



Tsi12M

**Tenkasi District Common Examinations**  
**Common Quarterly Examination - 2023**

21-09-2023

**Standard 12**  
**MATHEMATICS**  
**PART - A**

Time: 3.00 Hours

Marks: 90  
**20x1=20**

**Choose the correct Answer**

- 1) If  $A = \begin{bmatrix} 3 & 5 \\ 1 & 2 \end{bmatrix}$ ,  $B = \text{adj } A$  and  $C = 3A$ , then  $\frac{|\text{adj } B|}{|C|} =$
- a)  $\frac{1}{3}$                       b)  $\frac{1}{9}$                       c)  $\frac{1}{4}$                       d) 4
- 2) If  $A^T A^{-1}$  is symmetric, then  $A^2 =$
- a)  $A^{-1}$                       b)  $(A^T)^2$                       c)  $A^T$                       d)  $(A^{-1})^2$
- 3) If  $\rho(A) = \rho\left(\begin{bmatrix} A \\ B \end{bmatrix}\right) < n$ , number of unknowns, 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) If  $|Z-2+i| \leq 2$ , then the greatest value of  $|Z|$  is
- a)  $\sqrt{3}-2$                       b)  $\sqrt{3}+2$                       c)  $\sqrt{5}-2$                       d)  $\sqrt{5}+2$
- 5) The value of  $\left[\frac{1+\sqrt{3}i}{1-\sqrt{3}i}\right]^{10}$  is
- a)  $\text{cis}\left(\frac{2\pi}{3}\right)$                       b)  $\text{cis}\left(\frac{4\pi}{3}\right)$                       c)  $-\text{cis}\left(\frac{2\pi}{3}\right)$                       d)  $-\text{cis}\left(\frac{4\pi}{3}\right)$
- 6) If  $Z$  is a non-zero complex number, then which one of the following is not true
- a)  $\bar{\bar{Z}} = Z$                       b)  $\text{Re}(Z) = \frac{Z-\bar{Z}}{2}$                       c)  $|Z| = |\bar{Z}|$                       d)  $\text{Im}(Z) = \frac{Z-\bar{Z}}{2i}$
- 7) A polynomial equation in  $x$  of degree 'n' always has
- a) n distinct roots                      b) n real roots  
c) n imaginary roots                      d) atmost one root
- 8) The number of positive zeros of the polynomial  $\sum_{r=0}^n nC_r (-1)^r x^r$  is
- a) 0                      b) n                      c)  $< n$                       d) r
- 9) If  $\sin^{-1}x = 2 \sin^{-1}\alpha$  has a solution, then
- a)  $|\alpha| \leq \frac{1}{\sqrt{2}}$                       b)  $|\alpha| \geq \frac{1}{\sqrt{2}}$                       c)  $-\frac{\pi}{2} \leq x \leq \frac{\pi}{2}$                       d)  $-\frac{\pi}{4} \leq x \leq \frac{3\pi}{4}$
- 10) If  $|x| \leq 1$ , then  $2 \tan^{-1}x - \sin^{-1} \frac{2x}{1+x^2}$  is equal to
- a)  $\tan^{-1}x$                       b)  $\sin^{-1}x$                       c) 0                      d)  $\pi$
- 11) If  $x \in [-1, 1]$ , then the  $\cos^{-1}x =$
- a)  $\cos^{-1}x - \pi$                       b)  $\pi - \cos^{-1}x$                       c)  $\pi + \cos^{-1}x$                       d)  $\sin^{-1}x$

