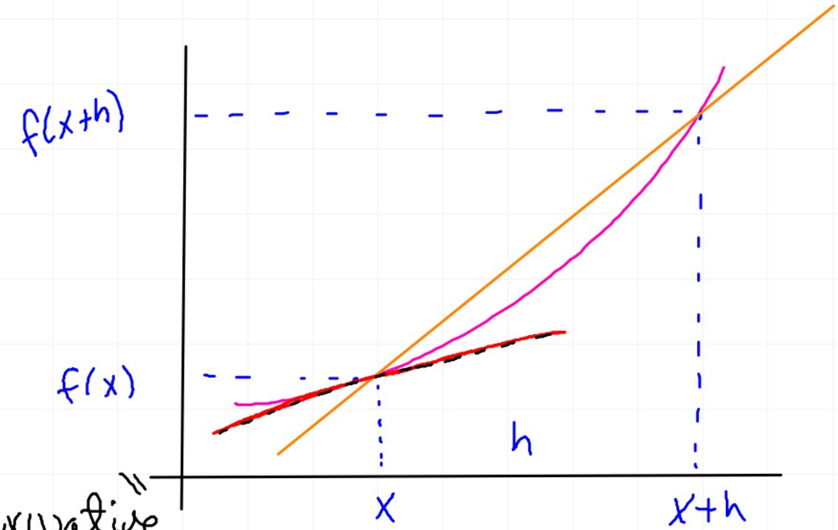
Definition of Derivative



difference quotient (avg rates)

"derivative"

(inst.)

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

$$f(x) = x^2 + 2x - 1$$

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

$$= \lim_{h \to 0} \frac{x^2 + 2xh + h^2 + 2x + 2h - 1 - x^2 - 2x + 1}{h}$$

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

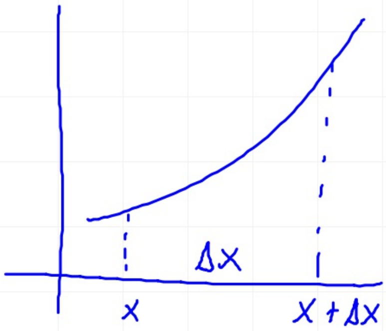
$$\cancel{= 2x + h + 2}$$

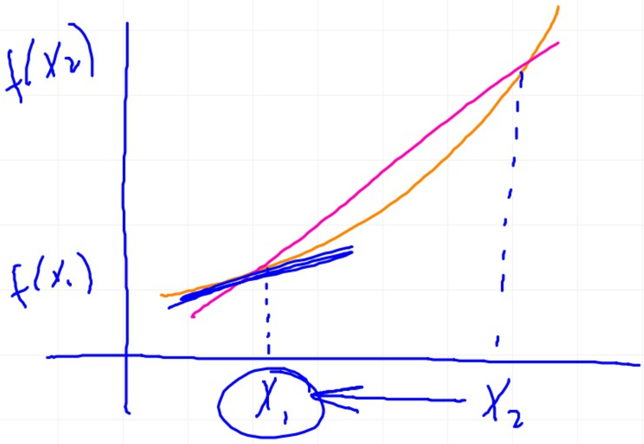
~~"supressing the h"~~

$$= 2x + 2$$

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

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





$$f'(x_1) = \lim_{x_2 \to x_1} \frac{f(x_2) - f(x_1)}{x_2 - x_1}$$

Given $f(x) = x^2 + 2x - 1$ find $f'(x)$.

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

$$= \lim_{h \to 0} \frac{x^2 + 2xh + h^2 + 2x + 2h - 1 - x^2 - 2x + 1}{h}$$

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

$$= 2x + 2$$

$$f'(x) = 2x + 2$$

Write eq tan to f at $x = 3$

$f(3) = 14 \rightarrow (3, 14)$

$f'(3) = 8 \rightarrow m_T = 8$

$\therefore y - 14 = 8(x - 3)$

Given $s(t) = t^2 + 2t - 1$ find $v(2)$.

$$s'(t) = \lim_{h \to 0} \frac{s(t+h) - s(t)}{h}$$

$$=$$

$$=$$

$$s'(t) = 2t + 2$$

$$v(t) = 2t + 2$$

$$v(2) = 6$$

Notation

$f(x) =$ $\qquad f'(x) =$ $\qquad f'(3) =$

$y =$ $\qquad \frac{dy}{dx} =$ $\qquad \left.\frac{dy}{dx}\right|_{x=3} =$

$\frac{d}{dx}\left[x^2+2x-1\right] =$ $\qquad D_x\left[\ln x\right] = \frac{1}{x}.$

$D_x\left[x^2+2x-1\right] =$

$$f(x) = \sec^3(\sin x^2)$$

$$f'(x) = \left[3\sec^2(\sin x^2)\right]\left[\sec(\sin x^2)\tan(\sin x^2)\right](\cos x^2)(2x).$$