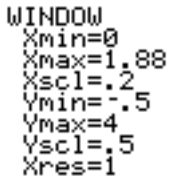
UNIT III: Finding Slope of Tangent With TI Calculators

After performing the incline lab (unit III), the students obtain a graph whose equation is x = kt^2. Here's a way to help students get the concept that one could determine the instantaneous velocity at a given time by finding the slope of the tangent to the curve, using a TI calculator.

1. Enter the equation using the [y=] key. Then, to make the tracing function choose "nice" (i.e., easier to read) values of x, use the following guideline when choosing Xmax and Xmin values under the [window] menu:



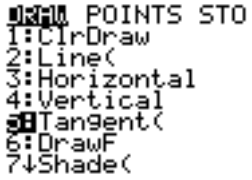
(Xmax - Xmin)/94 = the increment value you would like.

For this lab, choose Xmax to be 1.88 (a reasonable value considering the experiment); you will find that as you trace along the curve, x is incremented by 0.02 each time you press the right or left arrow key. You can set y values to whatever you'd like to show the top-opening parabola.

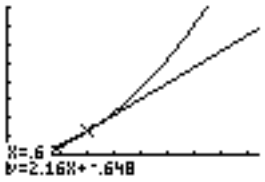
If you set the y-min to - .5 then the x-axis is far enough above the bottom of the screen to not interfere with the values displayed when you trace along the curve.

2. Choose [graph] to display the graph in the window you've just sized.

3. Now choose the draw function, [2nd][prgm], and choose 5: Tangent. Use the left and right arrow keys to move the cursor to the desired x-value, then hit [enter].



The calculator draws a tangent line and gives you the value of dy/dx (on a TI-82) or the equation of the line (on a TI-83). Either way, the derivative or the slope yields the instantaneous velocity at that time.



You can draw as many as 6 tangents to the curve (by repeating step 3) w/o getting too confused. If you'd like to clean things up, you can go back to the [window] function and adjust the Xmax value to something else, then choose [graph]; that erases the tangents, while leaving the original parabola. Then, go back to [window] and set the value of Xmax to 1.88 again, and you're ready to go on.

Anyway, use these values for a plot of v vs t using Graphical Analysis (unless, of course, you are a graphing calculator junkie). The slope of the velocity-time graph is twice the slope of the x = kt^2 equation. Voile'.

For those of you who have students with a TI-85, here's how to use the "slope finder":

1. Enter "graph" mode. Select "y(x)=" and enter the equation found from the x vs. t graph. "Exit" and select "graph". You should see the function graphed out. (Select your max and min as you wish.)

2. Push "more" to see the the "math" option. (Do not go directly to the math menu via 2nd-math - you get something else.) Select "math" (F1).

3. Push "more" twice to get "TANLN" and select it (F3).

4. There are now x= and y= numbers at the bottom of the screen. Move the right arrow key to find a desired x-value and hit enter. The calculator will graph a tangent line and give a value for dy/dx.

5. Push "exit" to select "TANLN" again and select another x-value.

   Note: If you don't want to see the graphed tangent lines, simply select dy/dx from the math options instead of step 3 above.