NORTH SOUTH UNIVERSITY

MAT 120 (Calculus and Analytical Geometry I)

MID Term Examination, Section: 4, **Semester:** Fall 2020

Total marks: 20 **Time:** 01 hour.

Numbers in the right margin indicate full marks of questions: Marks

(There are FIVE questions answer any FOUR)

1. Sketch the graph of the function $f(x) = \begin{cases} x+1 & \text{if } x < 0 \\ x-1 & \text{if } x > 0 \end{cases}$ 5

and test if the limits of $f(x)$ at $x = 0$ and at $x = 1$ exist or not. Find the limits at the given values of x if they exist.

2. Sketch the graph of $f(x) = \begin{cases} 1-x^2 & \text{for } x < 0 \\ 1 & \text{for } 0 \le x < 1 \\ \frac{1}{x} & \text{for } x > 1 \end{cases}$ 5

and discuss differentiability at $x = 0$ and at $x = 1$.

3. Let $y = x^3 + 1$.
(a) Find the average rate of change of y with respect to x over the interval [5, 7].
(b) Find the instantaneous rate of change of y with respect to x when x = 6. 5

4. (i) Find the equation for the tangent line to the curve y = 3/x at the point (3, 1) on this curve. (ii) Also find the area of the triangle formed from the coordinate axes and this tangent line. 5

5. (i) Find all points on the ellipse $x^2 + xy + y^2 = 3$ at which the tangent line is horizontal.
(ii) Write down the equations of horizontal tangent line. Show the tangents in graph. 5

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