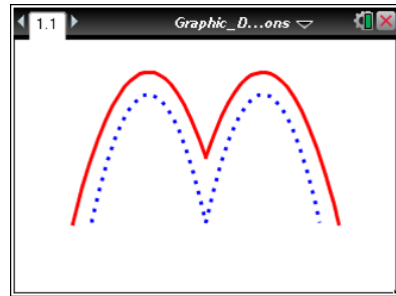


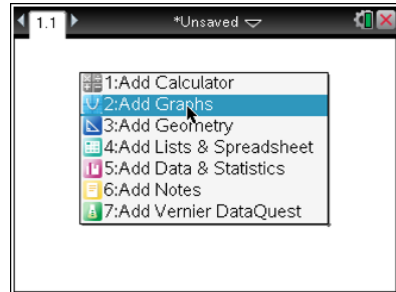
The teacher will display the completed example to the right as an example to re-create.



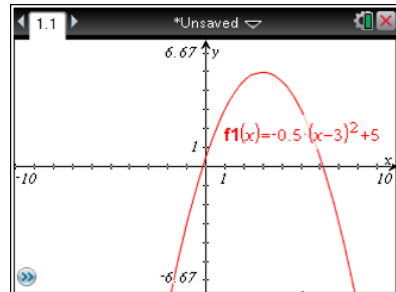
Work to make the image of the letter *M* on your handheld.

Transformations of parabolas, domain restrictions, and piecewise functions may be used get the result.

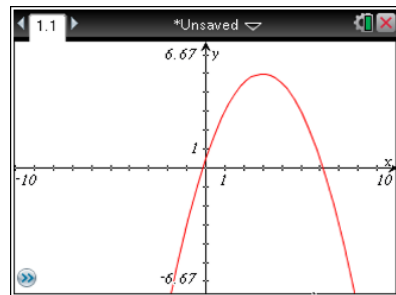
1. Press **2nd** > **New Document** > **Add Graphs**.



2. Click in the function entry line. In **f1(x)**, enter  $-0.5(x - 3)^2 + 5$  to create the right side of a curved letter *M*.



3. The label for the function may appear, depending on the settings of your handheld. To hide the label, move your cursor to it and press **ctrl** **menu** > **Hide**.



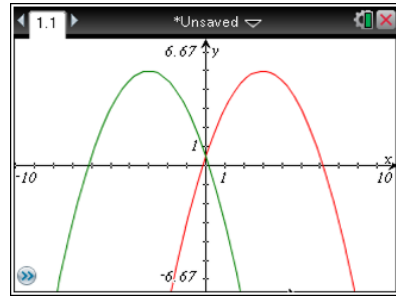
4. What change or changes need to be made to the equation of **f1(x)** to create the left half of the letter *M*?



# Graphic Designing with Transformed Functions

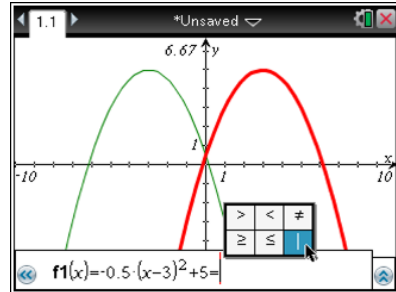
## Student Activity

5. Press **ctrl** **G** to get the function entry line to reappear. Use the answer to question 4 to make the left side of the letter, using **f2(x)**. Does your graph match the picture to the right? If it is incorrect, make corrections to **f2(x)** until it does match the picture to the right.

