Practice Problems: Derivatives, Monotonicity, and Limits

1. Limits

1. $\lim_{x \to 2}(3x + 1)$
2. $\lim_{x \to \infty} \frac{1}{x}$
3. $\lim_{x \to 0}(x^2)$
4. $\lim_{x \to \infty}(2x + 5)$

2. Monotonicity (Increasing or Decreasing)

1. $f(x) = -x^2 + 4x$
   Find where the function increases and decreases.
2. $f(x) = x^3$
   Check if the function is always increasing, decreasing, or both.
3. $f(x) = 2x - 5$
   Is it increasing or decreasing? Explain using the derivative.

3. Mini Challenge

$f(x) = x^2 - 4x + 3$

1. Find $f'(x)$.

2. Find where $f(x)$ is increasing.

3. Find where $f(x)$ is decreasing.