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Time : 1.30 Hrs.

First Mid-Term Test - 2024
MATHEMATICS

Register No. 11102

Marks : 50

PART - I**Note : i) All the questions are compulsory****10 x 1 = 10****ii) Choose the most appropriate answer from the given four alternatives and write the option code and the corresponding answer.**

1. If the function $f : [-3, 3] \rightarrow S$ defined by $f(x) = x^2$ is onto, then 'S' is
a) $[-9, 9]$ b) R c) $[-3, 3]$ d) $[0, 9]$
2. The number of relations on a set containing 3 element is
a) 9 b) 81 c) 512 d) 1024
3. The range of the function $f(x) = |\lfloor x \rfloor - x|$, $x \in R$ is
a) $[0, 1]$ b) $[0, \infty)$ c) $[0, 1)$ d) $(0, 1)$
4. The solution set of the following inequality $|x - 1| \geq |x - 3|$ is
a) $[0, 2]$ b) $[2, \infty)$ c) $(0, 2)$ d) $(-\infty, 2)$
5. The number of solutions of $x^2 + |x - 1| = 1$ is
a) 1 b) 0 c) 2 d) 4
6. The number of roots of $(x + 3)^4 + (x + 4)^4 = 16$ is
a) 4 b) 2 c) 3 d) 0
7. $\frac{1}{\cos 80^\circ} - \frac{\sqrt{3}}{\sin 80^\circ} =$ a) $\sqrt{2}$ b) $\sqrt{3}$ c) 2 d) 4
8. Which of the following is not true?
a) $\sin \theta = \frac{-3}{4}$ b) $\cos \theta = -1$ c) $\tan \theta = 25$ d) $\sec \theta = \frac{1}{4}$
9. If $\tan \alpha$ and $\tan \beta$ are the roots of $x^2 + ax + b = 0$ then $\frac{\sin(\alpha + \beta)}{\sin \alpha \sin \beta}$ is equal to
a) $\frac{b}{a}$ b) $\frac{a}{b}$ c) $-\frac{a}{b}$ d) $-\frac{b}{a}$
10. π and \sqrt{p} are
a) Rational numbers b) Irrational numbers c) Whole numbers d) Integers

PART - II**i) Answer any four questions.****4 x 2 = 8****ii) Question No.16 is compulsory**

11. If $n(A) = 10$ and $n(A \cap B) = 3$, find $n((A \cap B)^c \cap A)$.
12. Find the domain of $f(x) = \frac{1}{1 - 2\cos x}$
13. Solve $3|x - 2| + 7 = 19$ for x .
14. Find the roots of the polynomial equation $(x - 1)^3 (x + 1)^2 (x + 5) = 0$ and state their multiplicity.
15. Convert (i) $\frac{\pi}{5}$ radlans to degrees (ii) 6 radlans to degrees

16. Find the value of $\cos 15^\circ$.

PART - III

Note : (i) Answer any four questions.

4 x 3 = 12

ii) Question No.22 is compulsory.

17. Find the area of the triangle whose sides are 13cm, 14cm and 15cm.

18. If $\sin \theta = \frac{3}{5}$ and the angle θ is in the second quadrant, then find the values of other five trigonometric functions.

19. If $\log_2 x + \log_4 x + \log_{16} x = \frac{7}{2}$, then the value of x ,

20. Solve $\frac{x+1}{x+3} < 3$.

21. Find the range of the function $\frac{1}{2\cos x - 1}$

22. From the curve $y = |x|$, draw

i) $y = |x-1| + 1$ b) $y = |x+1| - 1$ c) $y = |x+2| - 3$

PART - IV

Answer all the questions.

4 x 5 = 20

23. 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 know only language A.

(OR)

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

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

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

25. a) If $a^2 + b^2 = 7ab$, show that $\log \left(\frac{a+b}{3} \right) = \frac{1}{2} (\log a + \log b)$

(OR)

b) State and prove Napier's formula.

26. a) Simplify $\frac{1}{3-\sqrt{8}} - \frac{1}{\sqrt{8}-\sqrt{7}} + \frac{1}{\sqrt{7}-\sqrt{6}} - \frac{1}{\sqrt{6}-\sqrt{5}} + \frac{1}{\sqrt{5}-2}$

(OR)

b) Derive cosine formula using the law of sines in a ΔABC .