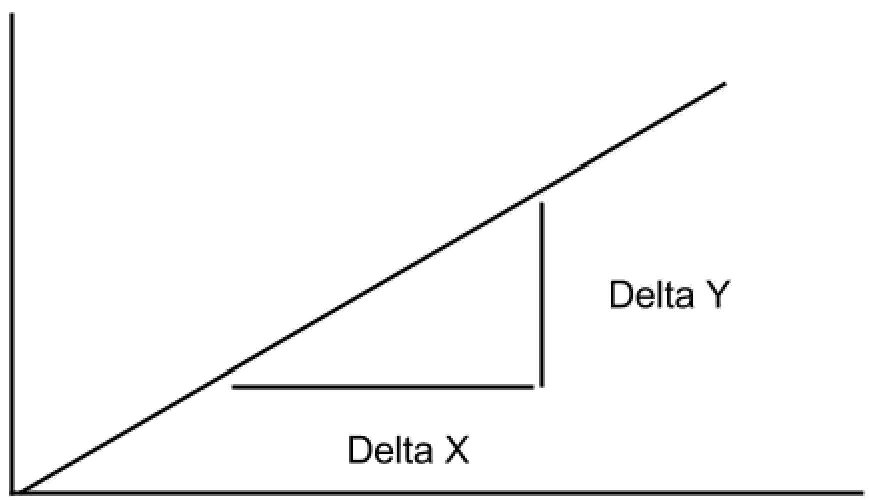
Derivatives as Rates of Change

http://ocw.mit.edu/courses/mathematics/18-01sc-single-variable-calculus-fall-2010/1.-differentiation/part-a-definition-and-basic-rules/session-3-derivative-as-rate-of-change/

What is a derivative?

In the last class we looked into a derivative as a tangent line of a moment. However, this can be thought of differently. It can also be thought of as measuring a change over the period Δx. Thinking about it this way gives rise to a rate of change. I think that it also expresses that there can be more than one way to think of a delta. A delta can be large or a delta can be small. It all depends on the size of the change.



A Physical Interpretation of a Derivative

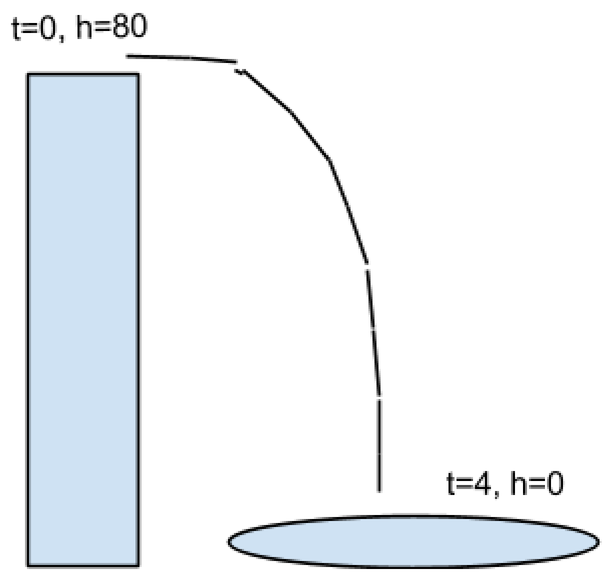
Examples

1. q=charge, p/q=current

2. s=distance, ds/dt=speed

The Pumpkin Drop

$$h = 80 - 5t^2$$



$$\Delta y/\Delta x = \frac{0-80}{4-0} =- 20 meters/second$$

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

$$\frac{80-5(x+\Delta x)^2-(80-5x^2)}{\Delta x}$$

$$\frac{80-5(x^2+2x\Delta x+\Delta x^2)-(80-5x^2)}{\Delta x}$$

$$\frac{80-5x^2-10x\Delta x-5\Delta x^2-80+5x^2}{\Delta x}$$

$$\frac{-10x\Delta x-5\Delta x^2}{\Delta x}$$

$$\lim_{\Delta x \Rightarrow 0} \frac{-10x\Delta x-5\Delta x^2}{\Delta x}$$

$$\frac{-10x\Delta x}{\Delta x}$$