Perambalur District

12 - STD SECOND MID TERM EXAMINATION - 2024

MATHS

TIME : 1.30 Hrs MARKS : 45

PART –I

I. Answer all the following questions. 10X1=10

1. The position of a particle moving along a horizontal line of any time t is given by $s(t)=3t^2-2t-8$. The time at which the particle is at rest is

(a) $t=0$ (b) $t=\frac{1}{3}$ (c) $t=1$ (d) $t=3$

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

(a) $-4\sqrt{3}$ (b) -4 (c) $\frac{\sqrt{3}}{12}$ (d) $4\sqrt{3}$

3. The number given by the Rolle's theorem for the function $x^3-3x^2, x\in[0,3]$ is

(a) 1 (b) $\sqrt{2}$ (c) $\frac{3}{2}$ (d) 2

4. The percentage error of fifth root of 31 is approximately how many times the percentage error in 31?

(a) $\frac{1}{31}$ (b) $\frac{1}{5}$ (c) 5 (d) 31

5. Linear approximation for $g(x)=\cos x$ at $x=\frac{\pi}{2}$ is

(a) $x+\frac{\pi}{2}$ (b) $-x+\frac{\pi}{2}$ (c) $x-\frac{\pi}{2}$ (d) $-x-\frac{\pi}{2}$

6. If we measure the side of a cube to be 4 cm with an error of 0.1 cm, then the error in our calculation of the volume is

(a) 0.4 cu.cm (b) 0.45 cu.cm (c) 2 cu.cm (d) 4.8 cu.cm

7. The area between $y^2=4x$ and its latus rectum is (a) $\frac{2}{3}$ (b) $\frac{4}{3}$ (c) $\frac{8}{3}$ (d) $\frac{5}{3}$

8. In the set R of real numbers '$*$' is defined as follows. Which one of the following is not a binary operation on R? (a) $a*b=\min(a,b)$ (b) $a*b=\max(a,b)$ (c) $a*b=a$ (d) $a*b=a^b$

9. If a compound statement involves 3 simple statements, then the number of rows in the truth table is (a) 9 (b) 8 (c) 6 (d) 3

10. The dual of $\neg(p\vee q)\vee[p\vee p(\wedge\neg r)]$ is

(a) $\neg(p\wedge q)\wedge[p\vee(p\wedge\neg r)]$ (b) $(p\wedge q)\wedge[p\wedge(p\vee\neg r)]$

(c) $\neg(p\wedge)\wedge[p\wedge(p\wedge r)]$ (d) $\neg(p\wedge q)\vee[p\wedge(p\vee\neg r)]$

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PART –II

II. ANSWER ANY 4 QUESTIONS. (Q.NO 16 is compulsory) 4x2=8

11. Evaluate : $\lim_{x\to\infty}\left(\frac{e^x}{x^m}\right), m \in N$.

12. Find df for $f(x)=x^2+3x$ and evaluate it for $x=2$ and $dx=0.1$

13. Find the partial derivatives of the following functions at the indicated points $f(x,y)=3x^2-2xy+y^2+5x+2,(2,-5)$

14. Let $A=\begin{bmatrix}0 & 1\\ 1 & 1\end{bmatrix}$, $B=\begin{bmatrix}1 & 1\\ 0 & 1\end{bmatrix}$ be any two boolean matrices of the same type. Find $A\vee B$ and $A\wedge B$

15. Determine whether $*$ is a binary operation on $(a*b)=a\sqrt{b}$ is binary on R

16. A point moves along a line in such a way that after t seconds its distance from the origin is $s=2t^2+3t$ metres.Find the average velocity of the points between $t=3$ and $t=6$ seconds.

PART- III

III. ANSWER ANY 7 QUESTIONS. (Q.NO 22 is compulsory) 4x3=12

17. Find the values in the interval $(1,2)$ of the mean value theorem satisfied by the function $f(x)=x-x^2$ for $1\le x\le 2$.

18. If the radius of a sphere, with radius 10 cm, were to decrease by 0.1 cm, approximately how much would its volume decrease?

19. $w(x,y,z)=x^2y+y^2z+z^2x,\ x,y,z\in R$ find the differential dw

20. Prove that the function $f(x)=x^2-2x-3$ is strictly increasing in $(2,\infty)$.

21. state and prove ~~involution~~ Commutative law using truth table

22. Prove $p\to(q\to r)\equiv(p\wedge q)\to r$ using truth table.

PART –IV

IV. ANSWER ALL THE FOLLOWING QUESTIONS. 3x5=15

23. a) Find the acute angle between $y=x^2$ and $y=(x-3)^2$. (OR)

b) If $w(x,yz)=x^2+y^2+z^2, x=e^t, y=e^t\sin t$ and $z=e^t\cos t$, find $\frac{dw}{dt}$.

24.a) Find the volume of a sphere of radius a. (OR)

b) Let A be $Q-\{1\}$. Define $*$ on A by $x*y=x+y-xy$. Is $*$ a binary on A. If so, examine the closure, commutative, associative, the existence of identity and existence of inverse properties.

25.a) If $u=\sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$, Show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\frac{1}{2}\tan u$. (OR)

b) Prove that among all the rectangles of the given area square has the least perimeter.