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- 12) The area of quadrilateral formed with foci of the hyperbola  $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$  and  $\frac{x^2}{a^2} - \frac{y^2}{b^2} = -1$  is
- a)  $4(a^2+b^2)$       b)  $2(a^2+b^2)$       c)  $a^2+b^2$       d)  $\frac{1}{2}(a^2+b^2)$
- 13) The eccentricity of the ellipse  $(x-3)^2+(y-4)^2 = \frac{y^2}{9}$  is
- a)  $\frac{\sqrt{3}}{2}$       b)  $\frac{1}{3}$       c)  $\frac{1}{3\sqrt{2}}$       d)  $\frac{1}{\sqrt{3}}$
- 14) The equation of the parabola with focus  $(-\sqrt{2}, 0)$  and directrix  $x = \sqrt{2}$  is
- a)  $x^2 = 2\sqrt{2}x$       b)  $y^2 = -4\sqrt{2}x$       c)  $y^2 = 4\sqrt{2}x$       d)  $x^2 = -4\sqrt{2}x$
- 15) 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)  $\vec{0}$
- 16) If  $\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{a} \times \vec{b}) \times \vec{c}$ , where  $\vec{a}, \vec{b}, \vec{c}$  are any three vectors such that  $\vec{b} \cdot \vec{c} \neq 0$  and  $\vec{a} \cdot \vec{b} \neq 0$ , then  $\vec{a}$  and  $\vec{c}$  are
- a) perpendicular      b) parallel  
c) inclined at an angle  $\frac{\pi}{3}$       d) inclined at an angle  $\frac{\pi}{6}$
- 17) 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  $\lambda$  is
- a)  $2\sqrt{3}$       b)  $3\sqrt{2}$       c) 0      d) 1
- 18) The slope of the line normal to the curve  $f(x) = 2 \cdot \cos 4x$  at  $x = \frac{\pi}{12}$  is
- a)  $-4\sqrt{3}$       b) -4      c)  $\frac{\sqrt{3}}{12}$       d)  $4\sqrt{3}$
- 19) Angle between  $y^2 = x$  and  $x^2 = y$  at the origin is
- a)  $\tan^{-1} \frac{3}{4}$       b)  $\tan^{-1} \frac{4}{3}$       c)  $\frac{\pi}{2}$       d)  $\frac{\pi}{4}$
- 20) The maximum value of the function  $x^2 e^{-2x}$ ,  $x > 0$  is
- a)  $\frac{1}{e}$       b)  $\frac{1}{2e}$       c)  $\frac{1}{e^2}$       d)  $\frac{4}{e^4}$

## PART - B

7x2=14

Answer any 7 questions. Qn.no. 30 is compulsory.

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

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- 22) Show that the system of equations,  $2x+5y=7$ ,  $6x+15y = 13$  is inconsistent.
- 23) Find  $Z^{-1}$ , if  $Z = (2+3i)(1-i)$
- 24) Find the polynomial equation of minimum degree with rational coefficients, having  $2i+3$  as a root.
- 25) Find the period and amplitude of  $y = 4 \sin(-2x)$
- 26) Find  $\tan^{-1} \left( \tan^{3x/5} \right)$
- 27) If  $y = 2\sqrt{2}x + c$  is a tangent to the circle  $x^2+y^2 = 16$ , find the value of  $C$ .
- 28) 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  $\vec{r} \cdot (6\hat{i} + 3\hat{j} + 2\hat{k}) = 8$
- 29) Verify Rolle's Theorem to the function  $f(x) = \left| \frac{1}{x} \right| + 1$ ,  $x \in [-1, 1]$
- 30) Find the square root of  $7-24i$ .

## PART - C

7x3=21

Answer any 7 questions. Qn. no. 40 is compulsory.

- 31) Solve the system of linear equations by matrix inversion method:  
 $2x-y = 8$ ,  $3x+2y = -2$

- 32) Find the rank of the matrix  $\begin{bmatrix} 1 & 1 & 1 & 3 \\ 2 & -1 & 3 & 4 \\ 5 & -1 & 7 & 11 \end{bmatrix}$  by row reduction method.

- 33) Simplify:  $\left[ \sin \frac{\pi}{6} + i \cos \frac{\pi}{6} \right]^{18}$

- 34) For any two complex numbers  $Z_1$  and  $Z_2$  such that  $|Z_1| = |Z_2| = 1$  and  $Z_1 \cdot Z_2 \neq -1$ , then show that  $\frac{Z_1 + Z_2}{1 + Z_1 Z_2}$  is a real number.

