Q.P Code	D 113035	Total Pages: 2	Name
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FIRST SEMESTER UG DEGREE EXAMINATION, NOVEMBER 2024

(CUFYUGP)

MAT1MN102 - CACULUS OF A SINGLE VARIABLE

2024 Admissions

Maximum Time :2 Hours	**Maximum Marks :70**

Section A

All Question can be answered. Each Question carries 3 marks (Ceiling : 24 Marks)

1	Find $\lim_{x\to 3} \dfrac{x^2-5x+6}{x-3}$
2	Find $\lim_{x\to 2^+} \dfrac{x}{x^2-4}$
3	Does the function $f(x) = \begin{cases} \sin x & \text{if } x \le \pi/2 \\ x^2 & \text{if } x > \pi/2 \end{cases}$, continous at $\pi/2$? Why?
4	A robot moves in the positive direction along a straight line so that after t minutes its distance is $s = 6t^4$ feet from the origin. Find the average velocity of the robot over the interval $[2, 4]$.
5	Using the definition of differentiation find $\dfrac{d}{dx}[x^2]$
6	Find $\dfrac{dy}{dx}$ if $y = \ln(\ln(\ln x))$
7	Find $\lim_{x\to 0} \dfrac{\ln\cos x}{x}$; $x \in (0, \pi/2)$
8	Show that the function $f(x) = x^4 - 2x^3$ is not one-to- one on $(-\infty, \infty)$.
9	Explain the term concavity of a function
10	Find all critical points of $f(x) = 3x^{5/3} - 15x^{2/3}$

Section B

All Question can be answered. Each Question carries 6 marks (Ceiling : 36 Marks))

11	$\lim_{x\to+\infty} \frac{1-e^x}{1+e^x}$
12	Discuss the continuity of the function $\frac{x+2}{x^2-4}$
13	Let $f(x) = \begin{cases} x^2-3x+2 & \text{if } x \leq 2 \\ x & \text{if } x > 2 \end{cases}$ Determine whether f is differentiable at x = 2. If so, find the value of the derivative there
14	Find $\frac{d^2y}{dx^2}$, if $y = \sin\sqrt{x} + \cos(5x)$
15	At what point is the tangent line to the curve $y^3 = 2x^2$ perpendicular to the line $x+2y-2 = 0$?
16	Use logarithmic differentiation to find $\frac{dy}{dx}$, if $y = (x^2+1)^{\cos x}$
17	Find the inflection points of the function $f(x) = xe^{-x}$
18	Find the relative extrema of $f(x) = \frac{x+3}{x-2}$

Section C

Answer any ONE. Each Question carries 10 marks (1x10=10 Marks))

19	Using the definition of differentiation find 1. $\frac{d}{dx}[\sin x]$ 2. $\frac{d}{dx}[\sqrt{x}]$
20	Consider the function $f(x) = x^5 + x + 1$. 1. Show that f is one-to-one on the interval $(-\infty, \infty)$. 2. Find a formula for the derivative of f. 3. Compute $(f^{-1})'(1)$