# PATTUKKOTTAI-PALANIAPPAN-MATHS

## MATHS QUARTERLY MODEL EXAM -2022-23

**CLASS:12** **PART-I** **TOTAL MARKS:90**

**TIME:3Hrs**

**All** questions are **compulsory.**

**20X 1 =20**

1. If $\frac{a_1}{x}+\frac{b_1}{y}=d_1, \frac{a_2}{x}+\frac{b_2}{y}=d_2$

$\Delta_1=\begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}, \Delta_2=\begin{vmatrix} a_1 & d_1 \\ a_2 & d_2 \end{vmatrix}$ and $\Delta_3=\begin{vmatrix} d_1 & b_1 \\ d_2 & b_2 \end{vmatrix}$, then $x$ and $y$ are respectively

(1) $\frac{\Delta_1}{\Delta_2}$ and $\frac{\Delta_1}{\Delta_3}$ (2) $\frac{\Delta_2}{\Delta_3}$ and $\frac{\Delta_1}{\Delta_2}$ (3) $\frac{\Delta_3}{\Delta_1}$ and $\frac{\Delta_2}{\Delta_1}$ (4) $\frac{\Delta_2}{\Delta_1}$ and $\frac{\Delta_3}{\Delta_1}$

2. If $A$ is an invertible square matrix and $k$ is a non-negative real number, then $(kA)^{-1}=$

(1) $kA^{-1}$ (2) $\frac{1}{k}k^{-1}$ (3) $-kA^{-1}$ (4) $-\frac{1}{k}A^{-1}$

3. If $A=\begin{bmatrix} 2 & 0 \\ 1 & 5 \end{bmatrix}$ and $B=\begin{bmatrix} 1 & 4 \\ 2 & 0 \end{bmatrix}$ then $|\operatorname{adj}(AB)|=$

(1) $-80$ (2) $-60$ (3) $-20$ (4) $-40$

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

(1) 12 (2) 15 (3) 11 (4) 14

5. The modulus and principal argument of the complex number $z=-2(\cos\theta - i\sin\theta)$ $\left(\text{where } 0<\theta\le\frac{\pi}{2}\right)$ are, respectively,

(1) $2,-\theta$ (2) $2,\pi-\theta$ (3) $-2,\theta$ (4) $2,-\pi+\theta$

6. If $x+iy=\left(-1+i\sqrt{3}\right)^{2019}$, then $x$ is

(1) $2^{2019}$ (2) $-2^{2019}$ (3) $-1$ (4) 1

7. If $z$ is a non zero complex number, such that $2iz^2 = \bar{z}$ then $|z|$ is

(1) 2 (2) 3 (3) $\frac{1}{2}$ (4) 1

8. If $\left|z-\frac{3}{z}\right|=2$, then the least value of $|z|$ is

(1) 3 (2) 5 (3) 2 (4) 1

9. The polynomial $x^3+2x+3$ has

(1) no zeros (2) one positive and two imaginary zeros

(3) three real zeros (4) one negative and two imaginary zeros

10. $2x^3-x^2-2x+2=Q(x)(2x-1)+R(x)$ for all values of $x$. The value of $R(x)$ is

(1) 1 (2) 0 (3) $\frac{1}{2}$ (4) $-\frac{1}{2}$

11. $\sin^{-1}\frac{3}{5}-\cos^{-1}\frac{12}{13}+\sec^{-1}\frac{5}{3}-\operatorname{cosec}^{-1}\frac{13}{12}$ is equal to

(1) $2\pi$ (2) $\pi$ (3) 0 (4) $\tan^{-1}\frac{12}{65}$

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

(1) $|\alpha| \le \frac{1}{\sqrt{2}}$ (2) $|\alpha| \ge \frac{1}{\sqrt{2}}$ (3) $|\alpha| < \frac{1}{\sqrt{2}}$ (4) $|\alpha| > \frac{1}{\sqrt{2}}$

13. The area of quadrilateral formed with foci of the hyperbolas $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ and $\frac{x^2}{a^2} - \frac{y^2}{b^2} = -1$ is

(1) $4(a^2+b^2)$ (2) $2(a^2+b^2)$ (3) $a^2+b^2$ (4) $\frac{1}{2}(a^2+b^2)$

14. 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

(1) $2x+1=0$ (2) $x=-1$ (3) $2x-1=0$ (4) $x=1$

15. The values of $m$ for which the line $y = mx + 2\sqrt{5}$ touches the hyperbola $16x^2 - 9y^2 = 144$ are the roots of $x^2 - (a+b)x - 4 = 0$, then the value of $(a+b)$ is

(1) 2 (2) 4 (3) 0 (4) $-2$

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

(1) 1 (2) 3 (3) $\sqrt{10}$ (4) $\sqrt{11}$

17. If $\vec{a}$ and $\vec{b}$ are unit vectors such that $[\vec{a}, \vec{b}, \vec{a}\times\vec{b}] = \frac{1}{4}$, then the angle between $\vec{a}$ and $\vec{b}$ is

(1) $\frac{\pi}{6}$ (2) $\frac{\pi}{4}$ (3) $\frac{\pi}{3}$ (4) $\frac{\pi}{2}$

18. Distance from the origin to the plane $3x - 6y + 2z + 7 = 0$ is

(1) 0 (2) 1 (3) 2 (4) 3

19. If the direction cosines of a line are $\frac{1}{c}, \frac{1}{c}, \frac{1}{c}$, then

(1) $c = \pm 3$ (2) $c = \pm\sqrt{3}$ (3) $c > 0$ (4) $0 < c < 1$

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

(1) $\vec{a}$ (2) $\vec{b}$ (3) $\vec{c}$ (4) $\vec{0}$

## PART-II

**Note: (i) Answer any SEVEN questions** **7×2 =14**

**(ii) Question number 30 is compulsory**

21. Find the matrix $A$ for which $A\begin{bmatrix} 5 & 3 \\ -1 & -2 \end{bmatrix} = \begin{bmatrix} 14 & 7 \\ 7 & 7 \end{bmatrix}$.

