N K MATHS ACADEMY

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REVISION EXAMANITION 2021-22

MATHEMATICS

(LESSONS-1 TO 7)

MARKS: 90 **TIME: 3.00 HRS**

I CHOOSE THE BEST ANSWER: **20X1=20**

1. If $A=\begin{bmatrix}3 & 5\\ 1 & 2\end{bmatrix}$, $B=adjA$ and $C=3A$, then $\frac{|adjB|}{|C|}$ =

(1) $\frac{1}{3}$ (2) $\frac{1}{9}$ (3) $\frac{1}{4}$ (4)1

2. If $A=\begin{bmatrix}7 & 3\\ 4 & 2\end{bmatrix}$, then $9I-A$ =

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

3. Let $A=\begin{bmatrix}2 & -1 & 1\\ -1 & 2 & -1\\ 1 & -1 & 2\end{bmatrix}$ and $AB=\begin{bmatrix}3 & 1 & -1\\ 1 & 3 & x\\ -1 & 1 & 3\end{bmatrix}$. If B is the inverse of A, then the value of x is

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

4. The value of $\sum_{i=1}^{13}\left(i^n+i^{n-1}\right)$ is

(1) $1+i$ (2) i (3)1 (4)0

5. If $z=\frac{\left(\sqrt{3}+i\right)^3\left(3i+4\right)^2}{\left(8+6i\right)^2}$, then $|z|$ is equal to

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

6. If $|z|=1$, then the value of $\frac{1+z}{1+\bar{z}}$ is

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

7. If α, β and γ are the roots 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) $-\frac{q}{p}$

8. If $x^3+12x^3+10ax+1999$ definitely has a positive root, if and only if

(1) $a\geq 0$ (2) $a\succ 0$ (3) $a<0$ (4) $a\leq 0$

9. The number of positive roots of the polynomial $\sum_{j=0}^{n}{}^nC_r(-1)^r x^r$ is

(1)0 (2)n (3)<n (4)r

10. The value of $\sin^{-1}(\cos x),\ 0\leq x\leq\pi$ is

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

11. 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) $|\alpha| > \frac{1}{\sqrt{2}}$

12. $\sin\left(\tan^{-1}x\right), |x| < 1$ 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) $\frac{x}{\sqrt{1+x^2}}$

13. The eccentricity of the hyperbola whose latus rectum is 8 and conjugate axis is equal to half the distance between the foci is

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

14. 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

15. 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

(1) $\left|\vec{a}\right|\left|\vec{b}\right|\left|\vec{c}\right|$ (2) $\frac{1}{3}\left|\vec{a}\right|\left|\vec{b}\right|\left|\vec{c}\right|$ (3)1 (4)-1

16. 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) $\frac{\pi}{2}$

17. The abscissa of the point on the curve $f(x) = \sqrt{8-2x}$ at which the slope of the tangents is -0.25?

(1) -8 (2) -4 (3) -2 (4) 0

18. Angle between $y^2 = x$ and $x^3 = y$ at the origin is

(1) $\tan^{-1}\frac{3}{4}$ (2) $\tan^{-1}\left(\frac{4}{3}\right)$ (3) $\frac{\pi}{2}$ (4) $\frac{\pi}{4}$

19. 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) $\frac{4}{e^2}$

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

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

II ANSWER ANY 7 QUESTIONS (Q.NO 30 IS COMPLUSORY): 7X2=14

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

22. If $z_1 = 3, z_2 = -7i, z_3 = 5 + 4i$, show that $z_1(z_2 + z_3) = z_1z_2 + z_1z_3$

23. Find the squares root of $-5 - 12i$.

24. Find a polynomial equation of minimum degree with rational coefficients, having $2 + \sqrt{3}i$ as a root.

25. Find the principal value of $\sin^{-1}\left(\sin\left(\frac{5\pi}{6}\right)\right)$

26. If $y = 4x + c$ is a tangent to the circle $x^2 + y^2 = 9$, find c.

27. Find the equation of the parabola with vertex $(1, -2)$ and focus $(4, -2)$.

28. Find the slope of the tangent to the curve $y = x^4 + 2x^2 - x$ at x =1.

29. Find the intercepts cut off by the plane $\vec{r}.\left(6\hat{i} + 4\hat{j} - 3\hat{k}\right) = 12$

30. If $\vec{a}, \vec{b}, \vec{c}$ are coplanar vectors show that $\left(\vec{a} \times \vec{b}\right) \times \left(\vec{c} \times \vec{d}\right) = 0$.

