DO NOW

Find $\lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$ given $f(x) = x^2 - 2x$

$$\lim_{\Delta x \to 0} \frac{(x+\Delta x)^2 - 2(x+\Delta x) - (x^2 - 2x)}{\Delta x}$$

$$\lim_{\Delta x \to 0} \frac{x^2 + 2x\Delta x + (\Delta x)^2 - 2x - 2\Delta x - x^2 + 2x}{\Delta x}$$

$$\lim_{\Delta x \to 0} \frac{2x\Delta x - 2\Delta x + (\Delta x)^2}{\Delta x}$$

$$\lim_{\Delta x \to 0} 2x - 2 + \Delta x$$

$$\boxed{2x-2}$$

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Chapter 2 Review

Limit: f(c) doesn't matter
"Road" to f(c)

Notation:

$\lim_{x \to c^-}$ → left-side limit

$\lim_{x \to c^+}$ → right-side limit

$\lim_{x \to c}$ → $\lim_{x \to c^-} = \lim_{x \to c^+}$

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Finding Limits:

1. Direct Substitution
2. Factor and reduce
3. Rationalize Numerator - radicals
4. Piecewise functions
5. Infinite Limits → show points

* Study/Review Limit Properties

$\lim_{x \to 0} \frac{\sin x}{x} = 1$ $\lim_{x \to 0} \frac{1 - \cos x}{x} = 0$

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Continuity:

3 conditions that must be met:

1. f(c) is defined
2. $\lim_{x \to c} f(x)$ exists
3. $\lim_{x \to c} f(x) = f(c)$

Types: 1. Removable – hole - can patch
↳ Can factor and reduce
2. Nonremovable – jumps/asymptotes
↳ cannot reduce out

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Vertical Asymptotes:

$h(x) = \frac{f(x)}{g(x)}$ $f(x) \neq 0$ $g(x) = 0$

Intermediate Value Theorem: Continuous functions

$f(a) < f(c) < f(b)$

where $a < c < b$

* Make a statement

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Find the constants a and b such that the function is continuous on the entire real number line.

$$f(x) = \begin{cases} -10, & x \leq -2 \\ ax + b, & -2 < x < 3 \\ 5, & x \geq 3 \end{cases}$$

$\lim_{x \to -2^-} = \lim_{x \to -2^+}$

$-10 = -2a + b$

$\lim_{x \to 3^-} = \lim_{x \to 3^+}$

$3a + b = 5$

$-2a + b = -10$

$3a + b = 5$

$a = 3$

$b = -4$

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