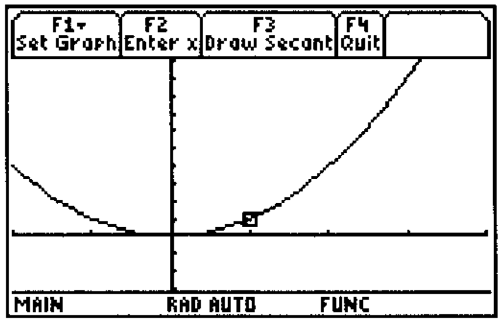
Name______________________________ Date______________

Definition of the Derivative Lab 5

1. Run the program **defderiv()**.
2. Select [F1] **Set Graph**. Select **1:Enter f(x)** and enter x^2 for f(x). Enter the window **[-2, 4] x [-3, 10]**.
3. Select [F2] **Enter x** and enter **1** for the x-value.
4. Select [F3] **Draw Secant** and enter **2** for the h-value. Sketch the secant line on the graph provided. Press [ENTER] to record the slope of the secant line in the table below.
5. Repeat step 4 for each of the *h*-values in the table.



x-value	*h*-value	slope
1	2	
1	1	
1	0.5	
1	0.1	

x-value	*h*-value	slope
1	- 2	
1	- 1	
1	- 0.5	
1	- 0.1	

a. As *h* approaches 0, what value does the slope appear to approach? ______________

b. What do the secant lines appear to graphically approach? ______________________

6. Select [F1] **Set Graph**, then **2: Enter Window** to enter a window of **[-1, 5] x [-3, 20]** and repeat for an *x*-value of 2.

x-value	*h*-value	slope
2	2	
2	1	
2	0.5	
2	0.1	

x-value	*h*-value	slope
2	- 2	
2	- 1	
2	- 0.5	
2	- 0.1	

a. As *h* approaches 0, what value does the slope appear to approach? ______________

b. What do the secant lines appear to graphically approach? ______________________

7. Enter a window of **[-2, 3] x [-1, 8]** and repeat for an *x*-value of 0.5.

x-value	*h*-value	slope
0.5	2	
0.5	1	
0.5	0.5	
0.5	0.1	

x-value	*h*-value	slope
0.5	- 2	
0.5	- 1	
0.5	- 0.5	
0.5	- 0.1	

a. As *h* approaches 0, what value does the slope appear to approach? ______________

b. What do the secant lines appear to graphically approach? ______________________

8. Enter a window of **[-5, 1] x [-2, 20]** and repeat for an x-value of -2.

x-value	h-value	slope
-2	2	
-2	1	
-2	0.5	
-2	0.1	

x-value	h-value	slope
-2	- 2	
-2	- 1	
-2	- 0.5	
-2	- 0.1	

a. As h approached 0, to what value does the slope appear to approach? ________________

b. What do the secant lines appear to graphically approach? ____________________________

9. Compare the values of x to that of the slopes in each part a. What pattern for the value of the slope do you see?

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10. If the derivative is defined to be the slope of a line tangent to the graph of f at a point x as well as $\lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$, make a conjecture about the exact value of the derivative of f.

$f'(x) =$ ____

11. Repeat for the function $f(x) = x^3$. Enter a window of **[-3, 3] x [-10, 10]**.

x-value	h-value	slope
1	1	
1	0.1	
1	0.01	

x-value	h-value	slope
1	- 1	
1	- 0.1	
1	- 0.01	

a. As h approached 0, to what value does the slope appear to approach? ________________

b. What do the secant lines appear to graphically approach? ____________________________

x-value	h-value	slope
0.5	1	
0.5	0.1	
0.5	0.01	

x-value	h-value	slope
0.5	-1	
0.5	- 0.1	
0.5	- 0.01	

c. As h approached 0, to what value does the slope appear to approach? ________________

d. What do the secant lines appear to graphically approach? ____________________________

x-value	h-value	slope
-1	1	
-1	0.1	
-1	0.01	

x-value	h-value	slope
-1	-1	
-1	- 0.1	
-1	- 0.01	

e. As h approached 0, to what value does the slope appear to approach? ________________

f. What do the secant lines appear to graphically approach? ________________________

12. Compare the values of x to that of the slopes in parts a, c, and e. Make a conjecture about the exact value of the derivative of $f(x) = x^3$.

$f'(x) =$ ____

13. Repeat for the function $f(x) = x^4$. Enter a window of **[-3, 3] x [-5, 20]**.

x-value	h-value	slope
1	1	
1	0.1	
1	0.01	

x-value	h-value	slope
1	-1	
1	- 0.1	
1	- 0.01	

a. As h approached 0, to what value does the slope appear to approach? ________________

b. What do the secant lines appear to graphically approach? ________________________

x-value	h-value	slope
0.5	1	
0.5	0.1	
0.5	0.01	

x-value	h-value	slope
0.5	-1	
0.5	- 0.1	
0.5	- 0.01	

c. As h approached 0, to what value does the slope appear to approach? ________________

d. What do the secant lines appear to graphically approach? ________________________

x-value	h-value	slope
-1	1	
-1	0.1	
-1	0.01	

x-value	h-value	slope
-1	-1	
-1	- 0.1	
-1	- 0.01	

e. As h approached 0, to what value does the slope appear to approach? ________________

f. What do the secant lines appear to graphically approach? ________________________

14. Compare the values of x to that of the slopes in parts a, c, and e. Make a conjecture about the exact value of the derivative of $f(x) = x^4$.

$f'(x) =$ ______________________________

15. Repeat for the function $f(x) = 2x^2$. Enter a window of **[-3, 3] x [-2, 10]**.

x-value	h-value	slope
1	1	
1	0.1	
1	0.01	

x-value	h-value	slope
1	-1	
1	- 0.1	
1	- 0.01	

a. As h approached 0, to what value does the slope appear to approach? ____________

b. What do the secant lines appear to graphically approach? ____________________

x-value	h-value	slope
0.5	1	
0.5	0.1	
0.5	0.01	

x-value	h-value	slope
0.5	-1	
0.5	- 0.1	
0.5	- 0.01	

c. As h approached 0, to what value does the slope appear to approach? ____________

d. What do the secant lines appear to graphically approach? ____________________

x-value	h-value	slope
-1	1	
-1	0.1	
-1	0.01	

x-value	h-value	slope
-1	-1	
-1	- 0.1	
-1	- 0.01	

e. As h approached 0, to what value does the slope appear to approach? ____________

f. What do the secant lines appear to graphically approach? ____________________

16. Compare the values of x to that of the slopes in parts a, c, and e. Make a conjecture about the exact value of the derivative of $f(x) = 2x^2$.

$f'(x) =$ ______________________________

17. Given $f(x) = 3x^2 - 2x - 3$, what conjecture can you make about the derivative?

$f'(x) =$ ______________________________

18. Generalize the pattern found in this lab. If $f(x) = ax^n$, $f'(x) =$ ____________________