

	B. Let $(x) = \frac{x^2-1}{x^4+1}$. By differentiating find the exact locations of the horizontal tangent lines.		
18.	A. Consider the function $f(x) = x^5 + x + 1$. (a) Show that f has a differentiable inverse function. (b) Use implicit differentiation to find a formula for the derivative of f^{-1}. (c) Compute $(f^{-1})'(1)$. OR B. Draw the graph of $y = x$. Prove that x is continuous everywhere but differentiable except at $x = 0$.	Analyse	CO 2
19.	A. A 13 ft ladder is leaning against a wall. If the top of the ladder slips down the wall at a rate of 2 ft/s, how fast will the foot be moving away from the wall when the top is 5 ft above the ground? OR B. A) Verify that the hypothesis of Rolle's Theorem are satisfied for the function $f(x) = x^2 - 8x + 15$ on the given interval $[3,5]$, and find all values of c in that interval that satisfy the conclusion of the theorem.	Apply	CO 2

10.	Find the slopes of the tangent lines to the curve $y^2 - x + 1 = 0$ at the points $(2, -1)$ and $(2, 1)$	Understand	CO 3
11.	Find the intervals on which $f(x) = x^2 - 4x + 3$ is increasing	Understand	CO 2

Part C.

Answer all 4 questions, choosing among options within each question.

Short Answer. 4 Marks Each.

(Cognitive Level: Remember/Understand/Apply/Analyse)

16 Marks. Time: 35 Minutes

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
12.	A. Find the derivative of $f(x) = \sqrt{(1 + x^2 \cos x)}$. OR B. Find the exact locations of the horizontal tangent lines of $f(x) = \frac{x^2-1}{x^4+1}$	Understand	CO 1
13.	A. Find the relative extrema of $f(x) = 3x^5 - 5x^3$. OR B. Find the intervals on which $f(x) = x^2 - 4x + 3$ is increasing and the intervals on which it is decreasing.	Understand	CO 3
14.	A. Evaluate $\lim_{x \rightarrow -\infty} \frac{4x^2 - x}{2x^3 - 5}$ OR B. Find $\lim_{x \rightarrow 0} (1 + \sin x)^{1/x}$	Analyse	CO 2
15.	A. Find the inflection points if any of $f(x) = x^4$ OR B. Find the equation of the tangent line of the curve $x^3 + y^3 = 3xy$ at the point $(1, 2)$.	Apply	CO 3

Part D.

Answer all 4 questions, choosing among options within each question.

Long Answer. 6 Marks Each.

(Cognitive Level: Understand/Apply/Analyse/Evaluate/Create)

24 Marks. Time: 60 Minutes

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
16.	A. Find the derivative of $\frac{x^2 \cos x}{1 + \sin x}$. OR B. Find (a) $\lim_{x \rightarrow \infty} (\sqrt{x^6 + 5} - x^3)$ (b) $\lim_{x \rightarrow \infty} \sqrt{x^6 + 5x^3} - x^3$	Understand	CO 1
17.	A. (a) If $(x) = 3x^4 - 2x^3 + x^2 - 4x + 2$. Find $f^{(4)}(x)$. (b) Find the area of the triangle formed from the coordinate axes and the tangent line to the curve $y = 5x^{-1} - \frac{1}{5}x$ at the point $(5, 0)$ OR	Understand	CO 3



U8433

Reg. No.:

Name:.....

**University of Kerala**

First Semester Degree Examination, November 2024

Four Year Under Graduate Programme

Discipline Specific Core Course

MATHEMATICS**UK1DSCMAT108 - DIFFERENTIAL CALCULUS**

Academic Level: 100-199

Time:2 Hours**Max.Marks:56****Part A.****Answer All Questions, Objective Type. 1 Mark Each.****(Cognitive Level: Remember/Understand)****6 Marks. Time: 5 Minutes**

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
1.	State the product rule for differentiation	Remember	CO1
2.	Find the derivative of $\cos x^2$.	Remember	CO1
3.	State Rolle's theorem	Understand	CO 3
4.	Find the critical points of $f(x) = e^x$	Understand	CO 3
5.	Find $\lim_{x \rightarrow 0} \frac{\sin 2x}{x}$	Remember	CO 2
6.	If $f(x) = 3x - 1$ and $g(x) = 3x + 1$ determine whether f and g are inverse functions.	Remember	CO 1

Part B.**Answer All Questions , Two-Three sentences. 2 Marks Each.****(Cognitive Level: Remember/Understand/Apply)****10 Marks. Time: 20 Minutes**

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
7.	Let $f(x) = \begin{cases} \frac{x-2}{x^2-4}, & x \neq 2 \\ 2, & x = 2 \end{cases}$ Check whether f is continuous at $x = 2$.	Remember	CO 1
8.	Find $\frac{d}{dx} [\tan(x^2 + 1)]$	Remember	CO 1
9.	Find $\frac{dw}{dt}$ if $w = \tan x$ and $x = t^2 - 2t$	Remember	CO 3