III ANSWER ANY 7 QUESTIONS (Q.NO 40 IS COMPULSORY): 7X3=21

31. Find the rank of $\begin{bmatrix} 2 & -2 & 4 & 3 \\ -3 & 4 & -2 & -1 \\ 6 & 2 & -1 & 7 \end{bmatrix}$ by reducing it to an echelon form.

32. If $\frac{z+3}{z-5i} = \frac{1+4i}{2}$ find the complex number z in the rectangular form.

33. Show that the points $1, -\frac{1}{2} + i\frac{\sqrt{3}}{2}, -\frac{1}{2} - i\frac{\sqrt{3}}{2}$ are the vertices of an equilateral triangle.

34. If α, β and γ are the roots of the cubic equation $x^3 + 2x^2 + 3x + 4 = 0$ form a cubic equation whose roots are $\frac{1}{\alpha}, \frac{1}{\beta}, \frac{1}{\gamma}$

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

36. Find the vertices, foci for the hyperbola $9x^2 - 16y^2 = 144$

37. Prove by vector method then an angle in a semi-circle is a right-angle.

38. Find the vector equation in parametric form and Cartesian equation of the line passing through $(-4, 2, -3)$ and is parallel to the line $\frac{-x-2}{4} = \frac{y+3}{-2} = \frac{2z-6}{3}$.

39. Evaluate: $\lim_{x \to 1^+}\left(\frac{1}{x} - \frac{1}{e^x - 1}\right)$

40. Find the absolute extrema of $f(x) = 6x^{\frac{4}{3}} - 3x^{\frac{1}{3}}$, $[-1, 1]$

III ANSWER THE FOLLOWING QUESTIONS: 7X5=35

41. . If $A = \begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{bmatrix}$, find the products AB and BA and Hence solve $x - y + z = 4, x - 2y - 2z = 9, 2x + y + 3z = 1$ **(OR)**

Solve $x_1 - x_2 = 3, 2x_1 + 3x_2 + 4x_3 = 17, x_2 + 2x_3 = 7$ by Cramer's rule.

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

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

43. Find a polynomial equation of minimum degree with rational coefficients, having $\sqrt{5} - \sqrt{3}$ as a root. **(OR)**

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

44. Show that the line $x - y + 4 = 0$ is a tangent to the ellipse $x^2 + 3y^2 = 12$. Also find the coordinates of the point of contact**.** **(OR)**

At a water fountain, water attains a maximum height of 4m at horizontal distance of 0.75m from the point of orgin. If the path of water is a parabola, find the height of water at a horizontal distance of 0.75*m* from the point of origin.

45. A rod of length 1.2m moves with its end always touching the coordinates axis. The locus of a point P on the rod,which is 0.3m from the end in contact with x-axis in an ellipse find the eccentricity**.** **(OR)**

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

46. Prove that vector method that the perpendicular (attitudes) from the vertices to the opposite sides of a triangle is concurrent. **(OR)**

Find the non-parametric form of vector equation, and Cartesian equation of the plane passing through the point (2, 3, 6) and parallel to the straight lines $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-3}{1}$ and $\frac{x+3}{2} = \frac{y-3}{-5} = \frac{z+1}{-3}$.

47. Find the acute angle between $y = x^2$ and $y = (x-3)^2$ **(OR)**

A rectangular page is to contain 24 cm^2 of print. The margins at the top and bottom of the page are 1.5 cm and the margins at other sides of the page is 1 cm. What should be the dimensions of the page so that the area of the paper used is minimum.