SALEM DISTRICT

11 - STD QL **QUARTERLY EXAMINATION - 2024**

Time : 3.00 Hrs **MATHEMATICS** Marks : 90

Choose the correct answer: **(PART - I)** **20 X 1 = 20**

1. For non-empty sets A and B, if $A \subset B$ then $(A \times B) \cap (B \times A)$ is equal to

   (a) $A \cap B$ (b) $A \times A$ (c) $B \times B$ (d) none of these

2. If the function $f: [-3,3] \to S$ defined by $f(x) = x^2$ is onto, then S is

   (a) $[-9,9]$ (b) $\mathbb{R}$ (c) $[-3,3]$ (d) $[0,9]$

3. The number of relations from a set containing 4 elements to the set containing 3 elements is

   (a) 2^{16} (b) 2^5 (c) 2^7 (d) 2^{12}

4. The solution of $5x - 1 < 24$ and $5x + 1 > -24$ is

   (a) $(4,5)$ (b) $(-5,-4)$ (c) $(-5, 5)$ (d) $(-5, 4)$

5. If 3 is the logarithm of 343 , then the base is

   (a) 5 (b) 7 (c) 6 (d) 9

6. If $\frac{1-2x}{3+2x-x^2} = \frac{A}{3-x} + \frac{B}{x+1}$, then the value of $A + B$ is

   (a) $\frac{-1}{2}$ (b) $\frac{-2}{3}$ (c) $\frac{1}{2}$ (d) $\frac{2}{3}$

7. The condition that the equation $ax^2 + bx + c = 0$ may have one root which is the double the other is

   (a) $2b^2 = 9ac$ (b) $b^2 = ac$ (c) $b^2 = 4ac$ (d) $9b^2 = 2ac$

8. If $\tan 40° = \lambda$, then $\frac{\tan 140° - \tan 130°}{1 + \tan 140° \tan 130°} =$

   (a) $\frac{1-\lambda^2}{\lambda}$ (b) $\frac{1+\lambda^2}{\lambda}$ (c) $\frac{1+\lambda^2}{2\lambda}$ (d) $\frac{1-\lambda^2}{2\lambda}$

9. If $f(\theta) = |\sin\theta| + |\cos\theta|, \theta \in R$, then $f(\theta)$ is in the interval

   (a) $[0,2]$ (b) $[1,\sqrt{2}]$ (c) $[1,2]$ (d) $[0,1]$

10. If $\alpha + \beta = \frac{\pi}{2}$ and $\beta + \gamma = \alpha$, then $\tan\alpha$ is equal to

    (a) $2(\tan\beta + \tan\gamma)$ (b) $\tan\beta + \tan\gamma$ (c) $\tan\beta + 2\tan\gamma$ (d) $2\tan\beta + \tan\gamma$

11. The number of 5 digit numbers all digits of which are odd is

(a) 25 (b) 5^5 (c) 5^6 (d) 625 .

12. If ${}^{a^2-a}C_2 = {}^{a^2-a}C_4$ then the value of 'a' is

(a) 2 (b) 3 (c) 4 (d) 5

13. If ${}^nC_4, {}^nC_5, {}^nC_6$ are in AP the value of n can be

(a) 14 (b) 11 (c)9 (d) 5

14. $n! + (n+1)! =$

(a) $n!\,(n+2)$ (b) $(n+2)!$ (c) $(2n+1)!$ (d) $n!$

15. If ${}^nC_{10} > {}^nC_r$ for all possible r, then a value of n is

(a) 10 (b) 21 (c) 19 (d) 20 .

16. The remainder when 38^{15} is divided by 13 is

(a) 12 (b) 1 (c) 11 (d) 5 .

17. Sum of n terms of the series $\sqrt{2} + \sqrt{8} + \sqrt{18} + \sqrt{32} + \cdots$ is

(a) $\frac{n(n+1)}{2}$ (b) $\frac{n(n+1)}{\sqrt{2}}$ (c) $2n(n+1)$ (d) 1

18. Which of the following equation is the locus of $(at^2, 2at)$

(a) $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ (b) $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ (c) $x^2 + y^2 = a^2$ (d) $y^2 = 4ax$

19. The length of perpendicular from the origin to the line $\frac{x}{3} - \frac{y}{4} = 1$, is

(a) $\frac{11}{5}$ (b) $\frac{5}{12}$ (c) $\frac{12}{5}$ (d) $-\frac{5}{12}$

20. If the two straight lines $x + (2k-7)y + 3 = 0$ and $3kx + 9y - 5 = 0$ are perpendicular then the value of k is

(a) $k = 3$ (b) $k = \frac{1}{3}$ (c) $k = \frac{2}{3}$ (d) $k = \frac{3}{2}$

PART - II

Answer any seven questions: (Q.No. 30 is compulsory) **7*2=14**

21. If $n(P(A)) = 1024, n(A \cup B) = 15$ and $n(P(B)) = 32$, then find $n(A \cap B)$.

22. Let $f = \{(1, 4), (2, 5), (3, 5)\}$ and $g = \{(4, 1), (5, 2), (6, 4)\}$. Find gof. Can you find fog?

23. If $\left(x^{\frac{1}{2}} + x^{\frac{-1}{2}}\right)^2 = \frac{9}{2}$, then find the value of $\left(x^{\frac{1}{2}} - x^{\frac{-1}{2}}\right)$ for $x > 1$.

