

# Derivative Review

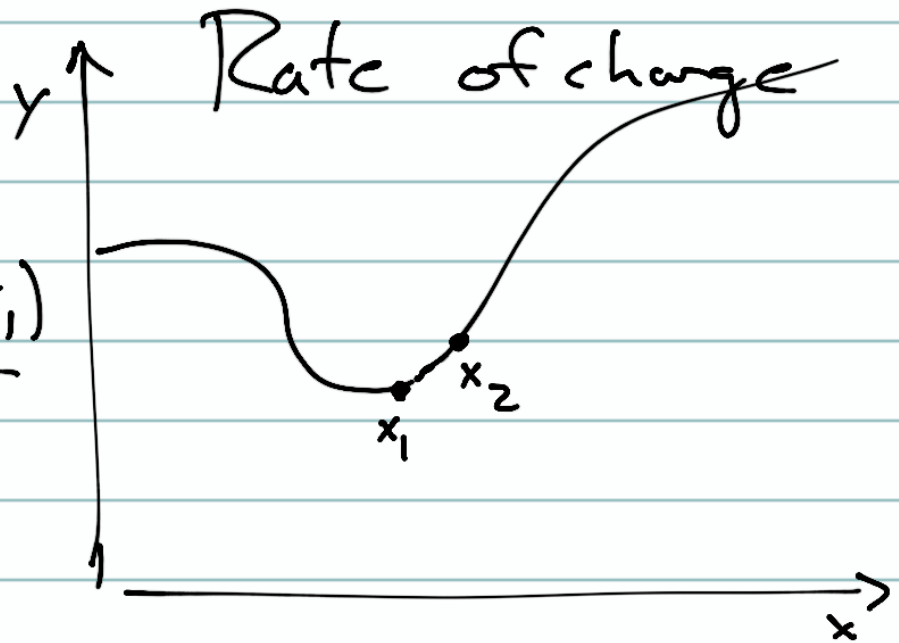
What does this mean?

$$\frac{dy}{dx}?$$

Approx def

$$\frac{dy}{dx} \approx \frac{y(x_2) - y(x_1)}{x_2 - x_1}$$

$$\approx \frac{\Delta y}{\Delta x}$$



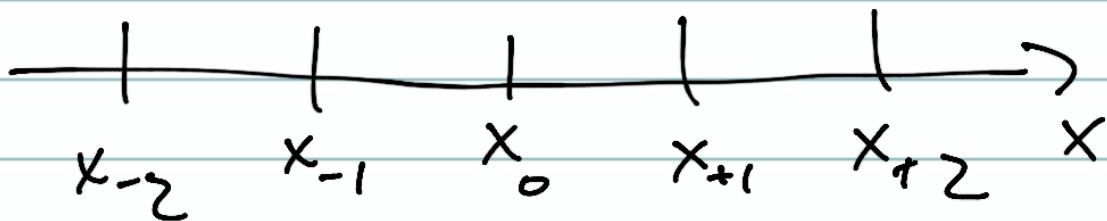
Mathematical def

Make  $\Delta x$  very small:

$$\frac{dy}{dx} = \lim_{\Delta x \rightarrow 0} \frac{\Delta y}{\Delta x}$$

However, when we don't have a mathematical way to calculate a derivative because one isn't available or we are calculating a derivative on data, we use the approximate method.

To get good approximation, we need to pay attention to the stencil



Stencil defines where we pull info from to calculate derivative

$$\frac{dy}{dx} \approx \frac{y(x_1) - y(x_0)}{x_1 - x_0} \quad \text{"Downwind"}$$

$$\frac{dy}{dx} \approx \frac{y(x_1) - y(x_{-1})}{x_1 - x_{-1}} \quad \text{"Centered"}$$

$$\frac{d^2 y}{dx^2} \approx \frac{y(x_1) - 2y(x_0) + y(x_{-1}))}{\Delta x^2}$$

$\therefore$