

KK11M

Kanyakumari District
Common Quarterly Examination - September 2024

Standard 11
MATHEMATICS

Time: 3.00 hrs

Marks: 90

PART - I ($20 \times 1 = 20$)

(i) Answer all the questions.

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

1. The number of ways in which one can post 5 letters in 7 letter boxes is

- (1) $7P_5$ (2) $7C_5$ (3) 5^7 (4) 7^5

2. If $f(x) = \left(\frac{1}{2}\right)^x$, then $f(0), f(1), f(2), f(3) \dots$ are in

- (1) AP (2) GP (3) HP (4) Both AP and HP

3. The number of terms in the expansion of $(2x - 3y)^9$ is

- (1) 9 (2) 10 (3) 11 (4) 12

4. The slope of a line which passes through the points (3, 2) and (-1, 5) is

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

5. If $\cos(A - B) = \frac{3}{5}$ and $\tan A \tan B = 2$, then the value of $\cos A \cos B$ is

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

6. If $\frac{|x-2|}{x-2} \geq 0$ then x belongs to

- (1) $[2, \infty)$ (2) $(2, \infty)$ (3) $(-\infty, 2)$ (4) $(-2, \infty)$

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7. The number of solutions of $x^2 + |x - 1| = 1$ is

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

8. The n^{th} term of sequence $\frac{1}{2}, \frac{3}{4}, \frac{7}{8}, \frac{15}{16}, \dots$ is

- (1) $2^n - n - 1$ (2) $1 - 2^{-n}$ (3) $2^{-n} + n - 1$ (4) 2^{n-1}

9. The coefficient of x^6 in $(2 + 2x)^{10}$ is

- (1) $^{10}C_6$ (2) 2^6 (3) $^{10}C_6 2^6$ (4) $^{10}C_6 2^{10}$

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

- (1) 45 (2) 40 (3) 39 (4) 38

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11. The number of 5 digit numbers all digits of which are odd is
 (1) 25 (2) 5^5 (3) 5^6 (4) 625
12. A wheel is spinning at 2 radians / second. How many seconds will it take to make 10 complete rotations?
 (1) 10π seconds (2) 20π seconds (3) 5π seconds (4) 15π seconds
13. If $f(\theta) = |\sin \theta| + |\cos \theta|$, $\theta \in R$, then $f(\theta)$ is in the interval
 (1) $[0,2]$ (2) $[1, \sqrt{2}]$ (3) $[1,2]$ (4) $[0,1]$
14. The number of constant functions from a set containing m elements to a set containing n elements is
 (1) mn (2) m (3) n (4) $m + n$
15. Let R be the universal relation on a set X with more than one element. Then R is
 (1) not reflexive (2) not symmetric (3) transitive (4) none of the above.
16. Equation of the straight line that forms an isosceles triangle with coordinate axes in the I-quadrant with perimeter $4 + 2\sqrt{2}$ is
 (1) $x + y + 2 = 0$ (2) $x + y - 2 = 0$
 (3) $x + y - \sqrt{2} = 0$ (4) $x + y + \sqrt{2} = 0$
17. Straight line joining the points $(2, 3)$ and $(-1, 4)$ passes through the point (α, β) if
 (1) $\alpha + 2\beta = 7$ (2) $3\alpha + \beta = 9$ (3) $\alpha + 3\beta = 11$
 (4) $3\alpha + \beta = 11$
18. The area of the triangle formed by the lines $x^2 - 4y^2 = 0$ and $x = a$ is
 (1) $2a^2$ (2) $\frac{\sqrt{3}}{2}a^2$ (3) $\frac{1}{2}a^2$ (4) $\frac{2}{\sqrt{3}}a^2$
19. If the function $f: [-3,3] \rightarrow S$ defined by $f(x) = x^2$ is onto, then S is
 (1) $[-9,9]$ (2) R (3) $[-3,3]$ (4) $[0,9]$
20. The value of $\sum_{r=1}^n \frac{nPr}{r!}$ is
 (1) 2^n (2) $2^n - 1$ (3) n^2 (4) $n^2 - 1$

PART - II (7 × 2 = 14)

Answer any seven questions. Question No.30 is compulsory.

