# Padasalai's

## Telegram Groups!

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- Padasalai's NEWS - Group

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- Lesson Plan - Group

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- TNPSC - Group

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# Maths - Full Test - I

XII Std

Time: 3 hrs
Max Marks: 90

## Part - A

(20×1 = 20)

1. If $A = \begin{pmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix}$ and $A(\text{adj}A) = \begin{pmatrix} k & 0 \\ 0 & k \end{pmatrix}$; then $k =$
① 0 ② $\sin\theta$ ③ $\cos\theta$ ④ 1

2. If $\rho(A) = \rho[A, B] = n$ < number of unknowns, then the system $Ax = B$ has ① consistent and has unique solution ② consistent.
③ consistent and has infinitely many solution ④ inconsistent.

3. The principal argument of $(\sin 40° + \cos 40°)^5$ is
① $-110°$ ② $-70°$ ③ $70°$ ④ $110°$.

4. If $z$ is a complex number and $z + \frac{1}{z} \in R$; then $|z| =$
① 0 ② 1 ③ 2 ④ 3

5. The number of positive roots of the polynomial $\sum_{r=0}^{n} {}^nC_r (-1)^r x^r$ is
① 0 ② n ③ $<n$ ④ r

6. If $x = \frac{1}{5}$; the value of $\cos(\cos^{-1}(x) + 2\sin^{-1}(x))$ is
① $-\sqrt{\frac{24}{25}}$ ② $\sqrt{\frac{24}{25}}$ ③ $\frac{1}{5}$ ④ $-\frac{1}{5}$

7. The domain of the function defined by $f(x) = \sin^{-1}(\sqrt{x-1})$ is
① $[1, 2]$ ② $[-1, 1]$ ③ $[0, 1]$ ④ $[-1, 0]$

8. An ellipse has OB as semi minor axis, F, F' its foci and $\angle FBF'$ is a right angle; then $e =$ ① $\frac{1}{\sqrt{2}}$ ② $\frac{1}{2}$ ③ $\frac{1}{4}$ ④ $\frac{1}{\sqrt{3}}$.

9. If the projection of $\vec{a} \times \vec{b}$ on unit vector $\vec{e}$ is 5, then $[\vec{a} \times \vec{b} \;\; \vec{b} \times \vec{c} \;\; \vec{c} \times \vec{a}] =$ ① 10 ② 5 ③ 25 ④ 50.

10. If the planes $\vec{r} \cdot (2\vec{i} - \lambda\vec{j} + \vec{k}) = 3$ and $\vec{r} \cdot (4\vec{i} + \vec{j} - \mu\vec{k}) = 5$ are $\parallel^{le}$, then $\lambda, \mu =$ ① $\frac{1}{2}, -2$ ② $-\frac{1}{2}, 2$ ③ $-\frac{1}{2}, -2$ ④ $\frac{1}{2}, 2$.

11. The maximum value of the function $x^2 e^{-2x}$; $x > 0$ is
① $1/e$ ② $\frac{1}{2e}$ ③ $\frac{1}{e^2}$ ④ $\frac{4}{e^4}$.

12. The % error of $5^{th}$ root of 31 is approximately how many times of % error of 31 is ① $\frac{1}{31}$ ② $\frac{1}{5}$ ③ 5 ④ 31

13) If $u(x,y) = x^2 y \sin\left(\frac{x}{y}\right)$; then $x u_x + y u_y =$
① $u$ ② $2u$ ③ $3u$ ④ $0$.

14) $\int_0^{\pi} \sin^4 x \, dx =$ ① $\frac{3\pi}{10}$ ② $\frac{3\pi}{5}$ ③ $\frac{3\pi}{4}$ ④ $\frac{3\pi}{2}$.

15) The order and degree of $y_2^3 = \sqrt{1+y_1}$ are
① $2;3$ ② $3;2$ ③ $2;6$ ④ $3;6$

16) I.F of $\frac{dy}{dx} = \frac{x+y+1}{x+1}$ is ① $\frac{1}{x+1}$ ② $x+1$ ③ $\frac{1}{\sqrt{x+1}}$ ④ $\sqrt{x+1}$

17) If $f(x) = \begin{cases} kx^2 & 0<x<1 \\ 0 & \text{otherwise} \end{cases}$ is a P.d.f of $X$; then $k=$
① $\frac{1}{2}$ ② $\frac{1}{3}$ ③ $3$ ④ $2$.

18) Let $X$ be a Bernoulli distribution with mean $0.4$; then var $(2X-3) =$
① $0.24$ ② $0.48$ ③ $0.6$ ④ $0.96$

19) $p \wedge (\neg p \vee q)$ is ① a tautology ② a contradiction
③ logically equivalent to $p \wedge q$ ④ logically equivalent to $p \vee q$.

20) Which one of the following is incorrect?
① $\neg(p \vee q) \equiv \neg p \wedge \neg q$ ② $\neg(p \wedge q) \equiv \neg p \vee \neg q$ ③ $\neg(p \vee q) \equiv \neg p \vee \neg q$
④ $\neg(\neg p) \equiv p$.

Part-B note:- ① Answer any 7 Qns. $(7 \times 2 = 14)$
② Qn (30) is compulsory.

