- Piazza & Math Learning Center

- Math Attitudes & Perceptions Survey
  - Due Sept 29
  - Worth 10 WeBWork pts.
  - From the last problem in Assignment 2 or 3

Last time · Derivatives $f(x)$,

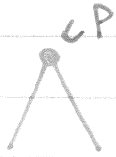
$$f'(x) = \lim_{h\to 0}(\text{Slope of secant line}) = \lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$$

Today (and a bit Wed.):
- Pictures!
- Qualitative information from the derivative.

Q: What is the tangent line to the graph of $f(x)$ at $x=a$

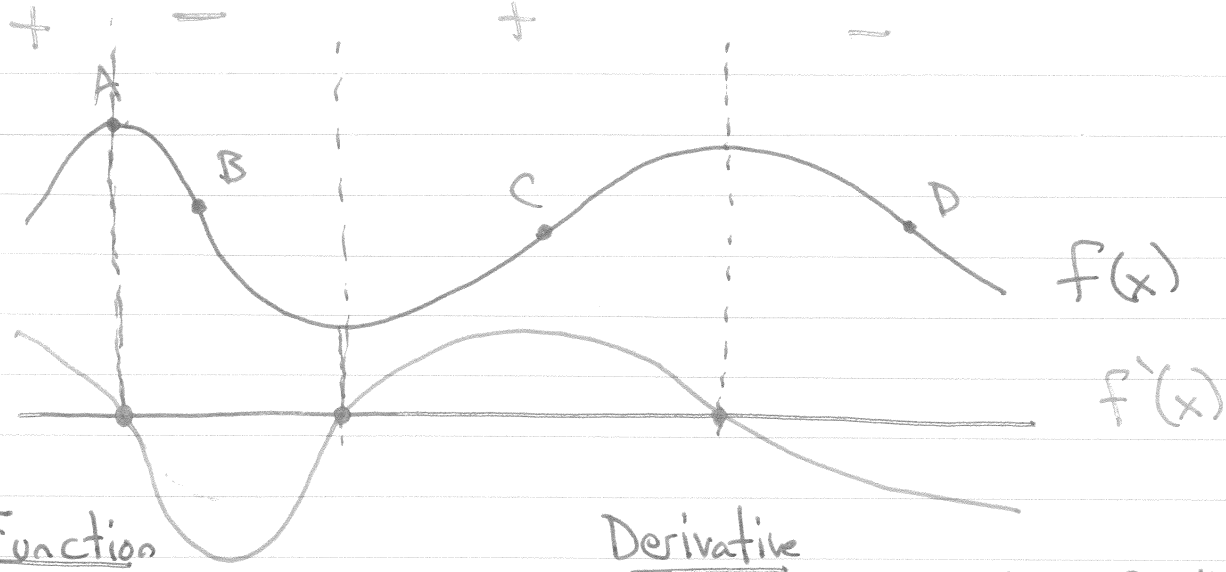
A: If you "zoom in" very close on $(a, f(a))$, the graph looks like a line. That line is the tangent line.

PS: For some functions, you can have a "cusp"
At that point P, the derivative does not exist



Continuous ✓

Differentiable X



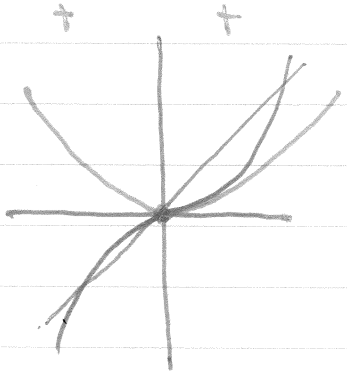
Function	Derivative
• Top of hill OR bottom of trough	• Is zero
• Uphill	• Positive
• Downhill	• Negative
• Steep	• Has large absolute value.

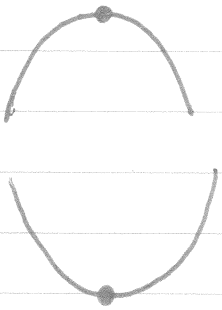
Top of hill
"Local maximum"

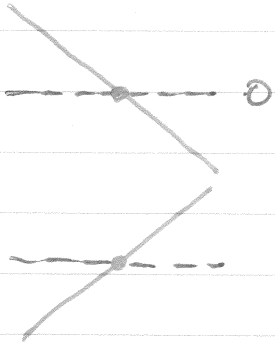
Bottom of trough
"Local minimum"

Q: Can the derivative be 0 at neither a local max OR local min?

Yes. Ex $y = x^3$







Fact:

Derivative of $y = x^2$ is $y = 2x$

$y = x^3$ is $y = 3x^2$ Why?

Later $y = x^n$ is ?

$f(x) = x^3$, then

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

$$= \lim_{h \to 0} \frac{x^3 + 3x^2h + 3xh^2 + h^3 - x^3}{h}$$

$$= \lim_{h \to 0} \frac{3x^2h + 3xh^2 + h^3}{h}$$

$$= \lim_{h \to 0} (3x^2 + \underbrace{3xh}_{\to 0} + \underbrace{h^2}_{\to 0}) = 3x^2$$

D)