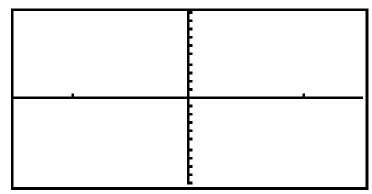
Assignment 8: Derivatives of Explicit Functions (2.1-9)   Name____________________
Please provide a handwritten response.

1a. The TI calculators will graph both a function and its derivative. Graph $f(x) = 3x^3 + 2x - 1$ by entering the function as $\mathbf{Y_1}$ and graph the derivative as $\mathbf{Y_2}$. The derivative is entered as follows.

	TI-83 Plus/TI-84 Plus	TI-86
DERIVATIVE	**MATH 8 (nDeriv)** Enter **Y_2=nDeriv(Y_1,X,X)** in the **Y=** MENU. (**Y_1** is found in **VARS Y-VARS** menu) The resulting graph will be that of the derivative.	**2ND CALC F3 (der1)** Enter **y2=der1(y1,x,x)** in the **y(x)=** MENU. The resulting graph will be that of the derivative.

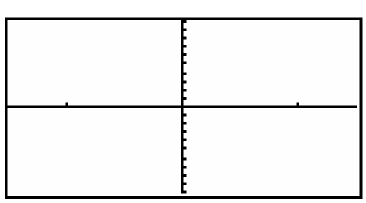
Graph $f(x) = 3x^3 + 2x - 1$ and its derivative and record the result below. Use different line styles for the function and its derivative.



$-1.5 \le x \le 1.5, -10 \le y \le 10$

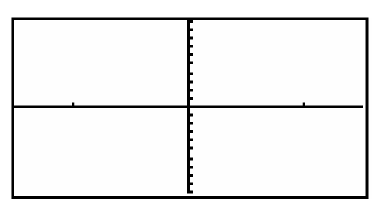
1b. The slope $m_{\tan}$ line tangent to the graph of f at, say, $x = 1$ is given by **Y_2(1).** Execute **Y_2(1)** to see that $m_{\tan}$= **11** in this case. Also execute **Y_1(1)** to see that $y = 4$ when $x = 1$. The equation of the tangent line at $x = 1$ is $y = 11(x-1) + 4 = 11x - 7$. Now, graph both $y_1 = 3x^3 + 2x - 1$ and $y_3 = 11x - 7$ together on the same set of axes (select y_1 and y_3). You can also draw the tangent line using the **DRAW** menu. Does the tangent line really look as though its slope is **11**? Why?

	TI-83 Plus/TI-84 Plus	TI-86
DRAW TANGENT LINE TO $f(x) = 3x^3 + 2x - 1$ **USING THE DRAW MENU**	Graph $Y_1 = 3x \wedge 3 + 2x - 1$ **2ND PGRM (DRAW) 5 Tangent(** Calculator will return the graph with the equation of the tangent line in the upper left hand corner of the screen. Type **1**, press **ENTER** and the calculator will draw the graph of the tangent line to the curve at $x = 1$.	Graph $y1 = 3x \wedge 3 + 2x - 1$ **GRAPH MORE F2(DRAW) MORE MORE MORE F2(TanLn)** Calculator will return **TanLn(** Type **y1,1)** and press enter. The calculator will draw the tangent line to the curve at $x = 1$.



$-1.5 \le x \le 1.5, -10 \le y \le 10$

Graph y_1 and y_3



$-1.5 \le x \le 1.5, -10 \le y \le 10$

Use **DRAW** Menu

2. Graph $y = sin\frac{2x}{x+1}$ and its first and second derivatives on the axes provided. To find the graph of second derivative f'' of $y_1 = f(x) = sin\frac{2x}{x+1}$, $y_2 = f'(x)$ use

	TI-83 Plus/TI-84 Plus	TI-86
SECOND DERIVATIVES	From **MATH** menu select **8** (**nDeriv(**) and obtain **nDeriv(Y$_2$,X,X)**. At **x=1** you would enter **nDeriv(Y$_2$,X,1)**	From **2ND** ÷ **(CALC)** select **F4 (der2)** and obtain **der2(*y*1,*x*,*x*)**. At ***x*=1** you would enter **der2(*y*1,*x*,1)**

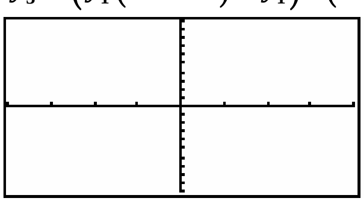
Label which is which. Differentiate $y = sin\frac{2x}{x+1}$ by hand and record the results below.

$-.5 \le x \le 2.5, -5 \le y \le 5$

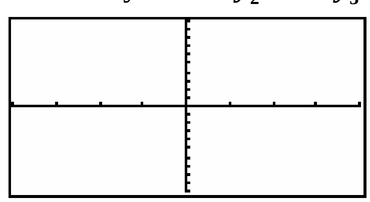
3a. Given $f(x) = x^2 e^{sin\,x}$. What rules would you have to use to differentiate this function by hand? Record your results below.

3b. Plot the first derivative of $f(x) = x^2 e^{sin\,x}$ on the axes (on the left) provided below (Enter $y_1 = f(x)$, $y_2 = f'(x)$. Turn y_1 off.)

3c. According to the definition of derivative, if ***h*** is a small fixed number, then the difference quotient $\frac{f(x+h) - f(x)}{h}$ should be close to $f'(x)$, and so their graphs should lie close together. For the moment let's choose $h = 0.5$. Now plot $f'(x)$ and the difference quotient on the same set of axes (on the right) below. Enter $y_1 = x^2 e^{sin\,x}$, $y_2 =$ derivative of y_1, and $y_3 = (y_1(x+0.5) - y_1)/(0.5)$. Do not plot y_1. Use different line styles for y_2 and y_3.



$-4 \le x \le 4, -10 \le y \le 10$



$-4 \le x \le 4, -10 \le y \le 10$

3d. Change the **0.5** to **0.4** in the difference quotient in part **c.** Repeat parts **b** and **c** again. Are the two graphs closer? Can you still tell them apart?

3e. Experiment with smaller and smaller values of ***h*** until the graphs of $f'(x)$ and the difference quotient over $-4 \le x \le 4$ become indistinguishable on your calculator screen. How small does ***h*** have to be for this to happen?