

3B - Calculus for Social and Life Sciences  
Week 7

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Remember, derivatives are basically just slopes.

$$\text{slope} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\text{derivative} = \frac{dy}{dx} = \lim_{\Delta x \rightarrow 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$$

You can think of a derivative as a **slope** or a **rate of change**, when interpreting problems.

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**Exercise.** A goblin catapult sits at the top of a 200 foot cliff, overlooking the enemy. Because the goblins forgot to build any safety features whatsoever for the catapult, one of the goblin artillerymen slips and falls off the cliff. His height in feet is given by the function  $h(t) = 200 - 16t^2$ , where  $t$  is the amount of time he has been falling, in seconds.

Find the average velocity of the goblin's fall, from

1.  $t = 1$  to  $t = 2$ .
2.  $t = 1$  to  $t = 1.1$ .
3.  $t = 1$  to  $t = 1.01$ .
4.  $t = 1$  to  $t = 1.001$ .
5. What would you guess is the goblin's exact velocity at  $t = 1$ ? [If you're not sure, use a calculator to find the average for  $t$  going from 1 to 1.01 and 1 to 1.001.]
6. Find the average velocity of the goblin's fall from time  $t$ , to time  $t + h$ . [Here we are thinking of  $h$  as a very small number.]