24. Find the values of $sin(480°)$.

25. Find the general solution of $\tan\theta = \sqrt{3}$.

26. Find the value of n if $\frac{1}{8!} + \frac{1}{9!} = \frac{n}{10!}$.

27. Find the middle terms in the expansion of $(x + y)^7$.

28. Write the n^{th} term of the following sequences: $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \frac{5}{6}, \ldots$

29. Show the points $\left(0, -\frac{3}{2}\right), (1, -1)$ and $\left(2, -\frac{1}{2}\right)$ are collinear.

30. Resolve into partial fractions: $\frac{1}{x^2-1}$.

PART - III

Answer any seven questions : (Q.No. 40 is compulsory) **7*3=21**

31. Discuss the following relations for reflexivity, symmetricity and transitivity :
On the set of natural numbers the relation R defined by "xRy if $x + 2y = 1$"

32. Find the largest possible domain of the real valued function $f(x) = \frac{\sqrt{4-x^2}}{\sqrt{x^2-9}}$.

33. If α and β are the roots of the quadratic equation $x^2 + \sqrt{2}x + 3 = 0$, form a quadratic polynomial with zeroes $\frac{1}{\alpha}, \frac{1}{\beta}$.

34. Solve the equation $\sqrt{6 - 4x - x^2} = x + 4$.

35. Prove that $cos\left(\frac{3\pi}{4} + x\right) - cos\left(\frac{3\pi}{4} - x\right) = -\sqrt{2}\, sin\, x$.

36. Prove that $tan\left(\frac{\pi}{4} + \theta\right) - tan\left(\frac{\pi}{4} - \theta\right) = 2\, tan\, 2\theta$.

37. Find the rank of the word GARDEN.

38. Find $\sum_{n=1}^{\infty} \frac{1}{n^2+5n+6}$.

39. Find the equation of the straight line parallel to $5x - 4y + 3 = 0$ and having x-intercept 3.

40. If $9P_5 + 5 \times 9P_4 = 10P_r$ then find r.

PART - IV

Answer all : 7*5=35

41. a) In the set Z of integers, define mRn if $m-n$ is a multiple of 12. Prove that R is an equivalence relation. ***(OR)***

b) In how many ways 4 mathematics books, 3 physics books, 2 chemistry books and 1 biology book can be arranged on a shelf so that all books of the same subjects are together.

42. a) If $A+B+C=\frac{\pi}{2}$, prove that $\sin 2A+\sin 2B+\sin 2C=4\cos A\cos B\cos C$. ***(OR)***

b) If $\frac{\log x}{y-z}=\frac{\log y}{z-x}=\frac{\log z}{x-y}$, then prove that $xyz=1$.

43. a) Solve : $\frac{x^2-4}{x^2-2x-15}\leq 0$. ***(OR)*** b) Solve : $\sqrt{3}\sin\theta-\cos\theta=\sqrt{2}$.

44. a) A committee of 7 peoples has to be formed from 8 men and 4 women. In how many ways can this be done when the committee consists of (i) exactly 3 women? (ii) at least 3 women? (iii) at most 3 women? ***(OR)***

b) If a, b, c are in geometric progression, and if $a^{\frac{1}{x}}=b^{\frac{1}{y}}=c^{\frac{1}{z}}$, then prove that x,y,z are in arithmetic progression.

45. a) Using the Mathematical induction, show that for any natural number n,

$1^2+2^2+3^2+\ldots+n^2=\frac{n(n+1)(2n+1)}{6}$. ***(OR)***

b) Rewrite $\sqrt{3}x+y+4=0$ into normal form.

46. a) If $\theta+\emptyset=\alpha$ *and* $\tan\theta=k\tan\emptyset$, then prove that $\text{Sin}(\theta-\phi)=\frac{k-1}{k+1}\sin\alpha$. ***(OR)***

b) If p is length of perpendicular from origin to the line whose intercepts on the axes are a *and* b, then show that $\frac{1}{p^2}=\frac{1}{a^2}+\frac{1}{b^2}$.

47. a) If $f:[-1,\infty)\to[0,\infty)$ is defined by $f(x)=(x+1)^2$, then prove that f is bijection and find its inverse. ***(OR)*** b) Find the sum of the coefficients of all even degree terms in the expansion of $\left(x+\sqrt{x^3-1}\right)^6+\left(x-\sqrt{x^3-1}\right)^6$, $(x>1)$.