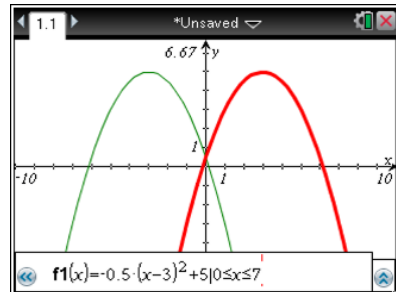


6. Hide the label for **f2(x)** as you did before.

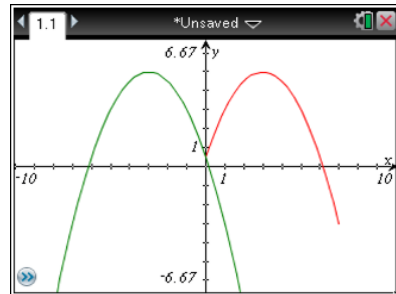
7. Now the shape is beginning to resemble the letter *M*, but the graphs cross at the *y*-axis. To make things look better, domain restrictions can be used. Press **ctrl** **G** to make the function entry line reappear. Scroll back up to **f1(x)**. We want to display only the graph of **f1(x)** from 0 to 7 along the *x*-axis. Press **ctrl** **=** to enter the menu of symbols (shown to the right). Choose the “such that” symbol, **|**, from the menu to begin the restriction.



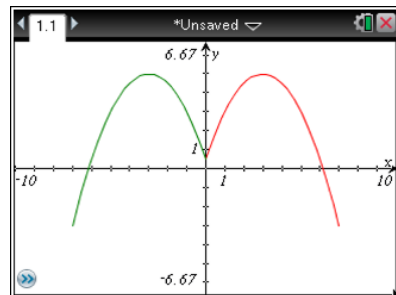
8. Type the restrictions for the domain of **f1(x)** as **0 ≤ x ≤ 7**. Press **ctrl** **=** to access the inequality symbols. Press **enter**.



9. After the restriction has been added, the function will graph only between the *x*-values of 0 and 7 inclusive. This will better represent the right side of the letter *M*.



10. Again using what you know about symmetry and functions, restrict the domain of **f2(x)** to better represent the left side of the letter *M*.





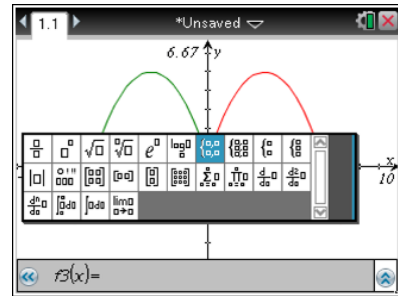
# Graphic Designing with Transformed Functions

## Student Activity

11. What domain restrictions are necessary for  $f_2(x)$  to make the graph appear like the picture in step 10?

12. Suppose you wanted the letter *M* to begin on the left at  $y = 0$  and end on the right at  $y = 0$ . What would the domain restrictions for  $f_1(x)$  and  $f_2(x)$  have to be to make that happen?

13. Piecewise functions can also be used when the domains are mutually exclusive (i.e., when they don't overlap). Press **ctrl** **G** to make the function entry line reappear. Then press **math** to enter the math template. Select the tool for piecewise functions (the seventh icon in the top row) to enter a piecewise function with two conditions.

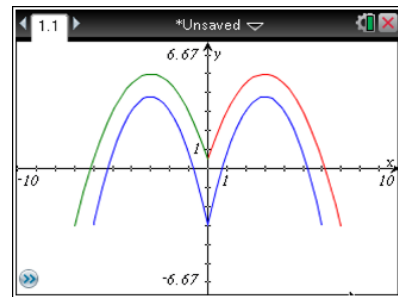


**Note:** The next icon to the right is for piecewise functions with the number of conditions defined by the user.

14. Using piecewise functions can be very efficient and can make restricting domains easier. The equation below for  $f_3(x)$  represents the beginning of the lower part of the letter *M*.

$$f_3(x) = \begin{cases} -0.75(x + 3)^2 + 3.8 & -6 \leq x \leq 0 \\ \text{_____} & \text{_____} \end{cases}$$

The first part of the piecewise function is for the left portion of the letter. Hide the equation as before.



15. What equation and restriction would need to be added to create the right half of the lower part of the letter? Do your equation and restriction work? Why or why not?