- 35) Solve:  $x^3 - 5x^2 - 4x + 20 = 0$

- 36) Find the value of  $\sin^{-1}(-1) + \cos^{-1}\left(\frac{1}{2}\right)$

- 37) Find the length of the Latus rectum of the parabola  $y^2 = 4ax$

- 38) Show that the line  $x-y+4 = 0$  is a tangent to the ellipse  $x^2+3y^2 = 12$

- 39) Find the value of  $\lambda$ , if the value of the parallelepiped whose coterminus edges are  $7\hat{i} + \lambda\hat{j} - 3\hat{k}$ ,  $\hat{i} + 2\hat{j} - \hat{k}$ ,  $-3\hat{i} + 7\hat{j} + 5\hat{k}$  is 90 cubic units.

- 40) A ball is thrown vertically upwards, moves according to the law  $S = 13.8t - 4.9t^2$  where  $S$  is in metres and  $t$  is in seconds.

(i) Find the velocity at  $t = 1$

(ii) Find the acceleration at  $t = 1$

(iii) Find the maximum height reached by the ball?

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PART - D

7x5=35

**Answer all the questions:**

- 41) a] The upward speed  $v(t)$  of a rocket at time  $t$  is approximated by  $v(t) = at^2 + bt + c$ ,  $0 \leq t \leq 100$  where  $a$ ,  $b$  and  $c$  are constants. It has been found that the speed at times  $t = 3$ ,  $t = 6$  and  $t = 9$  seconds are respectively, 64, 133 and 208 miles per second respectively. Find the speed at time  $t = 15$  seconds (use Gaussian Elimination Method)

(OR)

- b] If  $\frac{1+z}{1-z} = \cos 2\theta + i \sin 2\theta$ , show that  $z = i + \tan \theta$

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

(OR)

- b] 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.

- 43) a] Find all cube roots of  $\sqrt{3} + i$

(OR)

- b] Identify the type of conic and find centre, foci and vertices of the following  $y^2 + 8x - 6y + 1 = 0$

- 44) a] Investigate the values of  $\lambda$  and  $\mu$  the system of linear equations  $2x + 3y + 5z = 9$ ,  $7x + 3y - 5z = 8$ ,  $2x + 3y + \lambda z = \mu$  have (i) No solution (ii) a unique solution (iii) an infinite number of solutions.

(OR)

- b] Solve:  $6x^4 - 35x^3 + 62x^2 - 35x + 6 = 0$

- 45) a] Prove by vector method that  $\sin(\alpha + \beta) = \sin \alpha \cos \beta + \cos \alpha \sin \beta$

(OR)

- b] Evaluate:  $\lim_{x \rightarrow \pi/2} (\sin x)^{\tan x}$

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- 46) a] Find the parametric form of vector equation and cartesian equations of the plane containing the line  $\frac{x-2}{2} = \frac{y-2}{3} = \frac{z-1}{3}$  and parallel to the line

$$\frac{x-1}{3} = \frac{-y+1}{2} = \frac{z+1}{1}$$

(OR)

- b] Find the angle between  $y = x^2$  and  $y = (x-3)^2$

- 47) a] Solve the equations:  $(x-4)(x-7)(x-2)(x+1) = 16$

(OR)

- b] If  $\vec{a} = 2\hat{i} + 3\hat{j} - \hat{k}$ ,  $\vec{b} = 3\hat{i} + 5\hat{j} + 2\hat{k}$ ,  $\vec{c} = -\hat{i} - 2\hat{j} + 3\hat{k}$  verify that

$$(\vec{a} \times \vec{b}) \times \vec{c} = (\vec{a} \cdot \vec{c})\vec{b} - (\vec{b} \cdot \vec{c})\vec{a}$$

Kindly send me your study materials to [padasalai.net@gmail.com](mailto:padasalai.net@gmail.com)