Warm-Up

Evaluate \( \lim_{{x \to 1^-}} \frac{x^2 - 3x + 2}{x^2 - 2x + 1} \).

(a) 0  
(b) \( \infty \)  
(c) \(-\infty\)  
(d) 2  
(e) 1
1 2.1/2.2: Intro to Calculus and Limits

Goal #1: To find the slope of a line tangent to a curve at a given point.

\[ y = x^2 \]

\((1, 1)\)

line tangent at \(x = 1\)

line that "most closely resembles" the curve near \(x = 1\)

Idea: create a second point (find the slope of line) and move the second point "closer to" the first point.
Review Concept of Limit: (LIMITS Maplet):

Step 1 - Enter the limit from the left, the limit from the right and the value of the function in the boxes at the right.

Step 2 - Decide if each statement is True or False.

Left-hand limit \( \lim_{x \to 3^-} f(x) = 4 \)

Right-hand limit \( \lim_{x \to 3^+} f(x) = 4 \)

We don't care what happens at \( x = 3 \)

If \( \lim_{x \to a^-} f(x) \neq \lim_{x \to a^+} f(x) \), we say \( \lim_{x \to a} f(x) \) Does not Exist
Infinite Limits and Vertical Asymptotes:

Idea: As $x$ gets close to a value, the $y$ values grow without bound

Example: $\lim_{x \to 2^-} f(x) = \infty$ or $\lim_{x \to 2^+} f(x) = -\infty$

Graphically:

How do we tell we have this?

- Numerator approaches a nonzero #
- AND denominator approaches 0
Examples:

INFINITE LIMIT Maplet

\[ \lim_{x \to 1^+} \frac{x^2 - 3x + 2}{x^2 - 2x + 1} = \frac{0}{0} \]

Factor and cancel

\[ \lim_{x \to 1^+} \frac{(x-2)(x-1)}{(x-1)(x-1)} = \frac{0}{0} \]

\[ \infty \text{ or } -\infty \]
On Beyond Average: VERTICAL ASYMPOTOTES Maplet

\[
\begin{align*}
f(x) &= \frac{x^2 + 2x - 15}{x^2 + 4x - 5} \quad \text{Factor} \quad \frac{(x+5)(x-3)}{(x+5)(x-1)}
\end{align*}
\]

Step 1: Factor the numerator and denominator and cancel any common factors:
\[
f(x) = \frac{x-3}{x-1} \quad \text{Review} \quad \text{Check} \quad \text{Show}
\]

Step 2: Find the zeroes of the denominator:
\[
x = \quad \square \quad \text{None} \quad \text{Check} \quad \text{Show}
\]

\[x^2 + 4x - 5 = 0\]
\[(x+5)(x-1) = 0\]
\[x = -5 \quad x = 1\]

\[\text{ONLY vert. asym} \quad x = 1\]