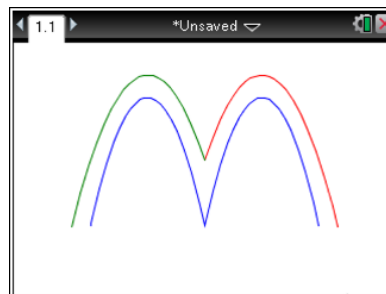


# Graphic Designing with Transformed Functions

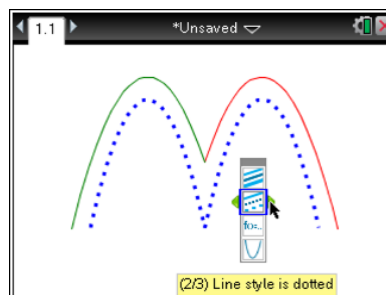
## Student Activity

16. If they do not work, go back and correct them so that your shape matches the image in step 14.

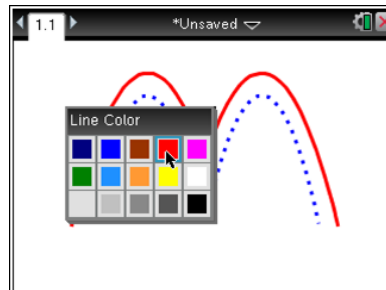
17. To improve the result, hide the coordinate axes. Move the cursor to the axes and press **ctrl** **menu** > **Hide/Show** > **Hide Axes** to keep only the letter *M* on the screen. You can also hide the chevron in the lower-left corner. Move the cursor to the chevron and press **ctrl** **menu** and select **Hide Chevron**.



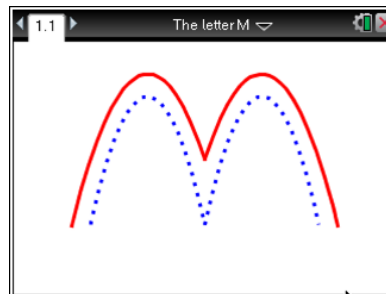
18. If you desire, you can change the graph's attributes, including the line weight (thickness) or line style (dotted, dashed, and so on). Move the cursor to the graph and press **ctrl** **menu** and select **Attributes**. Select the desired options using **▲** **▼** **▶** **◀**, and press **enter** to accept the changes.



19. If you desire, you can change the graph's color. Move the cursor to the graph and press **ctrl** **menu** > **Color** > **Line Color**.



20. You can save your work by pressing **ctrl** **S** or choosing **Save**. Type in a file name and press **tab** until you are on the **Save** button. Press **enter** to save the file.



21. What change(s) would have to be made to each of the equations for  $f_1(x)$ ,  $f_2(x)$ , and  $f_3(x)$  to make the letter *W* instead of *M*?



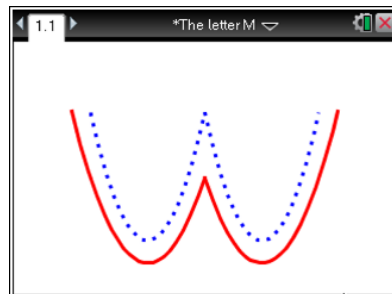
## Graphic Designing with Transformed Functions

### Student Activity

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22. What change(s) would have to be made to each of the domain restrictions for  $f_1(x)$ ,  $f_2(x)$ , and  $f_3(x)$  to make the letter  $W$  instead of  $M$ ?

23. Test your answers to questions 21 and 22 to see if you get a picture similar to the one to the right.



### Create Your Own Emoticon Activity

Your teacher will display several examples of emoticons. Some will be color images like those on the Internet, while others will be images created by other students using their TI-Nspires™. Your task is to design your own emoticon on your calculator using functions with domain restrictions.

