Good afternoon: no warm up; have your AP limits packet out when the bell rings

You will need a device today

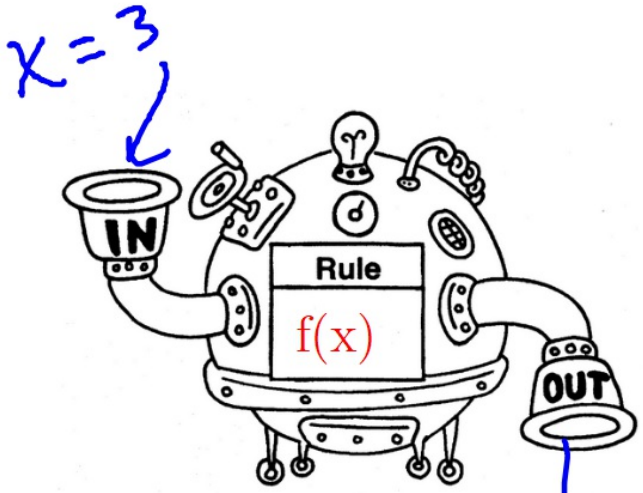
FYI:
next assessment is Monday 9/24

Google Classroom code: zu98o3

Submit answers through the quiz in classroom

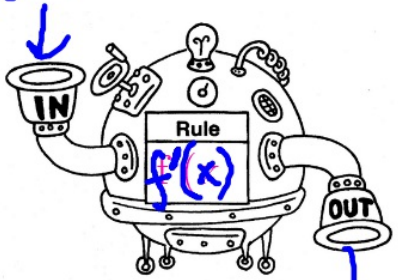
Reviewing the "derivative"

- Slope of the line tangent to a curve
- Instantaneous rate of change (vs. average rate of change)
- "Velocity" (as opposed to position)
- limit of the difference quotient
- slope at 1 point
- 'curviness' of a function at one point



x=3

y-value
@
x=3
(where?)



x=3

Slope of curve
(or of tangent line)
@ x=3
(How steep?)

Find the derivative of $f(x)=3x^2-6x-7$ using the limit definition.

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

$$\lim_{\Delta x\to 0}\frac{3(x+\Delta x)^2-6(x+\Delta x)-7-(3x^2-6x-7)}{\Delta x}$$

$$\lim_{\Delta x\to 0}\frac{3(x^2+2x\Delta x+\Delta x^2)-6x-6\Delta x-7-3x^2+6x+7}{\Delta x}$$

$$\lim_{\Delta x\to 0}\frac{3x^2+6x\Delta x+3\Delta x^2-6x-6\Delta x-7-3x^2+6x+7}{\Delta x}$$

$$\lim_{\Delta x\to 0}\frac{6x\Delta x+3\Delta x^2-6\Delta x}{\Delta x}$$

$$\lim_{\Delta x\to 0}\frac{\Delta x(6x+3\Delta x-6)}{\Delta x}$$

$$\lim_{\Delta x\to 0}\ 6x+3\Delta x-6 = 6x+3(0)-6 =$$

6x-6

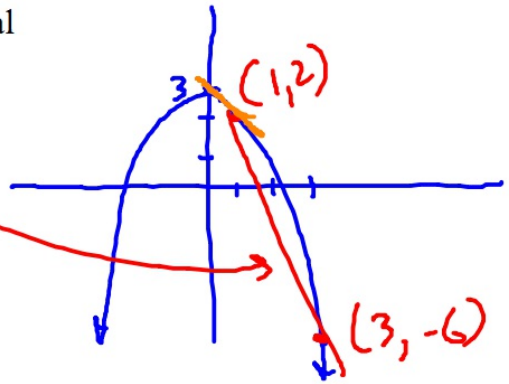
Finding the derivative with the limit definition is long and tedious....

...is there a faster way?

Find the average rate of change of the function over the interval
Find the instantaneous rate of change at the left endpoint.

$f(x)=3-x^2$ $[1,3]$

8th grade "slope"



$f(1)=3-1^2=2 \rightarrow (1,2)$

$f(3)=3-3^2=-6 \rightarrow (3,-6)$

Avg Rate of change (slope of secant line)

$= \frac{2--6}{1-3} \rightarrow \frac{8}{-2} \rightarrow -4$ Avg

Take derivative

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

$f'(x)=\lim_{\Delta x\to 0} \frac{3-(x+\Delta x)^2-3+x^2}{\Delta x} = \lim_{\Delta x\to 0} \frac{3-(x^2+2x\Delta x+\Delta x^2)-3-x^2}{\Delta x}$

$\lim_{\Delta x\to 0} \frac{3-x^2-2x\Delta x-\Delta x^2-3-x^2}{\Delta x}$

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

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

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

$f'(x)=-2x$

plug in # here

output is the instantaneous rate

$f'(1)=-2(1)$

$=-2$ ← slope of orange line above