ANNE'S ACADEMY
I FLOOR, JAFRO DENTAL CLINIC, HOLY CROSS COLLEGE ROAD, PUNNAI NAGAR, NAGERCOIL - 629004

Common Revision Test 2022 – 23 (Model Question) – Kanyakumari District
CLASS – XII
MATHEMATICS

Time Allowed : 3 Hrs Maximum Marks : 90

PART – I

I. Answer ALL questions. **20x1 = 20**

1) If A is a 3×3 non-singular matrix such that $AA^T = A^TA$ and $B = A^{-1}A^T$, then $BB^T =$

(1) A (2) B (3) I_3 (4) B^T

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

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

3) The principal argument of the complex number $\dfrac{\left(1+i\sqrt{3}\right)^2}{4i\left(1-i\sqrt{3}\right)}$ is

(1) $\frac{2\pi}{3}$ (2) $\frac{\pi}{6}$ (3) $\frac{5\pi}{6}$ (4) $\frac{\pi}{2}$

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

(1) $-\frac{q}{r}$ (2) $-\frac{p}{r}$ (3) $\frac{q}{r}$ (4) $-\frac{q}{p}$

5) $\sin^{-1}\left(2\cos^2 x-1\right)+\cos^{-1}\left(1-2\sin^2 x\right)=$

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

6) $\sin(\tan^{-1}x), |x|<1$ is equal to

(1) $\frac{x}{\sqrt{1-x^2}}$ (2) $\frac{1}{\sqrt{1-x^2}}$ (3) $\frac{1}{\sqrt{1+x^2}}$ (4) $\frac{x}{\sqrt{1+x^2}}$

7) If $x+y=k$ is a normal to the parabola $y^2=12x$, then the value of k is

(1) 3 (2) -1 (3) 1 (4) 9

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

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

9) The angle between the lines $\frac{x-2}{3}=\frac{y+1}{-2}, z=2$ and $\frac{x-1}{1}=\frac{2y+3}{3}=\frac{z+5}{2}$ is

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

10) If the planes $\vec{r}.(2\hat{i}-\lambda\hat{j}+\hat{k})=3$ and $\vec{r}.(4\hat{i}+\hat{j}-\mu\hat{k})=5$ are parallel, then the value of λ and μ are

(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 $x^2e^{-2x}, x>0$ is

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

12) The point of inflection of the curve $y=(x-1)^3$ is

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

13) If $f(x,y)=e^{xy}$, then $\frac{\partial^2 f}{\partial x\partial y}$ is equal to

(1) xye^{xy} (2) $(1+xy)e^{xy}$ (3) $(1+y)e^{xy}$ (4) $(1+x)e^{xy}$

14) If $f(x,y,z)=xy+yz+zx$, then f_x-f_z is equal to

(1) $z-x$ (2) $y-z$ (3) $x-z$ (4) $y-x$

15) The value of $\int_0^\infty e^{-3x}x^2dx$ is

(1) $\frac{7}{27}$ (2) $\frac{5}{27}$ (3) $\frac{4}{27}$ (4) $\frac{2}{27}$

16) If $\int_0^x f(t)\,dt = x+\int_x^1 tf(t)\,dt$, then the value of $f(1)$ is

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

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17) The number of arbitrary constants in the particular solution of a differential equation of third order is

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

18) P is the amount of certain substance left in after time t. If the rate of evaporation of the substance is proportional to the amount remaining, then

(1) $P = Ce^{kt}$ (2) $P = Ce^{-kt}$ (3) $P = Ckt$ (4) $Pt = C$

19) A random variable X has binomial distribution with $n = 25$ and $p = 0.8$ then standard deviation of X is

(1) 6 (2) 4 (3) 3 (4) 2

20) If a compound statement involves 3 simple statements, then the number of rows in the truth table is

(1) 9 (2) 8 (3) 6 (4) 3

PART – II

II. Answer any SEVEN questions. Question 30 is compulsory 7x2 = 14

21) 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.

22) Prove that a straight line and parabola cannot intersect at more than two points.

23) Find the square root of $6 - 8i$.

24) If $\cot^{-1}\left(\frac{1}{7}\right) = \theta$, find the value of $\cos\theta$.

25) The probability density function of X is given by $f(x) = \begin{cases} k\,x\,e^{-2x} & \text{for } x > 0 \\ 0 & \text{for } x \leq 0 \end{cases}$.

Find the value of k.

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

27) Compute the value of 'c' satisfied by the Rolle's theorem for the function

$f(x) = x^2(1-x)^2, x \in [0,1]$.

28) Determine the order and degree (if exists) of the following differential equation:

$$\left(\frac{d^4y}{dx^4}\right)^3 + 4\left(\frac{dy}{dx}\right)^7 + 6y = 5\cos 3x$$

29) Verify De-Morgans Theorems using Truth Table.

