Limits of Indeterminant Forms
Student Activity

Name _____

Class _____

In this activity you will be exploring $y = \dfrac{\sin(x)}{x}$. When the value of a function is $\dfrac{0}{0}$, the function at that point is said to be indeterminate.

Problem 1 – Graphical Limit

Graphing the function $f(x) = \dfrac{\sin(x)}{x}$:

Go to the y= screen and type [alpha] [y=] and select **1: n/d** and enter $\dfrac{\sin(x)}{x}$ into the fraction template.

Set the viewing window by pressing [zoom] and selecting **7:ZTrig** to view the graph.

1. According to the graph, approximately what value does **Y1**(x) appear to equal as x approaches 0?

Exploring the graph near $x = 0$:

Remove the axes from the graph by pressing [2nd] [zoom]. Arrow down to 'Axes' and press [▶] until "Off" appears. Press [graph] to return to the graph of the function.

2. Press [trace]. Examine points in the neighborhood of x = 0.

    a. Type 0.1 [enter]. Then type 0.01 [enter]. What does the y-value equal as you move the point from the right toward x = 0?

    b. Repeat for –0.1, –0.01, etc. What does the y-value equal as you move the point from the left toward x = 0?

    c. What happens when you type 0 [enter]? Why?

Problem 2 – Numerical Limit

Press [2nd] [window] to change TblStart to –0.1 and ΔTbl to 0.01.

3. Press [2nd] [graph] to view the table of the function being graphed. Arrow down to observe what is happening to **Y1** as x approaches 0. To see more decimal places for **Y1** arrow over to the **Y1** column and continue to arrow down and up.

    a. Is **Y1** defined when x = 0? Explain.

    b. Does **Y1** appear to approach the same value from both sides of zero?

Problem 3 – Practice Problems

Use a graph and a table to determine the limit of the following problems.

Tip: The last values for the *x*- and *y*-coordinates are automatically stored in case you want to recall the values of these coordinates for a calculation on the HOME screen. To see this press 2nd mode, then press x,т,θ,n and enter, then alpha 1.

4. $\displaystyle\lim_{x \to 1} \frac{x - 1}{x^3 - 1}$

5. $\displaystyle\lim_{x \to 0} \frac{1 - \cos(x)}{x^2}$

6. $\displaystyle\lim_{x \to 0} (1 + x)^{\frac{1}{x}}$