

FIRST MID TERM TEST - 2023

Time Allowed : 1.30 Hours

MATHEMATICS

[Max. Marks - 45]

Part - I

1. Answer all the questions by choosing the correct answer from the given 4 alternatives.
2. Write question number, correct option and corresponding answer
3. Each question carries 1 mark. 10x1=10

1. If $A = \{(x, y) \mid y = \sin x, x \in \mathbb{R}\}$ and $B = \{(x, y) \mid y = \cos x, x \in \mathbb{R}\}$ then $A \cap B$ contains
 - (a) no element
 - (b) infinitely many elements
 - (c) only one element
 - (d) cannot be determined
2. Let A and B be subsets of the universal set N , the set of natural numbers. Then $A' \cup [(A \cap B) \cup B']$ is
 - (a) A
 - (b) A'
 - (c) B
 - (d) N
3. Let R be the universal relation on a set X with more than one element. Then R is
 - (a) not reflexive
 - (b) non symmetric
 - (c) transitive
 - (d) none of the above
4. The function $f : [0, 2\pi] \rightarrow [-1, 1]$ defined by $f(x) = \sin x$ is
 - (a) one-to-one
 - (b) onto
 - (c) bijection
 - (d) cannot be defined
5. Let $f : \mathbb{R} \rightarrow \mathbb{R}$ be defined by $f(x) = 1 - |x|$. Then the range of f is
 - (a) \mathbb{R}
 - (b) $(1, \infty)$
 - (c) $(-1, \infty)$
 - (d) $(-\infty, 1]$
6. If $\frac{|x-2|}{x-2} \geq 0$, then x belongs to
 - (a) $[2, \infty)$
 - (b) $(2, \infty)$
 - (c) $(-\infty, 2)$
 - (d) $(-2, \infty)$
7. The value of $\log_8 \frac{1}{81}$ is
 - (a) -2
 - (b) -8
 - (c) -4
 - (d) -9
8. If a and b are the roots of the equation $x^2 - kx + 16 = 0$ and satisfy $a^2 + b^2 = 32$, then the value of k is
 - (a) 10
 - (b) -8
 - (c) -8, 8
 - (d) 6
9. 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) $\sqrt{k - 8c}$
10. If $\frac{1-2x}{3+2x-x^2} = \frac{A}{3-x} + \frac{B}{x+1}$, then the value of $A + B$ is
 - (a) $\frac{-1}{2}$
 - (b) $\frac{-2}{3}$
 - (c) $\frac{1}{2}$
 - (d) $\frac{2}{3}$

PART - II

1. Answer any four of the following 2. Each question carry 2 marks. 4x2=8
3. Question number 17 is compulsory.

11. If $n(P(A)) = 1024$, $n(A \cup B) = 15$ and $n(P(B)) = 32$, then find $n(A \cap B)$.
12. Check the relation $R = \{(1, 1), (2, 2), (3, 3), \dots, (n, n)\}$ defined on the set $S = \{1, 2, 3, \dots, n\}$ for the three basic relations.

13. If $f: [-2, 2] \rightarrow B$ is given by $f(x) = 2x^2$, then find B so that f is onto.

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

15. Solve $|2x - 3| = |x - 5|$.

16. Construct a quadratic equation with roots 7 and -3.

17. Find the domain of $\frac{1}{1 - 2 \sin x}$.

PART - III

1. Answer any four of the following. 2. Each question carry 3 marks.

4x3=12

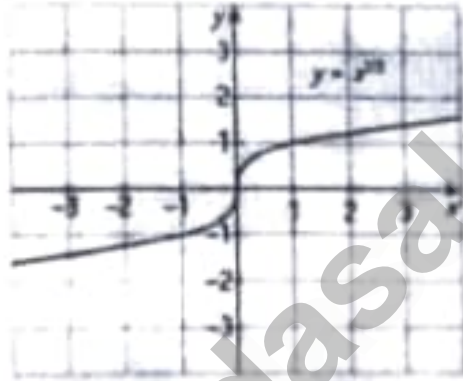
3. Question number 24 is compulsory.

18. Prove that $((A \cup B' \cup C) \cap (A \cap B' \cap C')) \cup ((A \cup B \cup C) \cap (B \cap C)) = B \cap C$.

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

20. Prove that $\sqrt{3}$ is an irrational number.

21. For the curve $y = x^{1/2}$ given in Figure, draw i) $y = -x^{1/2}$ ii) $y = x^{1/2} - 1$ iii) $y = (x+1)^{1/2}$



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

23. Resolve the following rational expressions into partial fractions: $\frac{1}{x^2 - a^2}$

24. If $x = \sqrt{2} + \sqrt{3}$ find $\frac{x^2 + 1}{x^2 - 2}$.

PART - IV

1. Answer all the questions. 2. Each question carry 5 marks.

3x5=15

25. a) If $f: \mathbb{R} \rightarrow \mathbb{R}$ is defined by $f(x) = 3x - 5$, prove that f is a bijection and find its inverse.

(OR)

b) If $f: \mathbb{R} - \{-1, 1\} \rightarrow \mathbb{R}$ is defined by $f(x) = \frac{x}{x^2 - 1}$, verify whether f is one-to-one or not.

26. a) Prove that $\log 2 + 16 \log \frac{16}{15} + 12 \log \frac{25}{24} + 7 \log \frac{81}{80} = 1$.

(OR)

b) If $f, g: \mathbb{R} \rightarrow \mathbb{R}$ are defined by $f(x) = |x| + x$ and $g(x) = |x| - x$, find $g \circ f$ and $f \circ g$.

27. 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) Solve the linear inequalities and exhibit the solution set graphically: $x + y \geq 3$, $2x - y \leq 5$, $-x + 2y \leq 3$.

Kindly send me your study materials to padasalai.net@gmail.com

CH/11/Mat/2