LAB 2 - Calculus I - Differentiation and Tangent Lines

Due: ____________________

For each of the following equations:

a) \( f(x) = \) any polynomial function, degree > 2,
   b) \( f(x) = \frac{ax - b}{cx - d} \) where \( a, b, c, d > 0 \),
   c) \( f(x) = x^n \sin(x) \) (any \( n > 1 \))
   d) \( \sec(x) \) (for any \( m \))
   e) \( ax^2 + b^n \) for any \( a, b \neq 0, n > 2 \)

1. Plot the equation using graph.cgi (see http://faculty.genesee.edu/kjmead for cgi programs)

2. Compute by hand, using differentiation techniques, the derivative \( \frac{dy}{dx} \) for this equation.

Remember that this derivative will tell you the slope of the tangent line at any point on the curve.

3. Find the coordinates of a point on the graph of \( f(x) \). Call this point \((x_1, y_1)\) This point may be an approximation good to the tenths or hundredths place. (Show work).

4. Use your point \((x_1, y_1)\) and your result for \( \frac{dy}{dx} \) to find the slope \( (m) \) of the tangent line to the curve at this point (again, good to one decimal place.)

5. Use your point \((x_1, y_1)\) and your computed slope \( (m) \) to determine the equation of the tangent line to the curve at this point. Use the point slope form of the line: \( y - y_1 = m(x - x_1) \). Rewrite this equation in \( y = mx + b \) form.

6. Enter this equation in graph.cgi and plot. You should have plotted the tangent line to the graph of the original equation at \((x_1, y_1)\). Zoom in on this point to make sure this line is close to the true tangent line. Since you may be approximating some numbers, your line may "just miss" the curve.

7. When you have plotted the tangent line, zoom in or out appropriately and print the screen containing your plot of the original equation, and the line. Label each line and tangent point.

On the same page as each graph, include the following information:

a. The original equation

b. A neatly worked out solution for \( \frac{dy}{dx} \). Show any relevant work.

c. Your work for deriving equations for the tangent line. Show all details. Neatly label the graphs with their equations. Circle your answers.

BE NEAT! SHOW ALL RELEVANT WORK! YOU MAY WORK WITH A PARTNER! Good luck.