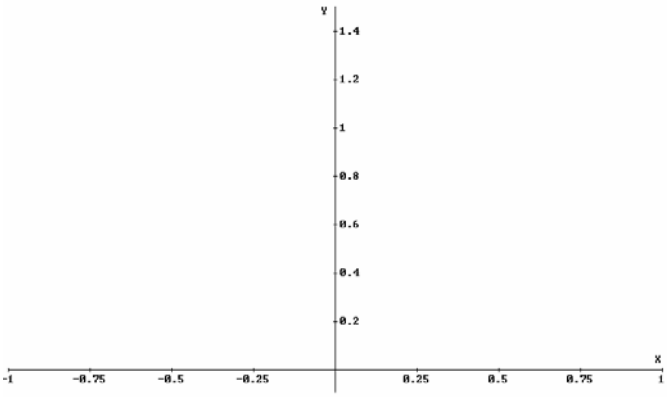
Assignment 5: Limits, Part I (1.1) **Name:_____**
Please provide a handwritten response.

1a. Many ordinary limits can be found using *Derive*. For example, **Author** $\frac{3x+9}{x^2-9}$ and then click lim. Enter a limit point of -3, select *x* as the variable, and click the dot next to "both" to have *Derive* calculate $\lim_{x\to -3}\frac{3x+9}{x^2-9}$. Click **OK** then use = to simplify the expression and record the result below; is the answer what we would expect?

1b. Our text suggests $\lim_{x\to 0}\frac{\sin(x)}{x}=1$. **Author** the function and use *Derive* to find the limit. Does the answer support the conjecture made in the text?

2a. Examine $\lim_{x\to 0}\frac{\tan(x)}{\sin(x)}$ graphically and numerically. First, enter $f(x)=\frac{\tan(x)}{\sin(x)}$ by **Author**ing f(x):=tan(x)/sin(x) then plot the function. Sketch the result on the axes to the right. What value for $\lim_{x\to 0}\frac{\tan(x)}{\sin(x)}$ does the graph suggest?



2b. Next, **Author** and use ≈ to simplify $f(0.1)$, $f(0.01)$, etc to complete the table at right. What value for $\lim_{x\to 0}\frac{\tan(x)}{\sin(x)}$ does the table suggest?

x	*f(x)*
0.1	
0.01	
0.001	
-0.001	
-0.01	
-0.1	

2c. Finally, highlight $f(x)$ and use lim to find the limit.
Did all three approaches lead to the same conclusion? What trigonometric function does *f*(*x*) simplify to?

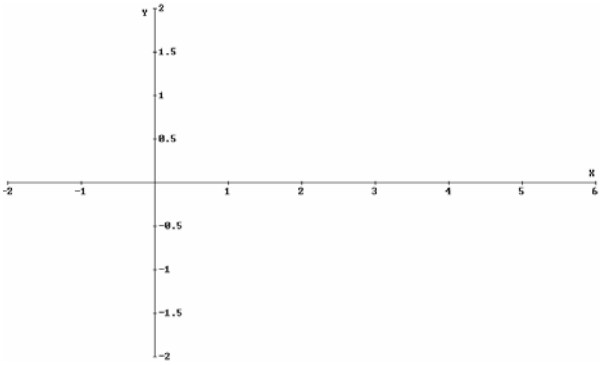
3a. Round-off error can cause very misleading computed results. We will now use *Derive* to examine this. Enter the function $f(x) = \dfrac{\cos(x)-1}{x^2}$ by **Author**ing f(x):=(cos(x)-1)/x^2. Use *Derive* to complete the table at right. (Be sure to count the zeros!) Use the table to estimate $\lim\limits_{x\to 0} \dfrac{\cos(x)-1}{x^2}$. Record the estimate below.

x	*f(x)*
0.1	
0.0001	
0.0000001	
0.00000001	
0.000000001	

3b. Now use lim to find $\lim\limits_{x\to 0} \dfrac{\cos(x)-1}{x^2}$ and record the result below.

3c. Do the results of 3a and 3b agree? If not, then which one do you think is correct? What does a plot of *f*(*x*) show the limit to be? Repeatedly "zoom" in on the graph at *x* = 0. What do you see?

4a. To find one-sided limits, we simply select either right or left when using lim. For example, suppose we wanted to examine $\lim\limits_{x\to 2} \dfrac{|x-2|}{x-2}$. First, we **Author** f(x):=abs(x-2)/(x-2) and plot the function to estimate the limit graphically. Sketch the result on the axes at right.



4b. Now find $\lim\limits_{x\to 2^+} \dfrac{|x-2|}{x-2}$ by highlighting *f(x)*, selecting lim, entering 2 as the limit point, *x* as the variable, and approach from "right". Record the result below.

4c. Now find the limit from the left by selecting "left" and record the result below.

4d. Finally ask *Derive* to find the limit approaching from both directions. Record the result below; would you have expected this result? Why?