EXPLORATION 2 – EXPLORING THE DERIVATIVES OF EXPONENTIAL FUNCTIONS

Before you begin:
Set a friendly window on your calculator [-2,7.4,1,-5,50,5] (82,83) [-1.5,4.8,1,-5,50,5] (85,86) and set TABLE to start at –5 and increment by 1. (Try to keep these throughout this problem set)

Enter the following functions: (for 85,86 all y's will and should be lower case)
Y1=B^x (83, use a BOLD line to see which graph is which)
Y2=(Y1(x+.0001)-Y1(x-.0001))/.0002 (this is a difference quotient which gives a good numerical approximation of the slope of the tangent—derivative—at each point)
Y3=Y2/Y1 (keep this one "turned off" except when we say to turn it on)

<u>Instructions for the exploration</u>

Go to the "home screen" (the one where calculations are done) Enter 2→B (2 STO B)
Graph. How do the shapes of the two graphs compare? Where does Y2 lie compared to Y1?
Go to the TABLE and see whether the values in the table bear out your observations.

Turn off Y1 and Y2, and turn on Y3. Go to TABLE and make an observation about how the slopes of the tangents (Y2 values) are actually related to the values of the functions throughout the function.

Redo the previous exploration (Be sure to turn Y3 off and turn Y1 and Y2 back on) using 5 as the value for B (5→B). Do it again with another number (your choice but keep it relatively small).

Now use *e*. *e*→B Do you get a surprising result? This is one of the very special properties of *e*. And it is the reason why we use this base and its related logarithms more than any others for computations involving exponential and logarithmic growth.

Now let's go back and take a look at those values that we found when we worked with bases 2 and 5. What are .693147 and 1.6094?

So, in general when $y = b^x$ we get $y' =$ __________

Now let's try the logarithmic function, $y = \ln x$.
Enter $y_1 = \ln x$. Go to TABLE and look at the values in y_2. Do you see any sort of pattern. Can you make a hypothesis? If $y = \ln x$, we get $y' =$ __________