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30) Find the acute angle between the planes $\vec{r}\cdot\left(2\hat{i}+2\hat{j}+2\hat{k}\right)=11$ and $4x-2y+2z=15$

PART – III

III. Answer any SEVEN questions. Question 40 is compulsory **7x3 = 21**

31) Find the inverse of $A=\begin{bmatrix}2&1&1\\3&2&1\\2&1&2\end{bmatrix}$ by Gauss-Jordan method.

32) If the roots of $x^3+px^2+qx+r=0$ are in H.P., prove that $9pqr=27r^2+2q^3$. Assume $p, q, r\neq 0$

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

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

35) Find the equations of tangent and normal to the ellipse $x^2+4y^2=32$ when $\theta=\dfrac{\pi}{4}$.

36) The cumulative distribution function of a discrete random variable is given by

$$F(x)=\begin{cases}0 & -\infty<x<-1\\ 0.15 & -1\le x<0\\ 0.35 & 0\le x<1\\ 0.60 & 1\le x<2\\ 0.85 & 2\le x<3\\ 1 & 3\le x<\infty\end{cases}$$

Find the probability mass function.

37) If D is the midpoint of the side BC of a triangle ABC, show by vector method that $|\overline{AB}|^2+|\overline{AC}|^2=2(|\overline{AD}|^2+|\overline{BD}|^2)$.

38) Salt is poured from a conveyer belt at a rate of 30 cubic metre per minute forming a conical pile with a circular base whose height and diameter of base are always equal. How fast is the height of the

39) Write down the (i) conditional statement (ii) converse statement (iii) inverse statement, and (iv) contrapositive statement for the two statements p and q given below.

p : The number of primes is infinite. q: Ooty is in Kerala.

40) Evaluate : $\lim\limits_{x\to\infty}(1+2x)^{\frac{1}{2\log x}}$.

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PART – IV

IV. Answer ALL questions. **7x5 = 35**

41) a) Determine the values of λ for which the following system of equations $(3\lambda-8)x+3y+3z=0,\ 3x+(3\lambda-8)y+3z=0,\ 3x+3y+(3\lambda-8)z=0$ has a non-trivial solution.

OR

b) Find the parametric form of vector equation, and Cartesian equations of the plane containing the line $\vec{r}=(\hat{i}-\hat{j}+3\hat{k})+t(2\hat{i}-\hat{j}+4\hat{k})$ and perpendicular to plane $\vec{r}\cdot(\hat{i}+2\hat{j}+\hat{k})=8$.

42) a) The probability density function of X is given by $f(x)=\begin{cases} k\,e^{-\frac{x}{3}} & \text{for } x>0 \\ 0 & \text{for } x\le 0\end{cases}$

Find (i) the value of k (ii) the distribution function (iii) $P(X<3)$ (iv) $P(5\le X)$ (v) $P(X\le 4)$.

OR

b) Find, by integration, the area of the region bounded by the lines $5x-2y=15,\ x+y+4=0$ and the x-axis.

43) a) Identify the type of conic and find centre, foci, vertices, and directrices of the following :

$$\frac{(x+3)^2}{225}-\frac{(y-4)^2}{64}=1$$

OR

b) Let $U(x,y)=e^x\sin y$, where $x=st^2,\ y=s^2t,\ \ s,t\in\mathbb{R}$. Find $\frac{\partial U}{\partial s},\frac{\partial U}{\partial t}$ and evaluate them at $s=t=1$.

44) a) If $a_1, a_2, a_3, \ldots a_n$ is an arithmetic progression with common difference d, prove that $\tan\left[\tan^{-1}\left(\frac{d}{1+a_1a_2}\right)+\tan^{-1}\left(\frac{d}{1+a_2a_3}\right)+\ldots+\tan^{-1}\left(\frac{d}{1+a_na_{n-1}}\right)\right]=\frac{a_n-a_1}{1+a_1a_n}$.

OR

b) Solve the following Linear differential equations:

$$\left(y-e^{\sin^{-1}x}\right)\frac{dx}{dy}+\sqrt{1-x^2}=0$$

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

OR

b) Let $M = \left\{ \begin{pmatrix} x & x \\ x & x \end{pmatrix} : x \in R - \{0\} \right\}$ and let $*$ be the matrix multiplication. Determine whether M is closed under $*$. If so, examine the commutative and associative properties satisfied by $*$ on M. If so, examine the existence of identity, existence of inverse properties for the operation $*$ on M.

46) a) Solve the following equation: $x^4 - 10x^3 + 26x^2 - 10x + 1 = 0$.

OR

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

47) a) On lighting a rocket cracker it gets projected in a parabolic path and reaches a maximum height of $4m$ when it is $6m$ away from the point of projection. Finally it reaches the ground $12m$ away from the starting point. Find the angle of projection.

OR

b) Let $\vec{a}, \vec{b}, \vec{c}$ be three non-zero vectors such that $\vec{c}$ is a unit vector perpendicular to both $\vec{a}$ and $\vec{b}$. If the angle between $\vec{a}$ and $\vec{b}$ is $\frac{\pi}{6}$, show that $[\vec{a}, \vec{b}, \vec{c}]^2 = \frac{1}{4} |\vec{a}|^2 |\vec{b}|^2$.

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