21. Let $S = \{1, 2, 3\}$ and $\rho = \{(1,1), (1,2), (2,2), (1,3), (3,1)\}$. Is ρ symmetric? If not, state the reason, write minimum number of ordered pairs to be included to ρ so as to make it symmetric and write minimum number of ordered pairs to be deleted from ρ so as to make it symmetric.
22. If $X = \{1, 2, 3, \dots, 10\}$ and $A = \{1, 2, 3, 4, 5\}$. Find the number of sets $B \subseteq X$ such that $A - B = \{4\}$

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23. Find the value of $\log_{\sqrt{2}} 1024$ 24. Find the value of $\sin 34^\circ + \cos 64^\circ - \cos 4^\circ$ 25. Find the principal value of $\operatorname{cosec}^{-1}(-1)$

26. How many three- digit numbers are there with 3 in the unit place?

(i) with repetition

(ii) without repetition.

27. How many chords can be drawn through 20 points on a circle?

28. Write the second and fourth terms of the sequences 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. Find the sum: $1 + \frac{4}{5} + \frac{7}{25} + \frac{10}{125} + \dots$ 30. Find the distance between two parallel lines $3x + 4y = 12$ and $6x + 8y + 1 = 0$

PART - III (7 × 3 = 21)

Answer any seven questions. Question No.40 is compulsory.

31. If $n(P(A)) = 1024$, $n(A \cup B) = 15$ and $n(P(B)) = 32$, then find $n(A \cap B)$ 32. From the curve $y = |x|$, draw (i) $y = |x| - 1$ (ii) $y = |x - 1| + 1$ 33. Solve $|2x - 17| = 3$ for x 34. If α and β are the roots of the quadratic equation $x^2 + \sqrt{2}x + 3 = 0$, form a quadratic polynomial with zeroes $\frac{1}{\alpha}, \frac{1}{\beta}$ 35. If $\sec\theta + \tan\theta = p$, obtain the values of $\sec\theta$, $\tan\theta$ and $\sin\theta$ in terms of p .36. Show that $\sin^2 \frac{\pi}{18} + \sin^2 \frac{\pi}{9} + \sin^2 \frac{7\pi}{18} + \sin^2 \frac{4\pi}{9} = 2$ 37. Find the angle between the straight lines $2x + 3y + 5 = 0$ and $x - 2y - 4 = 0$.38. In the binomial expansion of $(a + b)^n$, the coefficients of the 4^{th} and 13^{th} terms are equal to each other, find n .39. Find $\sum_{k=1}^n \frac{1}{k(k+1)}$

40. Find the distinct permutations of the letters of the word HARYANA ?

PART - IV (7 × 5 = 35)

Answer all the questions.

41. (a) Find a quadratic polynomial $f(x)$ such that, $f(0) = 1$, $f(-2) = 0$ and $f(1) = 0$

(OR)

(b) If $\log_2 x + \log_4 x + \log_{16} x = \frac{7}{2}$, find the value of x

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

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

43. (a) If p is length of perpendicular from origin to the line whose intercepts on the axes are a and b , then show that

$$\frac{1}{p^2} = \frac{1}{a^2} + \frac{1}{b^2}$$

(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) Expand $(1+x)^{\frac{2}{3}}$ up to four terms for $|x| < 1$.

(OR)

(b) If the 5th and 9th terms of a harmonic progression are $\frac{1}{19}$ and $\frac{1}{35}$, find the 12th term of the sequence.

45. (a) If $\tan x = \frac{n}{n+1}$ and $\tan y = \frac{1}{2n+1}$, Prove that $x + y = 45^\circ$.

(OR)

(b) If $A + B + C = \frac{\pi}{2}$, prove that $\sin 2A + \sin 2B + \sin 2C = 4 \cos A \cos B \cos C$

46. (a) A committee of 7 people 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) No restriction

(OR)

(b) Prove by Mathematical Induction that

$$1! + (2 \times 2!) + (3 \times 3!) + \dots + (n \times n!) = (n+1)! - 1.$$

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

(OR)

(b) If the function $f : R \rightarrow R$ be defined by $f(x) = x^2 + 5x + 9$, find the pre images of 8 and 9.