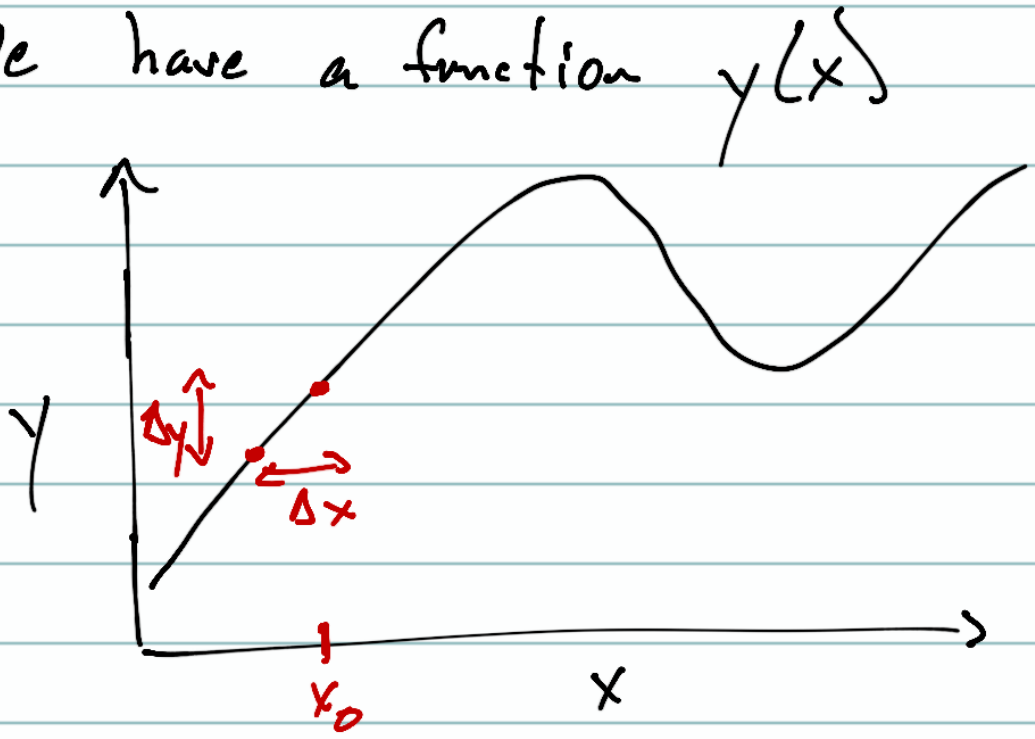
Derivative Review

We have a function $y(x)$



The derivative of this function with respect to a variable (here x) is how much that function changes for some change in the variable (Δx) (Δy)

$$\left.\frac{dy}{dx}\right|_{x=x_0} \approx \frac{\Delta y}{\Delta x} \approx \frac{y(x_0+\Delta x)-y(x_0)}{\Delta x}$$

put another way

The formal definition of a derivative is how this function changes as $\Delta x \to 0$ (gets really small)

→ Analytical approaches to calculating derivatives are all about calculating $\frac{dy}{dx}$ if given a mathematical function $y(x)$.

→ But, what if:

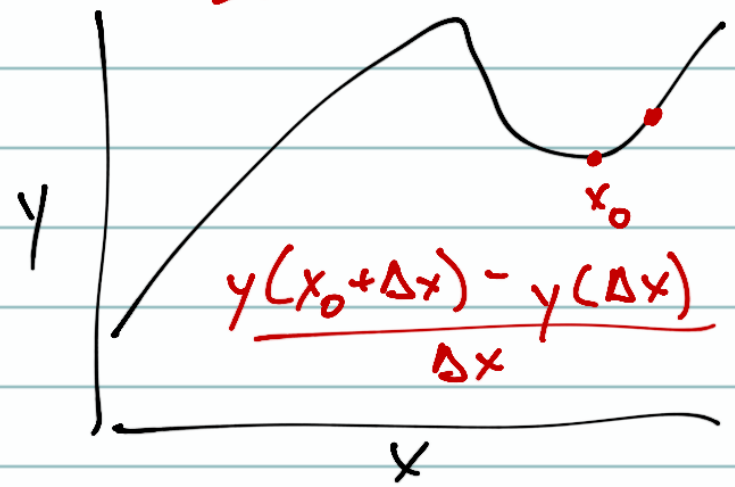
1. There is an analytical derivative of y
2. y is not a function, but instead a discrete set of data points
3. I am too lazy to calculate the derivative

We can numerically calculate the derivative by sticking with a finite Δx.

Then we can use various "stencils" to calculate numerical derivatives

important when doing this w/ noisy data

Less accurate



More accurate