#### The requirements:

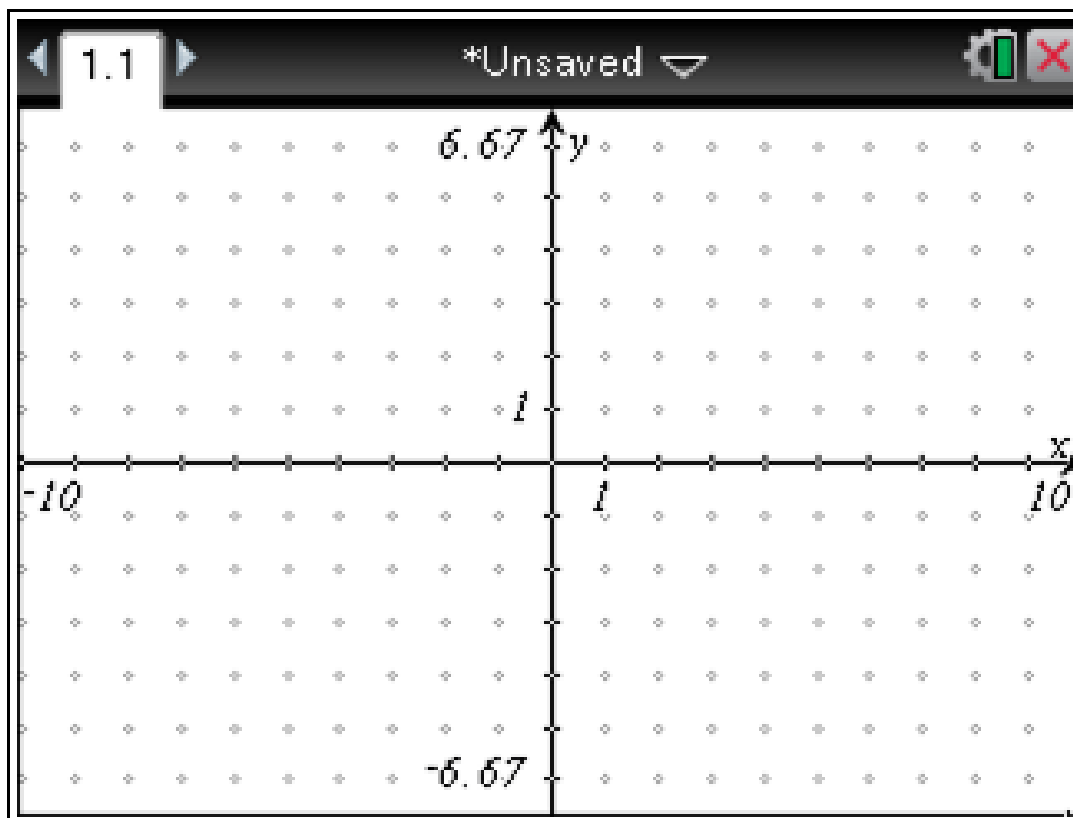
- You must use at least four different types of functions. Selections may include, but are not limited to, linear, quadratic, absolute value, exponential, logarithmic, radical, power, rational, conics, and trigonometric functions.
- Each function must be recorded in the table on the next page. For each function, include its domain and an identification of which part of the figure it creates.
- You must save your work on your calculator with the file name "Emoticon." The teacher will collect it for grading. Be prepared to show your finished product to the class.



# Graphic Designing with Transformed Functions

## Student Activity

1. Sketch a picture of your emoticon on the blank screen below.



2. Record your equations in the table below along with their domain restrictions. Be sure to identify which part of the image each function creates.

| Function Equation | Domain Restriction | What It Creates in the Figure |
|-------------------|--------------------|-------------------------------|
|                   |                    |                               |
|                   |                    |                               |
|                   |                    |                               |
|                   |                    |                               |
|                   |                    |                               |
|                   |                    |                               |
|                   |                    |                               |
|                   |                    |                               |
|                   |                    |                               |
|                   |                    |                               |
|                   |                    |                               |