United International **University**
School of Science and Engineering
Assignment-1(Mid- term Examination) Trimester: Summer-2024
Course Title: Calculus and Linear Algebra
Course Code: MATH 2183 Submission deadline :2 weeks

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1. a) For the function $\boldsymbol{f(x) = 5x^3 - 4x^2}$ find,

(i) It's critical, and inflection points.

(ii) The intervals on which $\boldsymbol{f(x)}$ is increasing and decreasing.

(iii) The intervals on which $\boldsymbol{f(x)}$ is concave up and down.

(iv) It's relative maximum and minimum by using **1st** and **2nd** derivative test.

(v) It's $\boldsymbol{x}$-intercept and $\boldsymbol{y}$-intercepts. Finally draw the graph of $\boldsymbol{f(x)}$ using the above informations.

2.

a) Consider the function $\boldsymbol{f(x,y) = \sin(2x^2y^2 + 6x^3y) + 10}$,
Show that $\boldsymbol{f_{xy}(x,y) = f_{yx}(x,y)}$.

b) Using chain rule find $\frac{\partial U}{\partial z}$, where

$$\boldsymbol{U(p,q,r) = \sqrt{(pqr)}},$$
$$\boldsymbol{p = tan(xy) + z}, \quad \boldsymbol{q = x^3 - 4y^3}$$

c) Use implicit differentiation to find $\frac{dy}{dx}$, where $\boldsymbol{5x^4 + y^3 + e^{xy} = 0}$

d) Find the slope of the surface $\boldsymbol{z = f(x,y) = \ln(xy^2 + 2xy) + xy}$ in the $\boldsymbol{x}$ direction at the point $\boldsymbol{(2,-1)}$.

e) Verify that $\boldsymbol{u(x,t) = e^{xy}\cos xt}$ is the solution of the differential equation $\boldsymbol{u_{xx} = 25u_t}$

3. Draw a graph of polynomial function $\boldsymbol{y = f(x)}$ with degree **4** by using the following information

Increasing Interval	Decreasing Interval	$y-$intercepts	$x-$intercepts	Critical Points
$(-\infty,-5]$	$[-5,2]$	$(0,4)$	$(-7,0),(6,0)$	$(-5,6)$
$[2,10]$	$[10,+\infty)$		$(1,0),(15,0)$	$(2,-8)$
				$(10,1)$