



United International University
School of Science and Engineering

Mid-term Examination Trimester: Spring-2022

Course Title: Linear Algebra, Ordinary & Partial Differential Equations
/ Calculus and Linear Algebra

Course Code: Math 183/Math-2183 Marks: 30 Time: 1 Hour 45 Mins

Answer all the questions.

1. Consider the function $f(x) = 2x^3 - 3x^2 - 36x + 5$, find [10]

- (i) Its critical and inflection points.
- (ii) The x-intercepts and y-intercepts.
- (iii) The intervals on which $f(x)$ is increasing and decreasing.
- (iv) The intervals on which $f(x)$ is concave up and down.
- (v) Relative extrema of $f(x)$.
- (vi) Sketch the graph of $f(x)$.

2.

i) Consider the function $f(x, y) = \cos(2x^2y^2 - 3x^2y^2)$; then [5]
find $f_x(x, y)$, $f_y(x, y)$, $f_{xx}(x, y)$, $f_{yy}(x, y)$.

ii) Using chain rule find $\frac{\partial T}{\partial y}$, where [2.5]
 $T = p^3qr + \sqrt{pqr}$, $p = \sin(xy)$ $q = \ln(x^2 + y^3)$
 $r = y + 2x$

iii) Using chain rule find $\frac{\partial w}{\partial v}$, where [2.5]
 $w = z \sin(xz) + \sqrt{xy}$, $x = 2u + 2v$, $y = \frac{u}{2v}$, $z = u^2 + v^2$

3. (a) Find the solution of the given differential equations [8]

i) $ty' - 2y = t^3e^t - t^4 + 4t^5$, $y(1) = \frac{3}{2}$

ii) $y' = \frac{3x^2 - e^x}{2y - 5}$, $y(0) = 1$

b) Determine the values of r for which the given differential [2]
equation has solutions of the form t^r

$$t^2y'' - 6ty' + 10y = 0$$