CENTUM ACHIEVERS' ACADEMY

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XII STD(MATHS)	FULL PORTION – 1	TIME : 2 ½ Hrs
		MARKS : 90

PART-I

Choose the correct answer from the given four alternatives : **(20× 1 = 20)**

1. If $A\begin{bmatrix}1 & -2\\ 1 & 4\end{bmatrix}=\begin{bmatrix}6 & 0\\ 0 & 6\end{bmatrix}$, then $A=$

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

2. If $(AB)^{-1}=\begin{bmatrix}12 & -17\\ -19 & 27\end{bmatrix}$ and $A^{-1}=\begin{bmatrix}1 & -1\\ -2 & 3\end{bmatrix}$, then $B^{-1}=$

   (1) $\begin{bmatrix}2 & -5\\ -3 & 8\end{bmatrix}$ (2) $\begin{bmatrix}8 & 5\\ 3 & 2\end{bmatrix}$ (3) $\begin{bmatrix}3 & 1\\ 2 & 1\end{bmatrix}$ (4) $\begin{bmatrix}8 & -5\\ -3 & 2\end{bmatrix}$

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

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

4. The product of all four values of $\left(\cos\frac{\pi}{3}+i\sin\frac{\pi}{3}\right)^{\frac{3}{4}}$ is

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

5. The number of real numbers in $[0,2\pi]$ satisfying $\sin^4 x-2\sin^2 x+1$ is

   (1) 2 (2) 4 (3) 1 (4) ∞

6. 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) $[-1,0]$

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

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 volume of the parallelepiped with its edges represented by the vectors $\hat{\imath}+\hat{\jmath},\hat{\imath}+2\hat{\jmath},\hat{\imath}+\hat{\jmath}+\pi\hat{k}$ is

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

10. If the planes $\vec{r}\cdot(2\hat{\imath}-\lambda\hat{\jmath}+\hat{k})=3$ and $\vec{r}\cdot(4\hat{\imath}+\hat{\jmath}-\mu\hat{k})=5$ 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 minimum value of the function $|3-x|+9$ is

    (1) 0 (2) 3 (3) 6 (4) 9

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

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

13. The percentage error of fifth root of 31 is approximately how many times the percentage error in 31 ?

(1) $\frac{1}{31}$ (2) $\frac{1}{5}$ (3) 5 (4) 31

14. If $w(x,y,z) = x^2(y-z) + y^2(z-x) + z^2(x-y)$, then $\frac{\partial w}{\partial x} + \frac{\partial w}{\partial y} + \frac{\partial w}{\partial z}$ is

(1) $xy + yz + zx$ (2) $x(y+z)$ (3) $y(z+x)$ (4) 0

15. The value of $\int_0^1 x(1-x)^{99}dx$ is

(1) $\frac{1}{11000}$ (2) $\frac{1}{10100}$ (3) $\frac{1}{10010}$ (4) $\frac{1}{10001}$

16. The value of $\int_0^a \left(\sqrt{a^2-x^2}\right)^3 dx$ is

(1) $\frac{\pi a^3}{16}$ (2) $\frac{3\pi a^4}{16}$ (3) $\frac{3\pi a^2}{8}$ (4) $\frac{3\pi a^4}{8}$

17. The integrating factor of the differential equation $\frac{dy}{dx} + P(x)y = Q(x)$ is x, then $P(x)$

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

18. 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

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. The proposition $p \wedge (\neg p \vee q)$ is

(1) a tautology (2) a contradiction

(3) logically equivalent to $p \wedge q$ (4) logically equivalent to $p \vee q$

PART-II

(i) Answer any SEVEN questions. **$(7\times 2 = 14)$**

(ii) Qn.No.30 is compulsory

21. Simplify $\sum_{n=1}^{10} i^{n+50}$

22. Show that, if p, q, r are rational, the roots of the equation $x^2 - 2px + p^2 - q^2 + 2qr - r^2 = 0$ are rational.

23. Find the domain of $f(x) = \sin^{-1}\left(\frac{x^2+1}{2x}\right)$

24. A circle of area 9π square units has two of its diameters along the lines $x + y = 5$ and $x - y = 1$. Find the equation of the circle.

