Department of Mathematics and Natural Sciences

MAT 110: Differential Calculus & Coordinate Geometry

Summer 2023

ASSIGNMENT 1

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Name: **ID:** **Section:**

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1. Determine the interval of the function $f(x) = \frac{1}{x} - \sqrt{\frac{x+6}{x^2+1}} + (3x^2+5) + \sin x$ in which the function is continuous. [5]

2. A function $g(x)$ is defined as: [6]

$$g(x) = \begin{cases} 2, & \text{if } x \leq -1 \\ ax + b, & \text{if } -1 < x < 3 \\ -2, & \text{if } x \geq 3 \end{cases}$$

   (a) Find a and b so that the function is continuous.

   (b) Find the differentiability of the function at $x = 3$.

3. A function $f(x)$ is defined as: [4]

$$f(x) = \begin{cases} e^{\frac{-|x|}{2}}, & \text{if } -1 < x < 0 \\ x^2, & \text{if } 0 \leq x < 2 \end{cases}$$

   Find $\lim_{x \to 0} f(x)$.

4. Find the vertical asymptotes of the function $f(x) = \frac{2x+1}{x^2 - x - 8}$. [4]

5. If $y = \cos\{\ln(1+x)^2\}$, find y_{n+2} by using **Leibnitz theorem**. [4]

6. Find $\frac{dy}{dx}$ of the following functions : [3+4]

   (a) $y = (\sqrt[3]{12x} + \sin^2(3x))^{-1}$

   (b) $\sin(x^2 + y^2) + y^3 = x + y$