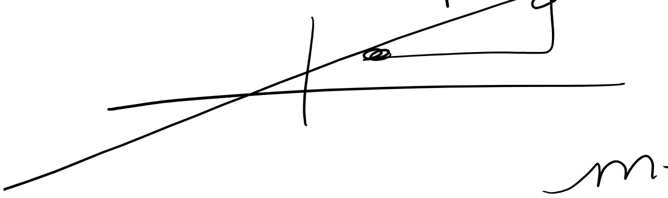
Rate of Change

Thursday, September 14, 2017 8:50 AM

Old:

m = Rate of change.

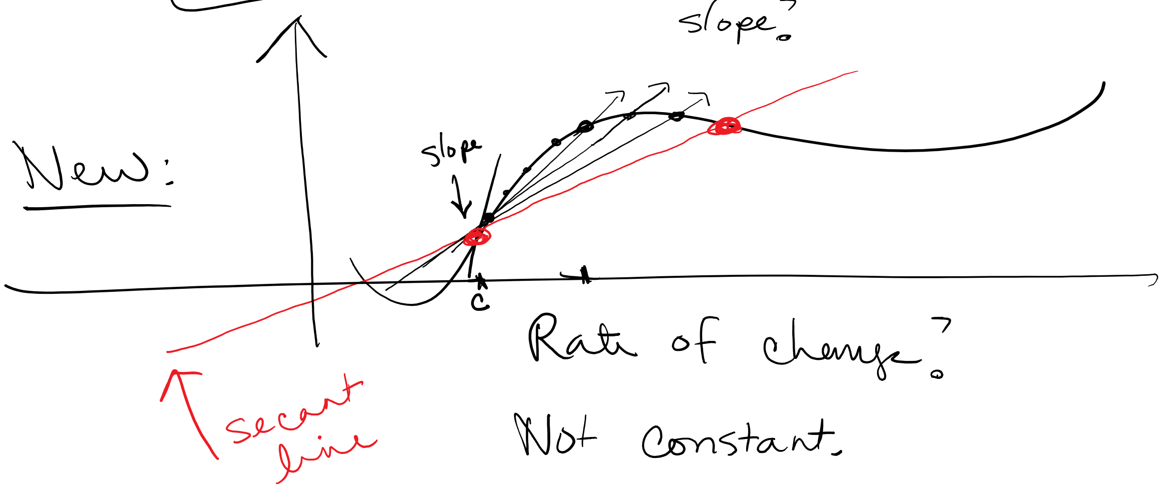


$$m = \frac{y_1 - y_2}{x_1 - x_2}$$

t, $\boxed{y - y_1 = m(x - x_1) \quad \text{pt. slope formula.}}$

slope?

New:



Rate of change?

Not constant.

We will move the right point closer & closer to the point of interest.

* We will squeeze the x values close together.

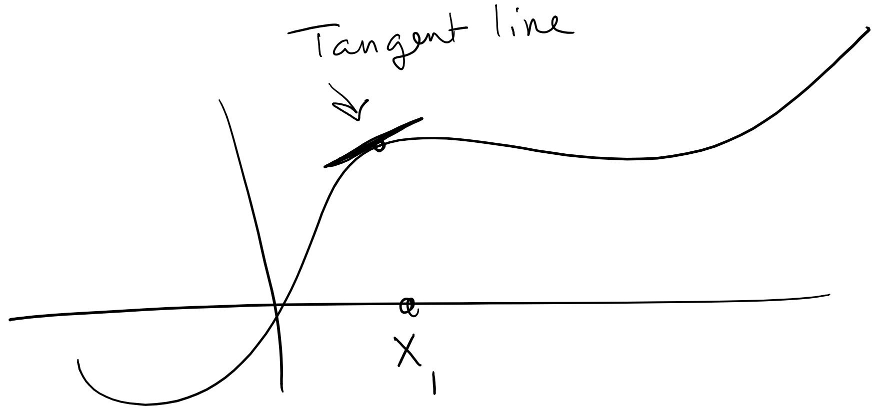
$\bullet\ (x_2, y_2)$

$\bullet$

(x_1, y_1)

