Calc AB

Lesson 36

9/14/15

Agenda: 9/14/15

Lesson 36

Critical Numbers/Values

★ Return Quiz 4 after lesson

Definition - a **Critical number** (or value) of a function f is a number c in the domain of f such that either $f'(c) = 0$ or $f'(c)$ is undefined. The critical point is $(c, f(c))$

Definition - **local extrema** values are places f has local maxima or local minima.

★ If f has a local extrema at c, then c is a critical number.

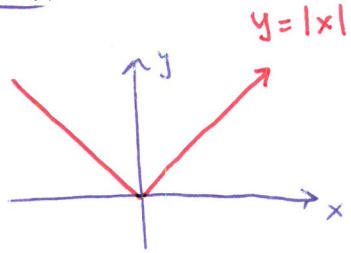
Q: When is $f'(c)$ undefined?

Recall: $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$ provided the limit exists.

Recall: A limit exists if the left and right hand limits approach the same number.

① $\lim_{h \to 0^-} \frac{f(c+h) - f(c)}{h} \neq \lim_{h \to 0^+} \frac{f(c+h) - f(c)}{h}$

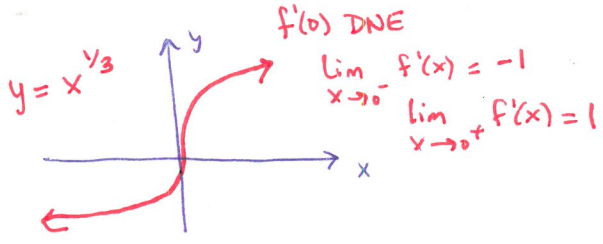
Example:



② $\lim_{h \to 0} \frac{f(c+h) - f(c)}{h} = +\infty$ or $-\infty$

Example:

$\lim_{x \to 0} f'(x) = \infty$



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Ex. Find all critical numbers of $g(x) = -\frac{5}{3}x^3 + \frac{5}{2}x^2 + 30x - 17$

$$g'(x) = -5x^2 + 5x + 30$$

Critical numbers when $g'(x) = 0$ since $g'(x)$ is always defined

$$0 = g'(x) = -5(x^2 - x - 6) = -5(x-3)(x+2)$$

When $\boxed{x = 3 \quad \text{or} \quad x = -2}$

Ex. Find all critical numbers of

$$h(x) = \sqrt{x} + \frac{1}{\sqrt{x}}$$

$$h'(x) = \frac{1}{2}x^{-1/2} - \frac{1}{2}x^{-3/2} = \frac{1}{2}x^{-3/2}\left[x - 1\right]$$

Critical numbers:

$$0 = h'(x) = \frac{1}{2}x^{-3/2}\left[x - 1\right] \quad \text{only when} \quad \boxed{x = 1}$$

$h'(x)$ is undefined at $x = 0$ but not in Domain!

★ Not every critical point is a local extrema!