1170: Lab 6

September 25th, 2012

Goals For This Week

In order to help you guys understand the derivative, we’re going to plot a function along with its secant line. We’ll go through problem 2.4.39 from the book, which looks specifically at $y(t) = 10t^{2.5}$. For this project, we’re going to write 3 functions!

1 The secant line of a function

Consider the function $y(t) = 10t^{2.5}$. First encode it into R with a line like this:

```r
y <- function(...) 
```

We want to find the formula for the line that intersects this function at two points ($t_0$ and $t_0 + \Delta t$). This is called the secant line.

This is the secant line written out in point-slope form.

$$s(t, t_0, \delta T) = (t - t_0) \frac{y(t_0 + \Delta t) - y(t_0)}{\delta T} + y(t_0)$$

As usual, we’ll start with the skeleton of the function. This function takes in three variables. $t_0$ and $\delta t$ define where the line intersects the function whereas $t$ is the value where we want to evaluate the line.

```r
secantline <- function(t, t0, delt){
  # I'll fill out the rest of this function for you. It just calculates the value for the secant line in the same way as above.
  y1 <- y(t0)
  y2 <- y(t0 + delt)
  slope <- (y2 - y1) / delt
  (t - t0) * slope + y1
}
```

2 Plot the secant line with the original function

Now I want you to write a function that plots both the original function and its secant line on top. Start like this

```r
plotsecant <- function(tmin, tmax, t0, delt){
  # }
```
I’m not going to give you the code for this, but here is a step by step of what the code should do.

1. Create a sequence of number that go from tmin to tmax and that are finely spaced.

2. Plot the function \( y = 10t^{2.5} \), using the function that you wrote, from tmin to tmax. The x label should be ‘t’. Be sure that your plot is a continuously line and not disconnected points.

3. On the same graph, plot your secant line. Use your secantline function.

3 Your assignment

Once again, please include your code with the assignment.

Use the plotsecant function to create plots of \( y(t) = 10t^{2.5} \) along with the secant line. Let \( t0=1 \). Let delt be 1 then .1 then .01 then .001. Adjust tmin and tmax so that the intersections of the secant line with the curve are clearly distinguishable. Save one plot for each value of delt. Finally, estimate the derivative of the function at \( t = 1 \) and explain your reasoning.