QUARTERLY COMMON EXAMINATION - 2024

11 - Std

MATHEMATICS

Time : 3.00 Hrs. MARKS : 90

Part - I

I **Note : i) All questions are compulsory.** 20 ×1 = 20

ii) Choose the most appropriate answer from the given four alternatives and write the option code and the corresponding answer

1. Let A and B be subsets of the universal set $\mathbb{N}$, the set of natural numbers. Then $A' \cup [(A \cap B) \cup B']$ is

   (1) A (2) A' (3) B (4) $\mathbb{N}$

2. Let $X = \{1,2,3,4\}$ and $R = \{(1,1),(1,2),(1,3),(2,2),(3,3),(2,1),(3,1),(1,4),(4,1)\}$. Then R is

   (1) reflexive (2) symmetric (3) transitive (4) equivalence

3. Let $f: \mathbb{R} \to \mathbb{R}$ be defined by $f(x) = 1 - |x|$. Then the range of f is

   (1) $\mathbb{R}$ (2) $(1, \infty)$ (3) $(-1, \infty)$ (4) $(-\infty, 1]$

4. If $f(x) = 2x - 3$ and $g(x) = x^2 + x - 2$ then $gof\,(x)$ is

   1) $2(2x^2 - 5x + 2)$ 2) $2x^2 - 5x - 2$

   3) $2(2x^2 + 5x + 2)$ 4) $2x^2 + 5x - 2$

5. If $|x + 2| \leq 9$, then x belongs to

   (1) $(-\infty, -7)$ (2) $[-11,7]$ (3) $(-\infty, -7) \cup [11, \infty)$ (4) $(-11,7)$

6. The value of $\log_{\sqrt{2}} 512$ is

   (1) 16 (2) 18 (3) 9 (4) 12

7. 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

   (1) $\sqrt{k^2 - 4c}$ (2) $\sqrt{4k^2 - c}$ (3) $\sqrt{4c - k^2}$ (4) $\sqrt{k - 8c}$

8. If $\cos 28^\circ + \sin 28^\circ = k^3$, then $\cos 17^\circ$ is equal to

   (1) $\frac{k^3}{\sqrt{2}}$ (2) $-\frac{k^3}{\sqrt{2}}$ (3) $\pm\frac{k^3}{\sqrt{2}}$ (4) $-\frac{k^3}{\sqrt{3}}$

9. In a triangle ABC, $\sin^2 A + \sin^2 B + \sin^2 C = 2$, then the triangle is
(1) equilateral triangle (2) isosceles triangle
(3) right triangle (4) scalene triangle

10. If $\sin\alpha + \cos\alpha = b$, then $\sin 2\alpha$ is equal to
(1) $b^2 - 1$, if $b \leq \sqrt{2}$ (2) $b^2 - 1$, if $b > \sqrt{2}$
(3) $b^2 - 1$, if $b \geq 1$ (4) $b^2 - 1$, if $b \geq \sqrt{2}$

11. Identify the quadrant in which an angle of given measure lies i)-55°
a) first quadrant b) second quadrant
c) third quadrant d) fourth quadrant

12. In 3 fingers, the number of ways four rings can be worn is _____ ways.
(1) $4^3 - 1$ (2) 3^4 (3) 68 (4) 64

13. If ${}^{a^2-a}C_2 = {}^{a^2-a}C_4$ then the value of 'a' is
(1) 2 (2) 3 (3) 4 (4) 5

14. If ${}^nC_4, {}^nC_5, {}^nC_6$ are in AP the value of n can be
(1) 14 (2) 11 (3)9 (4) 5

15. The coefficient of x^6 in $(2 + 2x)^{10}$ is
(1) ${}^{10}C_6$ (2) 2^6 (3) ${}^{10}C_6 2^6$ (4) ${}^{10}C_6 2^{10}$.

16. The HM of two positive numbers whose AM and GM are 16,8 respectively is (1) 10 (2) 6 (3) 5 (4) 4.

17. Find the number of ways of arranging the letters of the word CHEESE
(1) 120 (2) 240 (3) 720 (4) 6

18. Which of the following point lie on the locus of $3x^2 + 3y^2 - 8x - 12y + 17 = 0$
(1) (0,0) (2) $(-2,3)$ (3) (1,2) (4) $(0,-1)$

19. If the lines represented by the equation $6x^2 + 41xy - 7y^2 = 0$ make angles α and β with x - axis, then $\tan\alpha \tan\beta =$
(1) $-\frac{6}{7}$ (2) $\frac{6}{7}$ (3) $-\frac{7}{6}$ (4) $\frac{7}{6}$

