COMMON QUARTERLY EXAMINATION - 2024

Standard XI

Reg.No. | | | | | | |

MATHEMATICS

Time : 3.00 hrs **Marks : 90**

Part - I

I. Choose the correct answer: **20 x 1 = 20**

1. Let A and B be subsets of the universal set N, the set of natural numbers. Then $A' \cup [(A \cap B) \cup B']$ is
   a) A b) A' c) B d) N
2. The function $f : [0, 2\pi] \to [-1, 1]$ defined by $f(x) = \sin x$ is
   a) one-to-one b) onto c) bijection d) cannot be defined
3. The range of the function $\frac{1}{1-2\sin x}$ is
   a) $\left[-1, \frac{1}{3}\right]$ b) (0,1)
   c) $(-\infty, -1] \cup \left[\frac{1}{3}, \infty\right)$ d) $(-\infty, -1)$
4. The number of subsets of $A = \{x : x = 3n + 2, 2 \le n \le 5, n \in N\}$ is
   a) 16 b) 8 c) 64 d) 15
5. The solution of $5x - 1 < 24$ and $5x + 1 > -24$ is
   a) (4,5) b) (–5,–4) c) (–5,5) d) (–5,4)
6. The value of $\log_a b \log_b c \log_c a$ is
   a) 2 b) 1 c) 3 d) 4
7. The number of solutions of $x^2 + |x - 1| = 1$ is
   a) 1 b) 0 c) 2 d) 3
8. The value of $\log_{\sqrt{2}} 5/2$ is
   a) 16 b) 18 c) 9 d) 12
9. $\cos1^\circ + \cos2^\circ + \cos3^\circ + \ldots\ldots\ldots + \cos179^\circ$ is equal to
   a) –1 b) 0 c) 1 d) 89
10. If $f(\theta) = |\sin\theta| + |\cos\theta|$, $\theta \in R$ then $f(\theta)$ is in the interval
    a) [0,2] b) [1,2] c) [0,1] d) $[1, \sqrt{2}]$
11. If $\pi < 2\theta < \frac{3\pi}{2}$, then $\sqrt{2 + \sqrt{2 + 2\cos 4\theta}}$ equal to
    a) $-2\cos\theta$ b) $-2\sin\theta$ c) $2\cos\theta$ d) $2\sin\theta$

12. The sum of first n positive odd numbers is

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

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

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

14. There are 10 points in a plane and 4 of them are collinear. The number of straight lines joining any two points is

a) 45 b) 40 c) 39 d) 38

15. Number of sides of a polygon having 44 diagonals is

a) 4 ! b) 11 c) 22 d) 4

16. The sequence $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}+\sqrt{2}}, \frac{1}{3+2\sqrt{2}}, \ldots\ldots\ldots$ form an

a) A^P b) G^P c) H^P d) AG^P

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

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

18. The image of the point (2,3) in the line $y = -x$ is

a) (–3,–2) b) (–3,2) c) (–2,–3) d) (3,2)

19. The slope of the line which makes an angle 45° with the line $3x - y = -5$ are

a) 1,–1 b) $\frac{1}{2}, -2$ c) $2, -\frac{1}{2}$ d) $1, \frac{1}{2}$

20. The length of perpendicular from 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) $-\frac{5}{12}$

Part - II

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

21. For a set A, A x A contains 16 elements and two of its elements are (1,3) and (0,2). Find the elements of A.

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

23. Solve : $|3 - x| < 7$ for x

24. Prove $\log\frac{a^2}{bc} + \log\frac{b^2}{ca} + \log\frac{c^2}{ab} = 0$

25. Find the value of tan120°

26. If $\frac{1}{7!}+\frac{1}{8!}=\frac{A}{9!}$, then find the value of A.

27. Find the number of ways of arranging the letters of the word BANANA.

28. Write the first 6 terms of the sequence whose n^{th} term a_n is given below.

$$a_n=\begin{cases}1 & \text{if } n=1\\ 2 & \text{if } n=2\\ a_{n-1}+a_{n-2} & \text{if } n>2\end{cases}$$

29. Write the equation of the line through the point (1,–1) parallel to $x + 3y - 4 = 0$

30. Find the principal value of $\sin^{-1}\left(\frac{1}{\sqrt{2}}\right)$

Part - III

III. Answer any 7 questions. (Q.No.40 is compulsory) 7 x 3 = 21

31. If $n(A \cap B) = 3$ and $n(A \cup B) = 10$ then find $n(P(A \Delta B))$

32. Find the range of the function $f(x)=\frac{1}{1-3\cos x}$

33. Solve $23x < 100$ when

(i) x is a natural number (ii) x is an integer

34. Find the zeros of the polynomial function $f(x) = 4x^2 - 25$

35. Find the value of cos15°

36. If $nP_r = 11880$ and $nC_r = 495$, Find n and r

37. Find the coefficient of x^6 in the expansion of $(3 + 2x)^{10}$

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

39. Find the distance between the parallel lines $3x + 4y - 5 = 0$ and $6x + 8y - 15 = 0$

40. Simplify by rationalising the denominator : $\frac{7+\sqrt{6}}{3-\sqrt{2}}$

Part - IV

IV. Answer all the questions. 7 x 5 = 35

41. a) Resolve into partial fractions : $\frac{x^2+x+1}{x^2-5x+6}$ *(OR)*

b) Write the value of f at –3, 5, 2, –1, 0 if $f(x)=\begin{cases}x^2+x-5 & \text{if } x\in(-\infty,0)\\ x^2+3x-2 & \text{if } x\in(3,\infty)\\ x^2 & \text{if } x\in(0,2)\\ x^2-3 & \text{otherwise}\end{cases}$

42. a) In the set Z of integers, define mR_n if m – n is a multiple of 12, prove that R is an equivalence relation.

(OR)

b) Solve : $\frac{x+1}{x+3} < 3$

43. a) State and prove Napier's formula.

(OR)

b) Using the Mathematical induction, show that for any natural number n

$$\frac{1}{1.2}+\frac{1}{2.3}+\frac{1}{3.4}+\ldots\ldots+\frac{1}{n(n+1)}=\frac{n}{n+1}$$

44. a) If A + B = 45°, show that $(1 + \tan A)(1 + \tan B) = 2$

(OR)

b) The slope of one of the straight lines $ax^2 + 2hxy + by^2 = 0$ is twice that of the other, show that $8h^2 = 9ab$.

45. a) Let f, g : R→R be defined as $f(x) = 2x - |x|$ and $g(x) = 2x + |x|$. Find fog.

(OR)

b) Prove that $nC_r + nC_{r-1} = (n+1)C_r$

46. a) Prove that $\sqrt[3]{x^3+7}-\sqrt[3]{x^3+4}$ is approximately equal to $\frac{1}{x^2}$ when x is large.

(OR)

b) Prove that $\sqrt{2}$ is not a rational number.

47. a) Show that the equation $9x^2 - 24xy + 16y^2 - 12x + 16y - 12 = 0$ represents a pair of parallel lines. Find the distance between them.

(OR)

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

****