COMMON QUARTERLY EXAMINATION - 2024

Standard XI   Reg.No. ☐☐☐☐☐☐

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MATHEMATICS

Time : 3.00 hrs   Part - I   *Marks : 90*

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

1. The rule $f(x) = x^2$ is a bijection if the domain and the co-domain are given by

   a) R, R   b) R, $(0, \infty)$ c) $(0, \infty)$, R   d) $(0, \infty)$, $[0, \infty)$

2. Let R be the universal relation on a set x with more than one element. Then R is

   a) not reflexive   b) not symmetric   c) transitive   d) none of the above

3. If $n(A) = 2$ and $n(B \cup C) = 3$, then $n[(A \times B) \cup (A \times C)]$ is

   a) 2^3 b) 3^2 c) 6   d) 5

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 a and b are the real roots of the equation $x^2 - kx + c = 0$, then the distance between the points $(a,0)$ and $(b,0)$ is

   a) $\sqrt{k^2 - 4c}$ b) $\sqrt{4k^2 - c}$ c) $\sqrt{4c - k^2}$ d) $\sqrt{k - 8c}$

6. The value of $\log_a b \, \log_b c \, \log_c a$ is

   a) 2   b) 1   c) 3   d) 4

7. The maximum value of $4\sin^2 x + 3\cos^2 x + \sin\frac{x}{2} + \cos\frac{x}{2}$ is

   a) $4 + \sqrt{2}$ b) $3 + \sqrt{2}$ c) 9   d) 4

8. Which of the following is not true?

   a) $\sin\theta = -\frac{3}{4}$ b) $\cos\theta = 25$ c) $\tan\theta = \frac{1}{4}$ d) $\sec\theta = -1$

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

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

10. A wheel is spinning at 2 radian / second. How many seconds will it take to make 10 complete rotations?

    a) 10π seconds   b) 20π seconds   c) 5π seconds   d) 15π seconds

11. In 3 fingers, the number of ways four rings can be worn is _____ ways.

    a) $4^3 - 1$ b) 3^4 c) 68   d) 64

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

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

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

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

14. $1 + 3 + 5 + 7 + \ldots + 19$ is equal to

   a) 100   b) 81   c) 71   d) 61

15. If a is the arithmetic mean and g is the geometric mean of two numbers, then

   a) $a \le g$ b) $a \ge g$ c) $a = g$ d) $a > g$

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

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

17. The sum of an infinite G.P is 18. If the first term is 6, the common ratio is

   a) $\frac{1}{3}$ b) $\frac{2}{3}$ c) $\frac{1}{6}$ d) $\frac{3}{4}$

18. Which of the following point lie on the locus of $3x^2 + 3y^2 - 8x - 12y + 17 = 0$

   a) (0,0)   b) (-2,3)   c) (1,2)   d) (0,-1)

19. 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)

20. If a vertex of a square is at the origin and its one side lies along the line $4x + 3y - 20 = 0$,
    then the area of the square is

   a) 20 sq.units   b) 16 sq.units   c) 25 sq.units   d) 4 sq.units

Part - II

II.   Answer any 7 questions. (Q.No.30 is compulsory) $7 \times 2 = 14$

21. Let A = {a,b,c}. What is the equivalence relation of smallest cardinality on A? What is
    the equivalence relation of largest cardinality on A?

22. Solve : $|5x - 12| < -2$

23. Evaluate : $\left[\left((256)^{-\frac{1}{2}} \right)^{-\frac{1}{4}} \right]^3$

24. Find the value of $\sin(765°)$

25. Show that $\tan(45° + A) = \frac{1 + \tan A}{1 - \tan A}$

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

27. Evaluate the following :   i) $10C_3$ ii) $100C_{99}$

28. Find the middle term in the expansion of $(x + y)^6$

29. Write the first 6 terms of the exponential series e^{-2x}

30. Find the perpendicular distance from the origin to the line $x + y = 1$

Part - III

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

31. Let $f, g : R \to R$ be defined as $f(x) = 2x - |x|$ and $g(x) = 2x + |x|$. Find fog.

32. Resolve into partial fractions : $\dfrac{x}{(x+3)(x-4)}$

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

34 Show that $\dfrac{\sin 75^\circ - \sin 15^\circ}{\cos 75^\circ + \cos 15^\circ} = \dfrac{1}{\sqrt{3}}$

35. Find the distinct permutations of the letters of the word MISSISSIPPI.

36. Prove that $10C_2 + 2(10C_3) + 10C_4 = 12C_4$

37. Write the first 6 terms of the sequences whose n^{th} term is $a_n = \begin{cases} 1 & \text{, if } n = 1 \\ 2 & \text{, if } n = 2 \\ a_{n-1} + a_{n-2} & \text{, if } n > 2 \end{cases}$

38. Compute the sum of first n terms of the following series :
$6 + 66 + 666 + 6666 + \ldots\ldots$

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

40. Find the value of $\tan^{-1}\sqrt{3} + \cos^{-1}\dfrac{\sqrt{3}}{2}$

Part - IV

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

41. a) Write the values of f at $-4, 1, -2, 7, 0$ if

$$f(x) = \begin{cases} -x + 4 & \text{if } -\infty < x \le -3 \\ x + 4 & \text{if } -3 < x < -2 \\ x^2 - x & \text{if } -2 \le x < 1 \\ x - x^2 & \text{if } 1 \le x < 7 \\ 0 & \text{otherwise} \end{cases}$$

(OR)

b) If $A + B = 45^\circ$, show that $(1 + \tan A)(1 + \tan B) = 2$

42. a) If $^{(n+2)}C_7 : {}^{(n-1)}P_4 = 13 : 24$, find n.

(OR)

b) Find all values of x that satisfies the inequality $\dfrac{2x-3}{(x-2)(x-4)} < 0$

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

(OR)

b) By the principle of mathematical induction, prove that, for all integers $n \geq 1$

$$1^2 + 2^2 + 3^2 + \ldots\ldots + n^2 = \dfrac{n(n+1)(2n+1)}{6}$$

44. a) If $A \times A$ has 16 elements $S = \{(a,b) \in A \times A : a < b\}$, $(-1,2)$ and $(0,1)$ are two elements of S, then find the remaining elements of S.

(OR)

b) If the equation $\lambda x^2 - 10xy + 12y^2 + 5x - 16y - 3 = 0$ represents a pair of straight lines, then find the value of λ and the separate equations of the lines.

45. a) If $\log_2 x + \log_4 x + \log_{16} x = \dfrac{7}{2}$, find the value of x.

(OR)

b) Find the equations of parallel line and perpendicular line passing through the point $(1,2)$ to the line $3x + 4y = 7$

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

(OR)

b) If $A + B + C = 180^\circ$, prove that $\sin 2A + \sin 2B + \sin 2C = 4 \sin A \sin B \sin C$

47. a) Find the co-efficient of x^2 and the co-efficient of x^6 in $\left(x^2 - \dfrac{1}{x^3}\right)^6$

(OR)

b) Find the largest possible domain for the real valued function given by

$$f(x) = \dfrac{\sqrt{9-x^2}}{\sqrt{x^2-1}}$$

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