20. If $\sum n = 21$ then $\sum n^2 =$
(1) 18 (2) 91 (3) 90 (4) 92

Part – II

II Note : i) Answer any Seven questions. 7 ×2 = 14
ii) Question number 30 is compulsory

21. If $\wp(A)$ denotes the power set of A, then find $n\left(\wp\left(\wp(\wp(\phi))\right)\right)$

22. Find the domain of $f(x) = \frac{1}{1-2\cos x}$.

23. If a and b are the roots of the equation $x^2 - px + q = 0$, find the value of $\frac{1}{a} + \frac{1}{b}$.

24. Prove $\log a + \log a^2 + \log a^3 + \cdots + \log a^n = \frac{n(n+1)}{2}\log a$.

25. Find the value of $\cos 135°$

26. Find the value of $\sin 2\theta$, when $\sin\theta = \frac{12}{13}$, θ lies in the first quadrant.

27. If $\frac{6!}{n!} = 6$, then find the value of n.

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

$$a_n = \begin{cases} n+1 & \text{if } n \text{ is odd} \\ n & \text{if } n \text{ is even} \end{cases}$$

29. Find the slope of the straight line passing through the points (5,7) and (7,5). Also find the angle of inclination of the line with the x-axis.

30. Express the equation $4x - y + 4 = 0$ in the following equivalent form : Slope and y- Intercept form.

Part – III

III Note : i) Answer any Seven questions. $7 \times 3 = 21$

ii) Question number 40 is compulsory.

31. Let $A = \{a, b, c\}$and $R = \{(a,a), (b,b), (a,c)\}$. Write down the minimum number of ordered pairs to be included to R to make it

(i) reflexive (ii) symmetric (iii) transitive (iv) equivalence

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

33. A girl A is reading a book having 446 pages and she has already finished reading 271 pages. She wants to finish reading this book within a week. What is the minimum number of pages she would read per day to complete reading the book within a week?

34. If $x = -2$ is one root of $x^3 - x^2 - 17x = 22$, then find the other roots of equation.

35. Prove that $\cos(30° + x) = \frac{\sqrt{3}\cos x - \sin x}{2}$

36. Show that $\cot\left(7\frac{1°}{2}\right) = \sqrt{2} + \sqrt{3} + \sqrt{4} + \sqrt{6}$.

37. If $nC_4 = 495$, what is n?

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

39. If p_1 and p_2 are the lengths of the perpendiculars from the origin to the straight lines. $x\sec\theta + y\text{cosec}\theta = 2a$and $x\cos\theta - y\sin\theta = a\cos 2\theta$, then prove that $p_1^2 + p_2^2 = a^2$.

40. Find the coefficient of x^n in the expansion of e^{a+bx}.

33. 446 Pages in book.

Part – IV

Note : i) Answer all the questions. 7×5 = 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,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.

42. a) Find all values of x that satisfies the inequality $\frac{2x-3}{(x-2)(x-4)} < 0$. **(OR)**

b) If $A+B+C = 180^\circ$, prove that $Sin2A + Sin2B + Sin2C = 4\,SinA\,SinB\,SinC$.

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

b) Express the equation $\sqrt{3}x - y + 4 = 0$ in the following equivalent form :

(i) Slope and Intercept form (ii) Intercept form (iii) Normal form

44. a) By the principle of mathematical induction, prove that, for $n \ge 1$

$1^3 + 2^3 + 3^3 + \cdots + n^3 = \left(\frac{n(n+1)}{2}\right)^2$. **(OR)**

b) State and prove that Napier's Formula.

45. a) Prove that $\sqrt[3]{x^3+6} - \sqrt[3]{x^3+3}$ is approximately equal to $\frac{1}{x^2}$ when x is sufficiently large. **(OR)**

b) If $f:\mathbb{R} \to \mathbb{R}$ is defined by $f(x) = 2x - 3$ prove that f is a bijection and find its inverse.

46. a) If the equation $\lambda x^2 - 10xy + 12y^2 + 5x - 16y - 3 = 0$ represents a pair of straight lines, find (i) the value of λ and the separate equations of the lines (ii) point of intersection of the lines (iii) angle between the lines. **(OR)**

b) Resolve into partial fractions : $\frac{2x}{(x^2+1)(x-1)}$.

47. a) In a survey of 5000 persons in a town, it was found that 45% of the persons know Language A, 25% know Language B, 10% know Language C, 5% know Languages A and B, 4% know Languages B and C and 4% know Languages A and C. If 3% of the persons know all the three Languages, find the number of persons who knows only Language A.

(OR) b) If the letters of the word IITJEE are permuted in all possible ways and the strings thus formed are arranged in the lexicographic order, find the rank of the word IITJEE.