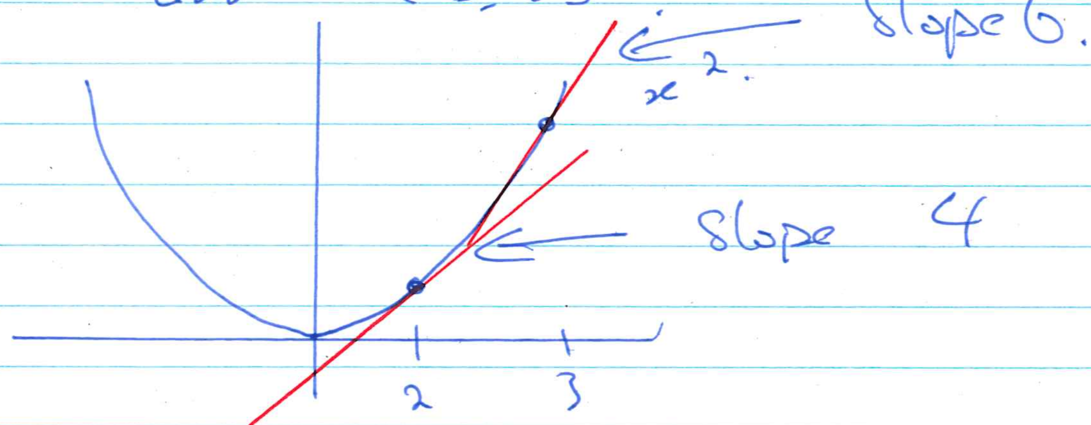
① Oct-9

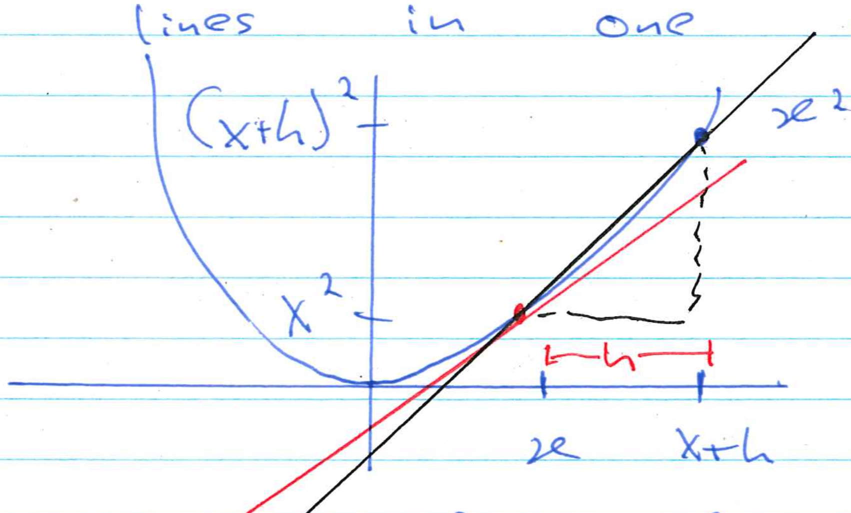
- HW4 Due Wed
- Labs run as usual next week
- ~~Due~~ HW5 Due next Mon (19th).

Last class we found the slope of the tangent lines to $f(x) = x^2$ at points $(2,4)$ and $(3,9)$



We did this by taking the limit of secant lines. (one computation for each)

Let's find the slopes of all tangent lines in one go.



$$m_{sec} = \frac{(x+h)^2 - x^2}{x+h - x}$$

$$= \frac{(x+h)^2 - x^2}{h}$$

Oct. 9.

