Class : 11

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COMMON QUARTERLY EXAMINATION-2024-25

MATHEMATICS

Time Allowed : 3.00 Hours] [Max. Marks : 90

PART - I

20×1=20

(i) Answer All the questions.
(ii) Choose the most suitable answer from the given four alternatives and write the option code and the corresponding answer.

1. $\cos 1^\circ + \cos 2^\circ + \cos 3^\circ + \ldots\ldots + \cos 179^\circ =$

(a) 0 (b) 1 (c) -1 (d) 89

2. $\dfrac{\cos 6x + 6\cos 4x + 15\cos 2x + 10}{\cos 5x + 5\cos 3x + 10\cos x}$ is equal to

(a) cos 2x (b) cos x (c) cos 3x (d) 2 cos x

3. Which of the following is not true?

(a) $\sin\theta = -\dfrac{1}{5}$ (b) $\cos\theta = 1$ (c) $\tan\theta = 20$ (d) $\sec\theta = \dfrac{1}{2}$

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

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

5. The product of r consecutive positive integers is divisible by

(a) r! (b) (r-1)! (c) (r+1)! (d) r^r

6. 1+3+5+7+.....+21 is equal to

(a) 121 (b) 81 (c) 71 (d) 61

7. If a is the arithmetic mean and g is the geometric mean of two number, then

(a) $a \leq g$ (b) $a \geq g$ (c) $a = g$ (d) $a > g$

8. If a, 8, b are in AP, a, 4, b are in GP, and if a, x, b are in HP then x is

(a) 2 (b) 1 (c) 4 (d) 16

9. The value of the series $\dfrac{1}{2} + \dfrac{7}{4} + \dfrac{13}{8} + \dfrac{19}{16} + \ldots\ldots$ is

(a) 14 (b) 7 (c) 4 (d) 6

10. Which of the following equation is the locus of $(a\cos\theta, b\sin\theta)$

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

11. 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)

12. If one of the lines given by $6x^2 - xy + 4cy^2 = 0$ is $3x + 4y = 0$, then c equals to

(a) -3 (b) -1 (c) 3 (d) 1

13. If $A = \{(x,y) : y = e^x, x \in R\}$ and $B = \{(x,y); y = e^{-x}, x \in R\}$ then $n(A \cap B)$ is

(a) Infinity (b) 0 (c) 1 (d) 2

14. If $n((AxB) \cap (AxC)) = 8$ and $n(B \cap C) = 2$, then $n(A)$ is

(a) 6 (b) 4 (c) 8 (d) 16

15. Let $f: R \to R$ be defined by $f(x) = |x|+1$, then the range of f is,

(a) $(-\infty, 1]$ (b) $(1, \infty)$ (c) $[1, \infty)$ (d) R

16. 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

17. The value of $\log_{\sqrt{3}} 243$ is

a) 10 b) 18 c) 5 d) 12

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

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

19. The value of $\log_3 11 . \log_{11} 13 . \log_{13} 15 . \log_{15} 27 . \log_{27} 81$ is

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

20. $\frac{1}{\cos 80^\circ} - \frac{\sqrt{3}}{\sin 80^\circ} =$

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

PART – II

Answer any Seven questions. Question number 30 is compulsory. **7X2= 14**

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

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

23. From the curve $y = \sin x$, draw $y = \sin|x|$.

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

25. Show that $\sin^2 \frac{\pi}{18} + \sin^2 \frac{\pi}{9} + \sin^2 \frac{7\pi}{18} + \sin^2 \frac{4\pi}{9} = 2$.

26. If $\frac{1}{8!} + \frac{1}{9!} = \frac{n}{10!}$, then find the value of n.

27. If ${}^nC_{12} = {}^nC_9$, find ${}^{21}C_n$.

28. Find the nearest point on the line $2x+y=5$ from the origin.

29. Show that $\tan(45^\circ+A) = \dfrac{\cos A + \sin A}{\cos A - \sin A}$

30. Construct a quadratic equation with roots 3 and -3.

PART – III

Answer any seven questions. Question No.40 is compulsory. 7X3= 21

31. If AxA 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.

32. In the set Z of integers, define mRn if m-n is divisible by 7. Prove that R is an equivalence relation.

33. Solve: $3x^2 + 5x - 2 \leq 0$.

34. Solve $x = \sqrt{x+20}$ for $x \in R$.

35. Simplify: $\dfrac{\sin 75^\circ - \sin 15^\circ}{\cos 75^\circ + \cos 15^\circ}$

36. A polygon has 90 diagonals. Find the number of its sides?

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

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

38. If P(r,c) is mid point of a line segment between the axes, then show that $\dfrac{x}{r} + \dfrac{y}{c} = 2$.

39. Find the range of the function $\dfrac{1}{1 - 3\cos x}$.

40. Simplify: $\dfrac{1}{\sqrt{1}+\sqrt{2}} + \dfrac{1}{\sqrt{2}+\sqrt{3}} + \dfrac{1}{\sqrt{3}+\sqrt{4}} + \ldots\ldots + \dfrac{1}{\sqrt{80}+\sqrt{81}}$

PART – IV

Answer All the questions. 7X5= 35

41. (a) Prove that $32(\sqrt{3}) \sin\dfrac{\pi}{48} \cos\dfrac{\pi}{48} \cos\dfrac{\pi}{24} \cos\dfrac{\pi}{12} \cos\dfrac{\pi}{6} = 3$.

(OR)

(b) Show that the equation $4x^2 + 4xy + y^2 - 6x - 3y - 4 = 0$ represents a pair of parallel lines. Find the distance between them.

42. (a) If the letters of the word IITJEE are permuted in all possible ways and the strings thus formed ae arranged in the lexicographic order. Find the rank of the word IITJEE.

(OR)

(b) State and prove Napier Formula.

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

(OR)

(b) Determine the region in the plane determined by the inequalities:
$2x+y \geq 8$, $x+2y \geq 8$, $x+y \leq 6$.

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

(OR)

(b) Show that the points (1,3), (2,1) and $(1/2, 4)$ are collinear, by using (i) concept of slope (ii) using a straight line and (iii) any other method.

45. (a) Find $\sqrt[3]{1001}$ approximately (two decimal places).

(OR)

(b) If f, g: R→R are defined by $f(x) = |x| + x$ and $g(x) = |x| - x$, find gof and fog.

46. (a) If $A + B + C = 180^\circ$, prove that $\tan\frac{A}{2}\tan\frac{B}{2} + \tan\frac{B}{2}\tan\frac{C}{2} + \tan\frac{C}{2}\tan\frac{A}{2} = 1$.

(OR)

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

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

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

(OR)

(b) Express the equation $\sqrt{3}x - y + 4 = 0$ in the following equivalent form (i) Slope and Intercept from (ii) Intercept form (iii) Normal form