21) Prove $A = \begin{pmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{pmatrix}$ is an orthogonal matrix.

22) Find the conjugate of $\frac{1+2i}{1-(1-i)^2}$.

23) Find the domain of $\tan^{-1}(\sqrt{9-x^2})$.

24) If the normal at '$t_1$' on the Parabola $y^2 = 4ax$ meets the Parabola again at '$t_2$' Prove $t_2 = -\left(t_1 + \frac{2}{t_1}\right)$.

25) A Particle is acted upon the forces $3\vec{i} - 2\vec{j} + 2\vec{k}$ and $2\vec{i} + \vec{j} - \vec{k}$. is displaced from $(1,3,-1)$ to $(4,-1,\lambda)$. If the Workdone by the forces is 16 units, Find $\lambda$.

26) Find $df$ if $f(x) = x^2 + 2x + 3$; $x = -0.5$; $dx = 0.1$.

27) Evaluate $\int_0^{\pi/4} \frac{\sec^2 x \, dx}{4 + \tan^2 x}$.

28. The C.D.F $F(x)$ of $X$ is given by $F(x) = \begin{cases} 0 & x < 0 \\ \frac{1}{2}(x^2+x) & 0 \le x < 1 \\ 1 & x \ge 1. \end{cases}$

Find P.d.f $f(x)$.

29. Show that $\neg(p \leftrightarrow q) \equiv p \leftrightarrow \neg q$.

30. Solve $x \cos y \, dy = e^x (x \log x + 1) dx$.

## Part - C

(7×3=21)

(1) Answer any 7 Qns (2) Qn 40 is compulsory

31. Find the inverse of $A = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 5 & 3 \\ 1 & 0 & 8 \end{pmatrix}$ by Gauss-Jordan method.

32. Solve: $9x^3 - 36x^2 + 44x - 16 = 0$ if the roots are in A.P

33. Find the value of $\sin^{-1}\left(\sin \frac{5\pi}{9} \cos \frac{\pi}{9} + \cos \frac{5\pi}{9} \sin \frac{\pi}{9}\right)$.

34. Find the equation of the ellipse having foci $(0, \pm 4)$ and vertices $(0, \pm 5)$.

35. Prove $[\vec{a}\times\vec{b} \;\; \vec{b}\times\vec{c} \;\; \vec{c}\times\vec{a}] = [\vec{a} \;\; \vec{b} \;\; \vec{c}]^2$.

36. Using L.M.V.T; find 'c' if $f(x) = (x-2)(x-7)$; $x \in [3, 11]$.

37. Evaluate $\int_0^1 x^3 dx$ as the limit of a sum.

38. Solve: $y e^y dx = (y^3 + 2x e^y) dy$.

39. Prove $p \to (q \to r) \equiv (p \wedge q) \to r$ without using truth table.

40. Four coins are tossed once. Find the p.m.f and mean for number of heads occurred.

## Part - D (Answer all questions)

(7×5=35).

41. Find $\lambda$, $\mu$ if the equations $2x+3y+5z=9$, $7x+3y-5z=8$ and $2x+3y+\lambda z=\mu$ have (i) no solution (ii) a unique solution (iii) an infinite number of solutions **(OR)**

Solve the equation $z^3 + 8i = 0$ where $z \in \mathbb{C}$.

42. Solve: $x^4 - 10x^3 + 26x^2 - 10x + 1 = 0$ **(OR)**

Solve: $2\tan^{-1}(\cos x) = \tan^{-1}(2 \operatorname{cosec} x)$.

43) Find the centre, vertices and the foci of the ellipse $4x^2+y^2+24x-2y+21=0$. (OR)

Prove by vector method; $\sin(\alpha+\beta)=\sin\alpha\cos\beta+\cos\alpha\sin\beta$.

44) If the curves $ax^2+by^2=1$ and $cx^2+dy^2=1$ intersect each other orthogonally; Prove $\frac{1}{a}-\frac{1}{b}=\frac{1}{c}-\frac{1}{d}$. (OR)

If $f(x,y)=\tan^{-1}\left(\frac{x}{y}\right)$; Show that $f_{xy}=f_{yx}$.

45) Find the area of the region bounded by the Parabola $y^2=x$ and the line $y=x-2$. (OR)

Show that the lines $x+1=2y=-12z$ and $x=y+2=6z-6$ are skew and hence find the shortest distance between them.

46) Solve: $y^2+x^2\frac{dy}{dx}=xy\frac{dy}{dx}$ (OR) Solve by using Cramer's rule.

$\frac{3}{x}-\frac{4}{y}-\frac{2}{z}-1=0$; $\frac{1}{x}+\frac{2}{y}+\frac{1}{z}-2=0$; $\frac{2}{x}-\frac{5}{y}-\frac{4}{z}+1=0$.

47) A retailer Purchase a certain kind of electronic device from a manufacturer. The manufacturer indicates that the defective rate of the device is 5%. The Inspector of the retailer randomly picks 10 items from a shipment. What is the Probability that there will be (i) atleast one (ii) exactly two defective items. (OR)

Let $A=Q-\{1\}$. Define $*$ on $A$ by $x*y=x+y-xy$. Verify (1) closure (2) Commutative (3) Associative (4) Existence of Identity (5) Existence of Inverse.

All the Best

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