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| **Problem 1 – Draw a Tangent Line by Hand** |
| Screen001On the graph to the right, draw a line tangent to *y* = *x*2 in the first quadrant.**Step 1:** Approximate the slope of the line. Show your work.**Step 2:** Write the equation of your line. |
| **Problem 2 – Draw and Explore Tangent Lines Using Technology** |
| Press o and enter the function **Y1=X2**.Press q **6:ZStandard** to view the graph.Next, recreate the tangent line you drew in Problem 1. To do this, you will first need to calculate the slope of the tangent at the value of *x* you previously chose. To do this, from the graphing screen, press y r [calc] and select option **6:dy/dx**.Let’s zoom in and observe the behavior. Press q and select the option **2:Zoom In**. Move the cursor near the point of tangency you chose for Problem 1 and press Í. Zoom in again by repositioning the cursor to the desired *x* value (if needed) and pressing Íagain.Repeat the process of zooming in on the point of tangency a couple more times to observe what happens. |  |

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| **1.** Write your observation of how your tangent line and the graph **Y1(x)=x2**compare when examined close up.**2.**Will this type of behavior occur for all other functions? Explain your reasoning.You may want to try it for another function. You can choose your own or try *y* = sin(*x*). |
| **Problem 3 – Graph a Piecewise Function to Explore Local Linearity** |
| A function is said to be linear over an interval (i.e. locally linear over a small interval) if the slope is constant. Let’s discover if all functions have a constant slope when they are examined in a small enough interval. |
| On your calculator, graph . To do this you will have to use both the **Y1=** and **Y2=** entry lines. Enter the two parts of the piecewise function as shown in the screenshot below and to the right.To type an inequality, press y »[test] and select the desired symbol.  |   |
| First, observe the graph by pressing q **6:ZStandard**. |   |
| Discover if all functions have the property of local linearity by zooming in on the point (2, 4) several times.**3.** What is happening in the neighborhood of (2, 4) for the piecewise function,? Does this function demonstrate local linearity at that location? |
| **Problem 4 – Graphing Another Piecewise Function** |
| Graph the function  using the same procedure from Problem 3.To explore if all piecewise functions lack the property of local linearity, beginning with **Zoom Standard**, and then zoom in on (2, 4) a few times of the function **4.** Does this function appear to be locally linear in the neighborhood of (2, 4)? Compare and contrast this function to the one graphed and explored in Problem 3. |
| **Problem 5 – Conclusion** |
| You know the slope is . For the function *f*(*x*), this can be written as . **5.** If you were finding the slope of function in the interval of a repeatedly zoomed in graph, describe what happens to . |