$$m_{tan} = \lim_{h \to 0} m_{sec}$$

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

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

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

$$= \lim_{h \to 0} \frac{\cancel{h}(2x+h)}{\cancel{h}}$$

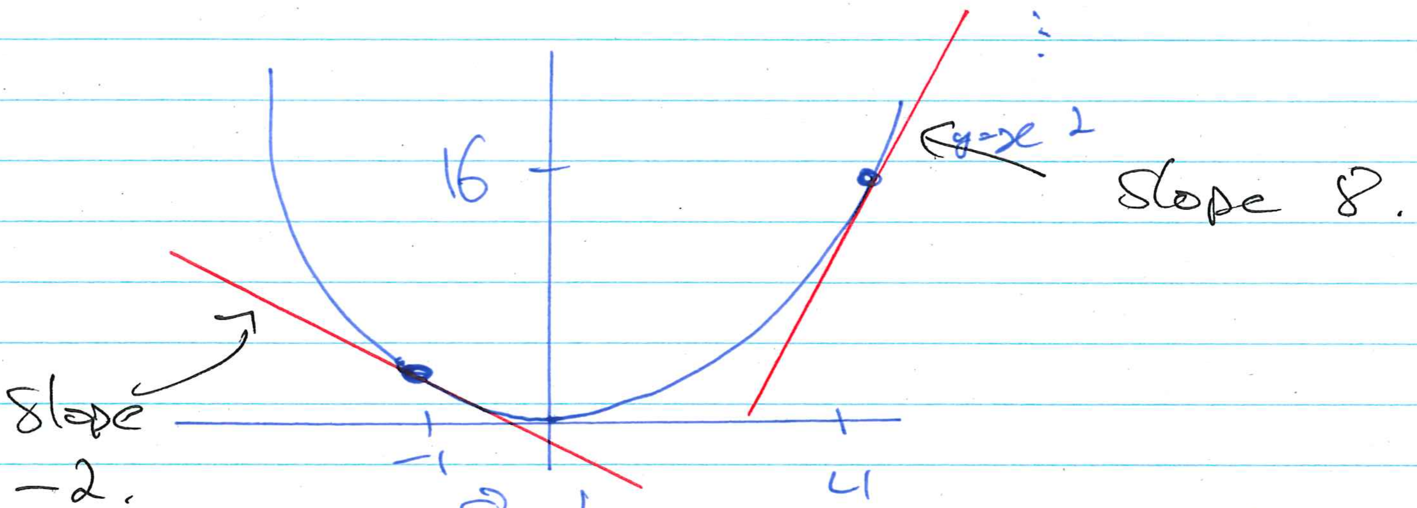
$$= \lim_{h \to 0} 2x + h = 2x + 0$$

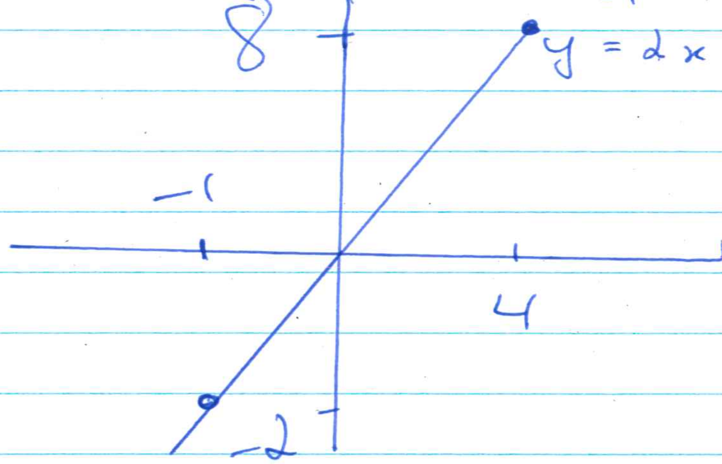
$$= 2x.$$

this function tells us the slope of the tangent line to x^2 at <u>any</u> point x.

Oct. 9

For example: at $x = 2$, slope is 4
$3 \qquad 6$
$4 \qquad 8$
$\vdots \qquad \vdots$



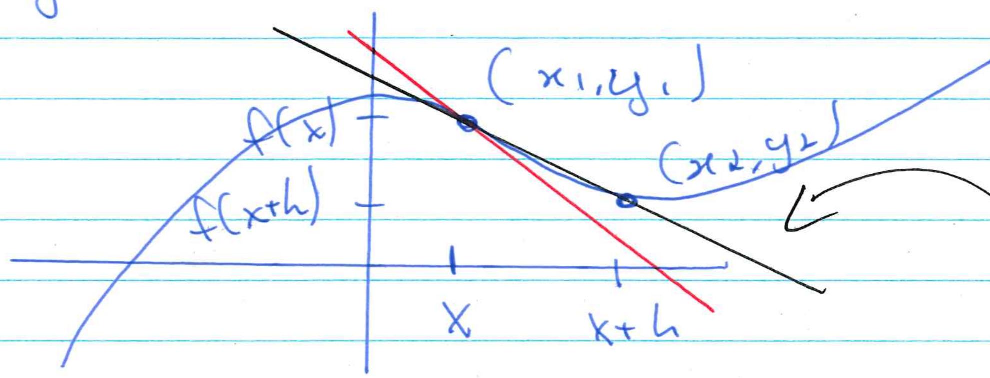


If $f(x) = x^2$ we write

$$D(f) = \frac{df}{dx} = f'(x) = 2x.$$

different notations for the derivative

In general,



$$m_{sec} = \frac{f(x+h) - f(x)}{x+h - x}.$$

$$= \frac{f(x+h) - f(x)}{h}.$$

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