25. A particle is acted upon by the forces $3\hat{\imath} - 2\hat{\jmath} + 2\hat{k}$ and $2\hat{\imath} + \hat{\jmath} - \hat{k}$ is displaced from the point $(1,3,-1)$ to the point $(4,-1,\lambda)$. If the work done by the forces is 16 units, find the value of λ.

26. Find the asymptotes of $f(x) = \frac{x^2+6x-4}{3x-6}$

27. Evaluate $\lim_{(x,y)\to(0,0)} \cos\left(\frac{e^x \sin y}{y}\right)$, if the limit exists.

28. Find an approximate value of $\int_1^{1.5} x dx$ by applying the left-end rule with the partition $\{1.1, 1.2, 1.3, 1.4, 1.5\}$

29. Assume that a spherical rain drop evaporates at a rate proportional to its surface area. Form a differential equation involving the rate of change of the radius of the rain drop.

30. Suppose two coins are tossed once. If X denotes the number of tails, (i) write down the sample space (ii) find the inverse image of 1 (iii) the values of the random variable and number of elements in its inverse images.

PART-III

(i) Answer any SEVEN questions. **$(7\times 3 = 21)$**

(ii) Qn.No.40 is compulsory

31. If adj $(A) = \begin{bmatrix} 2 & -4 & 2 \\ -3 & 12 & -7 \\ -2 & 0 & 2 \end{bmatrix}$, find A.

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

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

34. Find the equation of the circle described on the chord $3x + y + 5 = 0$ of the circle $x^2 + y^2 = 16$ as diameter.

35. If $v(x, y) = \log\left(\frac{x^2+y^2}{x+y}\right)$, prove that $x\frac{\partial v}{\partial x} + y\frac{\partial v}{\partial y} = 1$

36. Find the volume of a right-circular cone of base radius r and height h.

37. Solve the differential equations $\frac{dy}{dx} = e^{x+y} + x^3 e^y$

38. If $X \sim B(n, p)$ such that $4P(X = 4) = P(X = 2)$ and $n = 6$. Find the distribution, mean and standard deviation of X.

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

40. Find the angle between $y = x^2$ and $y = (x - 3)^2$.

PART-IV

Answer the following questions. **$(7\times 5 = 35)$**

41. a) 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 the system of equations $x - y + z = 4$, $x - 2y - 2z = 9, 2x + y + 3z = 1$. **(OR)**

b) Evaluate $\sin\left[\sin^{-1}\left(\frac{3}{5}\right) + \sec^{-1}\left(\frac{5}{4}\right)\right]$

42. a) Find all cube roots of $\sqrt{3} + i$. **(OR)**

b) A particle is acted upon by the forces $3\hat{\imath} - 2\hat{\jmath} + 2\hat{k}$ and $2\hat{\imath} + \hat{\jmath} - \hat{k}$ is displaced from the point $(1,3,-1)$ to the point $(4,-1,\lambda)$. If the work done by the forces is 16 units, find the value of λ.

43. a) By using Gaussian elimination method, balance the chemical reaction equation:

$C_5H_8 + O_2 \to CO_2 + H_2O$. **(OR)**

b) Solve the equation : $(2x - 3)(6x - 1)(3x - 2)(x - 2) - 5 = 0$.

44. 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 16 m, 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) Solve $(1+x^3)\frac{dy}{dx}+6x^2y=1+x^2$

45. a) Evaluate $\int_{-\pi}^{\pi}\frac{\cos^2 x}{1+a^x}dx$ **(OR)**

b) If we blow air into a balloon of spherical shape at a rate of 1000 cm^3 per second, at what rate the radius of the baloon changes when the radius is 7 cm ? Also compute the rate at which the surface area changes.

46. a) The mean and standard deviation of a binomial variate X are respectively 6 and 2 .
Find (i) the probability mass function (ii) $P(X=3)$ (iii) $P(X\geq 2)$.**(OR)**

b) If $u=\sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$, Show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\frac{1}{2}\tan u$.

47. a) The curve $y=(x-2)^2+1$ has a minimum point at P. A point Q on the curve is such that the slope of PQ is 2 . Find the area bounded by the curve and the chord PQ.**(OR)**

b) Verify (i) closure property, (ii) commutative property, (iii) associative property,(iv) existence of identity, and (v) existence of inverse for the operation $+_5$ on $\mathbb{Z}_5$ using table corresponding to addition modulo 5.

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