22. Simplify $i\,i^2 i^3 \cdots i^{2000}$

23. If $\omega \ne 1$ is a cube root of unity, show that $(1-\omega+\omega^2)^6 + (1+\omega-\omega^2)^6 = 128$.

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

25. Is $\cos^{-1}(-x)=\pi-\cos^{-1}(x)$ true? Justify your answer.

26. Find the centre and radius of the circle $3x^2+\ a+1\ y^2+6x-9y+a+4=0$.

27. Find the equation of the parabola with vertex $(-1,-2)$, axis parallel to $y$-axis and passing through $(3,6)$.

28. If the vectors $a\hat{i}+a\hat{j}+c\hat{k},\ \hat{i}+\hat{k}$ and $c\hat{i}+c\hat{j}+b\hat{k}$ are coplanar, prove that $c$ is the geometric mean of $a$ and $b$.

29. Find the acute angle between the lines. $2x=3y=-z$ and $6x=-y=-4z$.

30. If $A$ is a non-singular square matrix of order $n$, then $|\mathrm{adj}(\mathrm{adj}A)|=|A|^{(n-1)^2}$

**PART-III**

**Note: (i) Answer any SEVEN questions** **7×3 =21**

**(ii) Question number 40 is compulsory**

31. Find the inverse of the non-singular matrix $A=\begin{bmatrix}0 & 5\\ -1 & 6\end{bmatrix}$, by Gauss-Jordan method.

32. In a competitive examination, one mark is awarded for every correct answer while $\frac{1}{4}$ mark is deducted for every wrong answer. A student answered 100 questions and got 80 marks. How many questions did he answer correctly ? (Use Cramer's rule to solve the problem).

33. Find the least value of the positive integer $n$ for which $\left(\sqrt{3}+i\right)^n$

(i) real (ii) purely imaginary.

34. If $p$ is real, discuss the nature of the roots of the equation $4x^2+4px+p+2=0$, in terms of $p$.

35. Find the value of $\cos\left[\frac{1}{2}\cos^{-1}\left(\frac{1}{8}\right)\right]$

36. Prove that the length of the latus rectum of the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ is $\frac{2b^2}{a}$.

37. If the normal at the point '$t_1$' on the parabola $y^2=4ax$ meets the parabola again at the point '$t_2$', then prove that $t_2=-\left(t_1+\frac{2}{t}\right)_1$.

38. If $\vec{a}=\hat{i}+2\hat{j}+3\hat{k},\ \vec{b}=2\hat{i}-\hat{j}+\hat{k},\ \vec{c}=3\hat{i}+2\hat{j}+\hat{k}$ and $\vec{a}\times(\vec{b}\times\vec{c})=l\vec{a}+m\vec{b}+n\vec{c}$, find the values of $l,m,n$.

39. If a plane meets the coordinate axes at $A,B,C$ such that the centriod of the triangle $ABC$ is the point $(u,v,w)$, find the equation of the plane.

40. Find the principal argument $\mathrm{Arg}\,z$, when $z=\frac{-2}{1+i\sqrt{3}}$.

## PART-IV

**Note: Answer all the questions** **7×5 =35**

41a) If $ax^2+bx+c$ is divided by $x+3, x-5$, and $x-1$, the remainders are $21, 61$ and $9$ respectively. Find $a, b$ and $c$. (Use Gaussian elimination method.)

**(OR)**

b) Find the value of $k$ for which the equations $kx-2y+z=1,\quad x-2ky+z=-2,\quad x-2y+kz=1$ have

(i) no solution (ii) unique solution (iii) infinitely many solution

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

**(OR)**

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

43 a) Find all zeros of the polynomial $x^6-3x^5-5x^4+22x^3-39x^2-39x+135$, if it is known that $1+2i$ and $\sqrt{3}$ are two of its zeros.

**(OR)**

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

44 a) Find the value of $\cos^{-1}\left(\cos\left(\frac{4\pi}{3}\right)\right)+\cos^{-1}\left(\cos\left(\frac{5\pi}{4}\right)\right)$.

**(OR)**

b) Solve: $\cot^{-1}x-\cot^{-1}(x+2)=\frac{\pi}{12},\ x>0$ .

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

**(OR)**

b) Find the vertex, focus, equation of directrix and length of the latus rectum of $y^2-4y-8x+12=0$

46a) Prove by vector method that the perpendiculars (attitudes) from the vertices to the opposite sides of a triangle are concurrent.

**(OR)**

b) Find parametric form of vector equation and Cartesian equations of the plane passing through the points $(2,2,1), (1,-2,3)$ and parallel to the straight line passing through the points $(2,1,-3)$ and $(-1,5,-8)$.

47 a) 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) is 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?

**(OR)**

b) Prove by vector method that $\sin(\alpha-\beta)=\sin\alpha\cos\beta-\cos\alpha\sin\beta$.

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