

## Using Basic Graphs and Transformations to Draw Pictures *Nspire Version*

The purpose of this project is for you to program your calculator to draw a picture that incorporates many of the “basic graphs” that we have studied in class as well as your knowledge of transformations (vertical shifts, vertical stretches and shrinks, horizontal shifts). You will write a program to draw the picture.

### Here is a list of the Basic Graphs that you can/must use:

- |                                  |   |
|----------------------------------|---|
| 1. $y = mx + b$                  | slanted or oblique line ( $m \neq 0$ )  |
| 2. $y = c$                       | horizontal line                         |
| 3. $y =  x $                     | absolute value                          |
| 4. $y = x^2$                     | parabola (quadratic)                    |
| 5. $y = x^3$                     | cubic                                   |
| 6. $y = \frac{c}{x}$             | hyperbola (inverse variation hyperbola) |
| 7. $y = \sqrt{x}$                | square root                             |
| 8. $y = \pm\sqrt{r^2 - x^2}$     | semicircle (top, bottom, both)          |
| 9. $y = [x]$                     | greatest integer (step)                 |
| 10. $y = \sqrt[3]{x}$            | cube root                               |
| 11. $y = 2^x$                    | exponential (“easy chair”)              |
| 12. $y = \tan x$                 | tangent                                 |
| 13. $y = \sin x$ or $y = \cos x$ | sinusoid                                |

### **Requirements:**

1. every picture must contain at least one sinusoid (#13)
2. 5 different “Basic Graphs” including #13 makes you eligible for a ‘C’
3. 7 different “Basic Graphs” including #13 makes you eligible for a ‘B’
4. 9 different “Basic Graphs” including #13 makes you eligible for an ‘A’
5. 10 – 13 different “Basic Graphs” makes you eligible for bonus points
6. you must use some sort of transformation on at least 90% of your functions
7. you must use **restricted domains** on at least 80% of your functions (see the explanation on page 3 of this document for restricted domains)
8. you must have a minimum of 10 functions graphed
9. your picture must be recognizable
10. bonus points can also be earned for extra creative drawings as perceived by the teacher

### What You Will Turn In When Finished

1. Either a “hand drawn” sketch of your picture drawn before your calculator picture was constructed, OR a print out of a picture that you wanted to have your calculator “draw”.
2. A paragraph explaining what your picture is.
3. A list of all the functions (equations) that you used in your drawing classified by number (1 to 13 from the list above). You do not need to list the restricted domain here.

For example: 1)  $y = 2x + 3$

$$y = -x + 1$$

2) none

$$3) y = |x - 3| - 4$$

$$y = -|x + 1| - 2$$

4. A paragraph discussing the following: (***please label your answers: a, b, c, d, e, f.***)
  - a) what you liked about this project
  - b) what you disliked about this project
  - c) what you learned while doing this project
  - d) what problems that you encountered while doing this project
  - e) any other comments you would like to share
  - f) amount of time you needed to complete this project

### Helpful Hints

1. Name your Nspire file as follows: First Initial, space, Last Name, space, bgpic

For example, my file name would be:

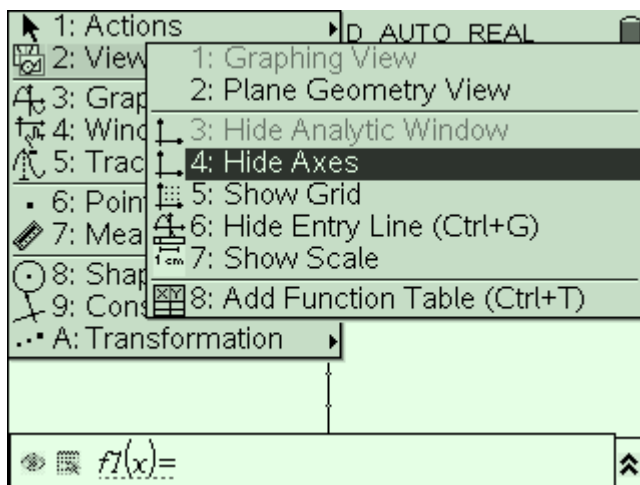
t reardon bgpic

Notice that all letters are in lower case.

