Assignment 1: Introduction to Calculus

Course: MATH 101 — Instructor: Dr. Smith — Due: October 20, 2025

Problem 1

Find the derivative of $f(x) = 3x^2 + 5x - 2$.

Solution:
Using the power rule:

$$\begin{aligned} f'(x) &= \frac{d}{dx}(3x^2 + 5x - 2) \\ &= 3 \cdot 2x + 5 - 0 \\ &= 6x + 5 \end{aligned}$$

Problem 2

Evaluate the following integral:

$$\int (2x + 3)\, dx$$

Solution:
Using the power rule for integration:

$$\int (2x + 3)\, dx = x^2 + 3x + C$$

where C is the constant of integration.

Problem 3

Solve the following limit:

$$\lim_{x \to 2} \frac{x^2 - 4}{x - 2}$$

Solution:

We can factor the numerator:

$$\begin{aligned}\lim_{x\to 2}\frac{x^2-4}{x-2} &= \lim_{x\to 2}\frac{(x-2)(x+2)}{x-2}\\ &= \lim_{x\to 2}(x+2)\\ &= 4\end{aligned}$$

Problem 4

Find the equation of the tangent line to $f(x) = x^3 - 2x$ at the point $(1, -1)$.

Solution:
First, find the derivative: $f'(x) = 3x^2 - 2$

At $x = 1$: $f'(1) = 3(1)^2 - 2 = 1$

Using point-slope form:

$$\begin{aligned}y - (-1) &= 1(x-1)\\ y &= x - 2\end{aligned}$$