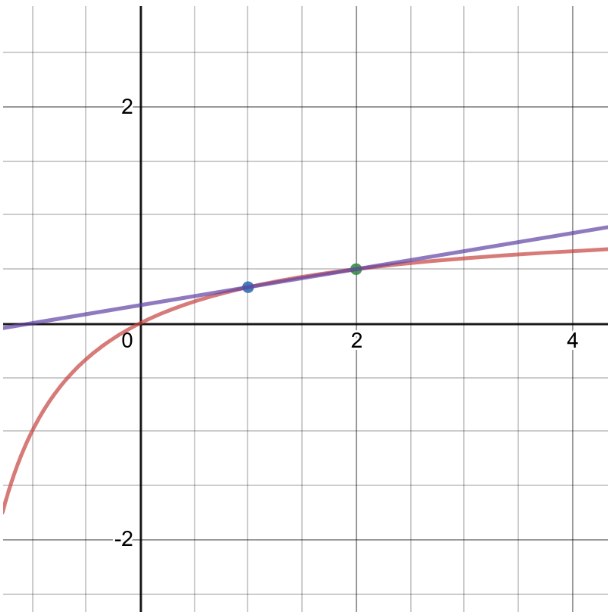
The first job in Calculus is to find the slope of the line tangent to a curve. Eventually we will have quick shortcuts but at the beginning we will do it numerically.

1. Here is the graph of $y = \dfrac{x}{2+x}$ along with the “secant” line that crosses the curve at the points $(1, 1/3), (2, 1/2)$ The line has slope $\dfrac{1}{2} - \dfrac{1}{3} = \dfrac{1}{6}$



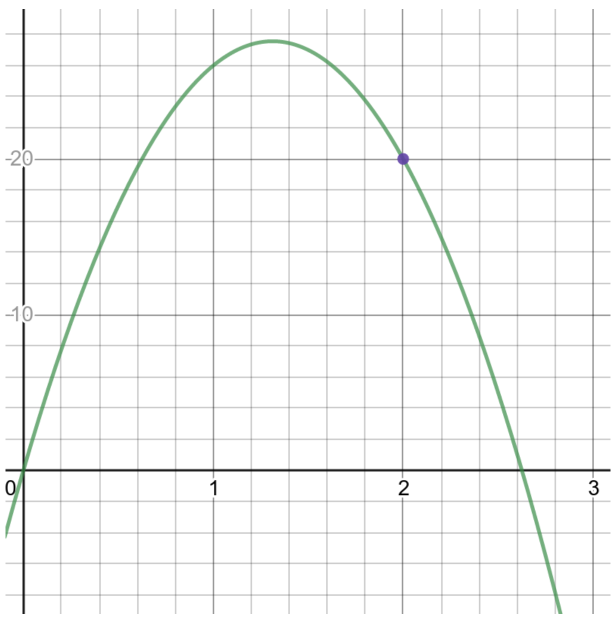
Question 1 states “The point P(1, 1/3) lies on the curve y = x/(2 + x). If Q is the point (x, x/(1 + x)), use a scientific calculator to find the slope of the secant line PQ (correct to six decimal places) for the following values of x” and then gives many values of x closer and closer to 1. You do not want to compute this with a scientific calculator. Set up a template in wolfram via

$$\frac{\frac{x}{2+x} - \frac{1}{3}}{x - 1}$$

which is the change in y over the change in x and then type “ for $x = .5$” or for $x = .9$ or any value you like. My example is for $x = .9$ wolfram

2. If a ball is thrown into the air with a velocity of 42 ft/s, its height in feet t seconds later is given by $h(t) = 42t - 16t^2$

(a) Find the average velocity for the time period beginning when t = 2 and lasting for each of the following: .5 seconds, .1 seconds etc.
The idea as that as the difference gets closer and closer to 0 we will find the instantaneous velocity at $t = 2$. In two weeks you will be able to answer this question in 5 seconds in your head. First a picture:



This is not a picture of the trajectory of the ball. The ball goes straight up and down. It is a graph of time vs height, so for example at time $t = 2$ the ball is $h(2) = 20$ feet up in the air. Also from what we know about quadratics, the maximum height will occur at the vertex. The first coordinate of the vertex of $y = ax^2 + bx + c$ is $-\frac{b}{2a}$. In this case it is $\frac{42}{32} = \frac{21}{16}$ and therefore the maximum height is $h\left(\frac{21}{16}\right) = \frac{441}{16} = 27.5625$

At 2 seconds the ball is dropping, so we expect the average velocity to be negative.

Again we want to set up a template to compute the averages, it is the change in y over the change in t. They are giving you the change in t so no need to subtract, set up

$$\frac{42(2+h) - 16(2+h)^2 - 20}{h}$$

and plug in different values for h wolfram

What we are after is what these numbers approach as $h \to 0$ We would write

$$\lim_{h \to 0} \frac{h(2+h) - h(2)}{h} = \lim_{h \to 0} \frac{42(2+h) - 16(2+h)^2 - 20}{h}$$

but in order to understand this we have to say some stuff about limits. We will look in the book to finish these exercises.