)

b] Prove that $\sin^{-1}\frac{3}{5} - \cos^{-1}\frac{12}{13} = \sin^{-1}\frac{16}{65}$

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45) 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] Solve $\left(y + \sqrt{x^2 + y^2}\right)dx - x\,dy = 0$, $y(1) = 0$

46) a] If $\omega(x, y, z) = \log\left(\frac{5x^3y^4 + 7y^2xz^4 - 75y^3z^4}{x^2 + y^2}\right)$ find $x\frac{\partial\omega}{\partial x} + y\frac{\partial\omega}{\partial y} + z\frac{\partial\omega}{\partial z}$

(OR)

b] The probability density function of X is given by $f(x) = \begin{cases} Ke^{-2x} & \text{for } x > 0 \\ 0 & \text{for } x \le 0 \end{cases}$

(i) Find the vaue of K.
(ii) Distribution function
(iii) $P(X < 2)$

47) a] Find the vector parametric, vector non-parametric and Cartesian form of the equation of the plane passing through the points (–1, 2, 0) (2, 2, –1) and parallel to the straight line $\frac{x-1}{1} = \frac{2y+1}{2} = \frac{z+1}{-1}$

(OR)

b] Evaluate: $\int_0^{1/2} \frac{\sin^{-1}x}{(1-x^2)^{3/2}}\,dx$

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