2. It doesn't matter what Window you use so pick an easy one to work with. You may want to only work in the first quadrant. That is up to you. But pick a Window that allows you to draw your picture easily and clearly.

When you are finished, you will want to hide the axes. From the Graph page, select **menu, 2:**

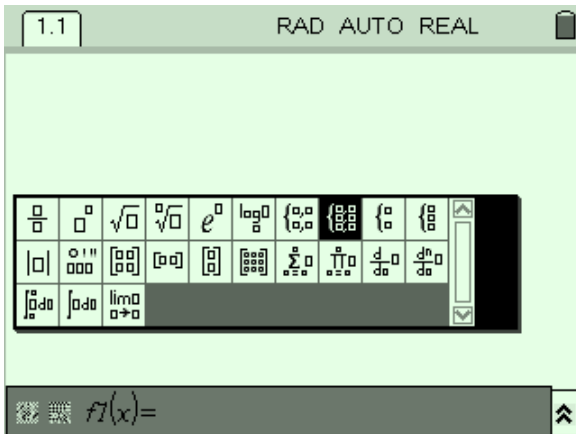
**View, 4: Hide Axes:**



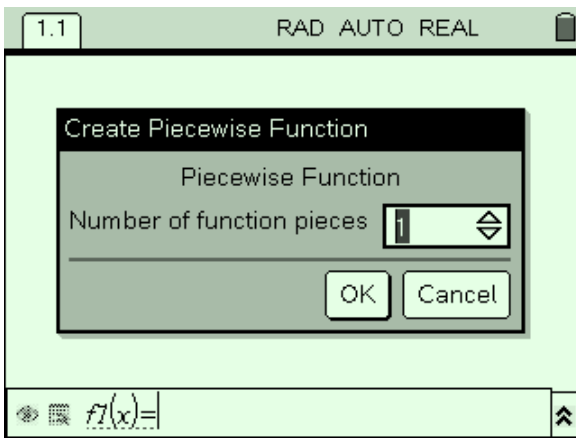
3. You will also want to hide the Entry Line. See choice 6 in the figure above. Or use **ctrl g**

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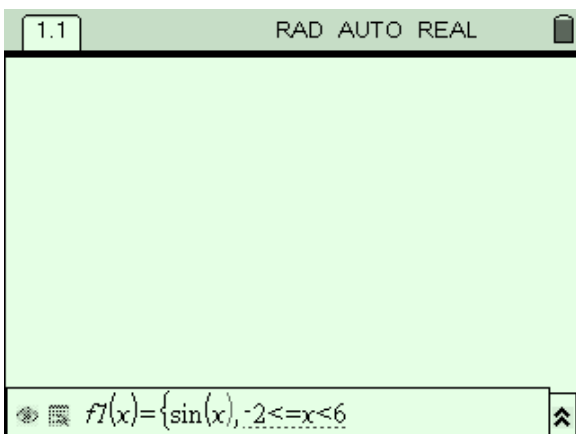
4. You will need to use the piece wise template to more easily restrict the domain of your function. This template is 'above' the multiplication (times) sign. Select the template shown below:



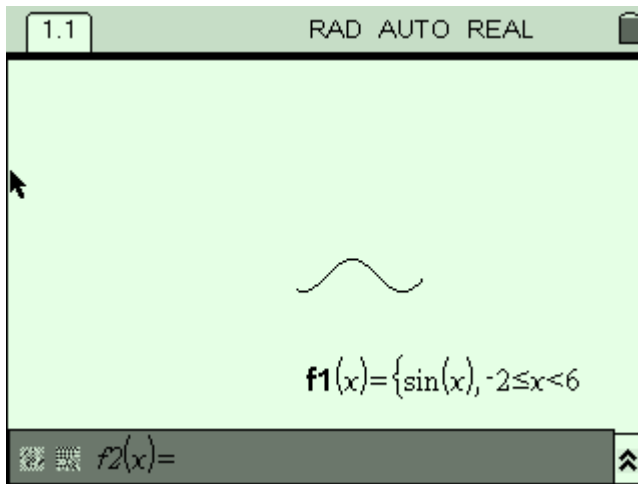
But only select '1' for the number of function pieces:



