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SECOND MID TERM TEST-NOVEMBER 2023

12 TH STANDARD

REG NO.

TIME:1.30Hrs MATHEMATICS Marks:45

PART-I

Choose the correct answer 10X1=10

1. The function $\sin^4 x + \cos^4 x$ is increasing in the interval

(1) $\left[\frac{5\pi}{8}, \frac{3\pi}{4}\right]$ (2) $\left[\frac{\pi}{2}, \frac{5\pi}{8}\right]$ (3) $\left[\frac{\pi}{4}, \frac{\pi}{2}\right]$ (4) $\left[0, \frac{\pi}{4}\right]$

2. A stone is thrown up vertically. The height it reaches at time t seconds is given by $x = 80t - 16t^2$. The stone reaches the maximum height in time t seconds is given by

(1) 2 (2) 2.5 (3) 3 (4) 3.5

3. The slope of the line normal to the curve $f(x) = 2\cos 4x$ at $x = \frac{\pi}{12}$ is

(1) $-4\sqrt{3}$ (2) -4 (3) $\frac{\sqrt{3}}{12}$ (4) $4\sqrt{3}$

4. A random variable X has binomial distribution with $n = 25$ and $p = 0.8$ then standard deviation of X is (1) 6 (2) 4 (3) 3 (4) 2

5. A pair of dice numbered 1, 2, 3, 4, 5, 6 of a six-sided die and 1, 2, 3, 4 of a four-sided die is rolled and the sum is determined. Let the random variable X denote this sum. Then the number of elements in the inverse image of 7 is

(1) 1 (2) 2 (3) 3 (4) 4

6. If $P(X = 0) = 1 - P(X = 1)$. If $E(X) = 3\text{Var}(X)$, then $P(X = 0)$ is

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

7. In the last column of the truth table for $\neg(p \vee \neg q)$ the number of final outcomes of the truth value 'F' are

(1) 1 (2) 2 (3) 3 (4) 4

8. Subtraction is not a binary operation in

(1) $\mathbb{R}$ (2) $\mathbb{Z}$ (3) $\mathbb{N}$ (4) $\mathbb{Q}$

9. In the set $\mathbb{Q}$ define $a \odot b = a + b + ab$. For what value of y, $3 \odot (y \odot 5) = 7$?

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

10 Which one is the contrapositive of the statement $(p \vee q) \to r$?

(1) $\neg r \to (\neg p \wedge \neg q)$ (2) $\neg r \to (p \vee q)$ (3) $r \to (p \wedge q)$ (4) $p \to (q \vee r)$

PART – II

Answer any 3 questions (Question No. 15 is Compulsory) 3×2=6

11. The temperature T in celsius in a long rod of length 10 m, insulated at both ends, is a function of length x given by $T = x(10 - x)$. Prove that the rate of change of temperature at the midpoint of the rod is zero.

12. The mean and variance of a binomial variate X are respectively 2 and 1.5. Find $P(X = 0)$

13. On $\mathbb{Z}$, define $*$ by $(m * n) = m^n + n^m : \forall m, n \in \mathbb{Z}$. Is $*$ binary on $\mathbb{Z}$?