Instantaneous

$$\lim_{x_2 \to x_1} \frac{y_2 - y_1}{x_2 - x_1} = \text{Rate of Change at } x_1$$



- The instantaneous Rate of change
- The slope of tangent line
- The Derivative
- $$\lim_{x \to c} \frac{f(x) - f(c)}{x - c}$$
- $$\lim_{\Delta x \to 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$$
- $$\lim_{h \to 0} \frac{f(x + h) - f(x)}{h}$$

old: $(a+b)^3 =$ Binomial Expansion.

$$\begin{array}{ccccccc} & & & 1 & & & \\ & & 1 & & 1 & & \\ & 1 & & 2 & & 1 & \\ 1 & & 3 & & 3 & & 1 \end{array}$$

$$1a^3 + 3a^2b + 3ab^2 + b^3$$

$(2x+1)^3$

$$\begin{array}{cccc} 1 & 3 & 3 & 1 \\ (2x)^3 1^0 & (2x)^2 1^1 & (2x)^1 \cdot 1^2 & 1 \cdot 1^3 \end{array}$$

$$8x^3 + 12x^2 + 6x + 1$$

$f(x) = 3x - 7$

$$\boxed{\begin{array}{c}\text{Derivative} \\ f'(x) = 3\end{array}}$$

$f(x+\Delta x) - f(x)$

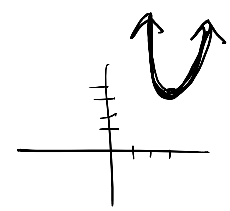
$$\lim_{\Delta x \to 0} \frac{\qquad}{\Delta x}$$

$$\lim_{\Delta x \to 0} \frac{\left[3(x+\Delta x)-7\right]-\left[3x-7\right]}{\Delta x}$$

$$\lim_{\Delta x \to 0} \frac{\cancel{3x}+3\Delta x\cancel{-7}-\cancel{3x}+\cancel{7}}{\Delta x}$$

$$\lim_{\Delta x \to 0} \frac{3\cancel{\Delta x}}{\cancel{\Delta x}} = \boxed{3}$$

$$f(x) = (x-3)^2+4$$



$$f'(x) = \lim_{\Delta x} \frac{f(x+\Delta x)-f(x)}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{\left[(x+\Delta x-3)^2+4\right]-\left[(x-3)^2+4\right]}{\Delta x}$$

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

$x^2 + x\Delta x - 3x$

$+ x\Delta x \quad + (\Delta x)^2 \quad - 3\Delta x$

$- 3x \quad - 3\Delta x \quad + 9$

cool kids

Algebra 1

$$\boxed{x^2+2x\Delta x-6x+(\Delta x)^2-6\Delta x+9}+4-\left[(x^2-6x+9)+4\right]$$

Algebra 1

$\left[x^2 + 2x\Delta x - 6x + (\Delta x)^2 - 6\Delta x + 9\right] + 4 - \left[(x^2 - 6x + 9) + 4\right]$

$\cancel{x^2} + \underline{2x\Delta x} \cancel{-6x} + \underline{(\Delta x)^2} - \underline{6\Delta x} \cancel{+9} \cancel{+4} \cancel{-x^2} \cancel{+6x} \cancel{-9} \cancel{-4}$

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

0

$$\boxed{f'(x) = 2x - 6}$$

a new function.

$f(x) = (x-3)^2 + 4$

- $f'(x) = 2x - 6$
- $f'(7) = 8$
- What is equation of tangent line to $(x-3)^2+4$ when $x = 7$.

$m = 8$

$(7, 20)$

$$\boxed{y - 20 = 8(x - 7)}$$

2.1 5, 6, 7, 19, 21, 23,
25, 26, 81-86