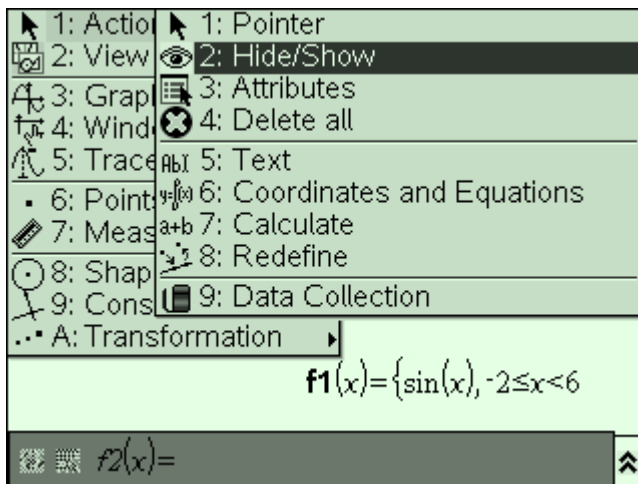
For example, in the screen below, I am graphing the sine function from  $x = -2$  to  $x = 6$ , including  $-2$  but not including  $6$ . This is called a **restricted domain** as mentioned in the requirements.



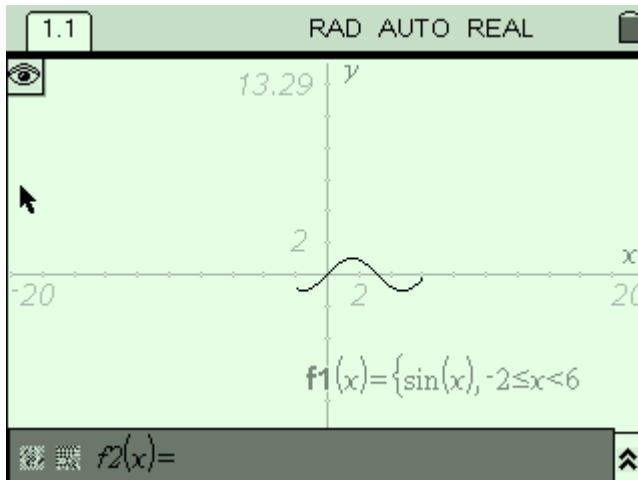
Press **enter** to graph:



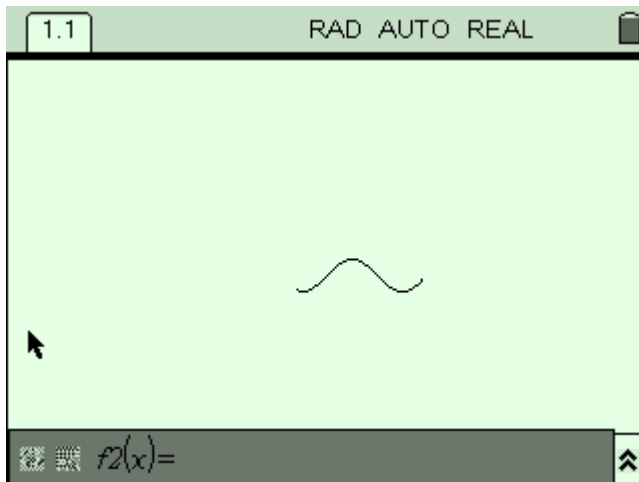
Use the Hide/Show feature to “hide” the **f1(x)** equation (and all function equations). This is accomplished by **menu, 1: Tools (Action), 2: Hide/Show**



Now ‘hover’ the arrow icon over the **f1(x)** equation and press **enter**. The equation is not completely hidden until you press the **esc** key.



Result of pressing **esc**:



5. Continue to ‘build’ your picture with more and more functions defined in pieces. Hide the function equations from view.

6. Continually remember to “save” your work so that if the calculator should crash, you will have most of the work saved. I also suggest that you save it with more than one name, that is, have a backup file.

**NOTE:** This project was created with input from several other teachers and I thank them for their assistance and willingness to share:

Jane Barnard from Missouri

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Ron Lancaster from Ontario, Canada

Robert Rowe from Missouri

*Isn't it amazing what we can accomplish now that *The World Is Flat*?*

***The World Is Flat***, written by Thomas L. Friedman

*A “must” read for each of us.*