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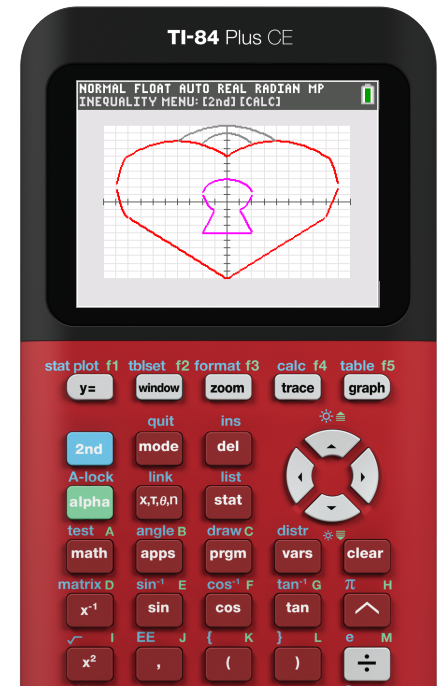
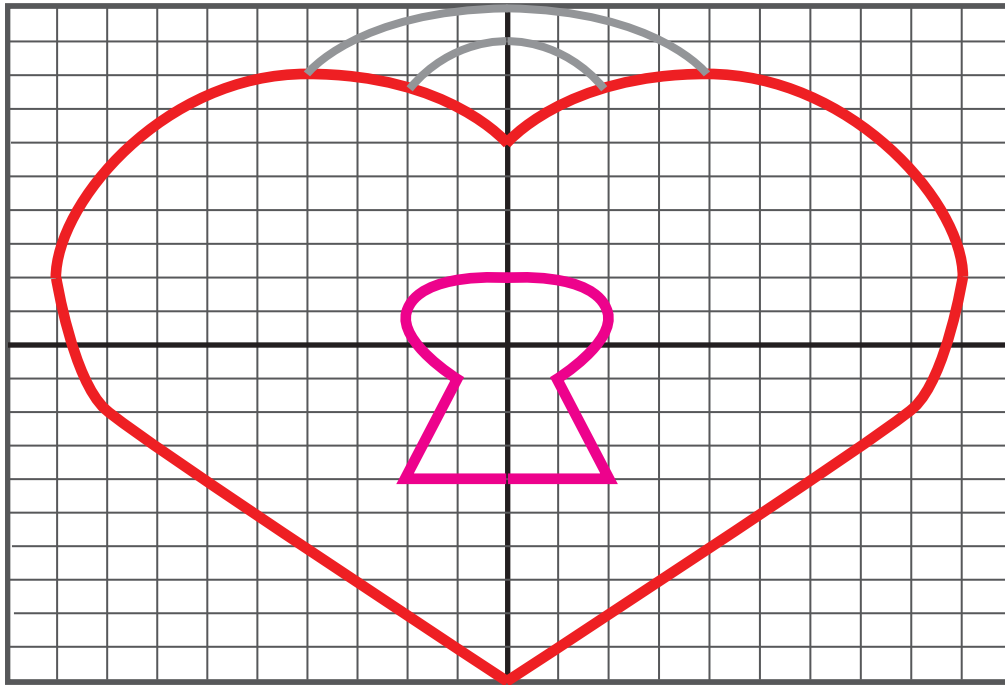
Unlocking math – teacher notes

In this differentiated activity, students will use their knowledge of functions and limited domains to do one of the following:

- » Write equations to create the given design.
- » Use their knowledge of transformations to produce the rest of the design.
- » Make their own design and write the corresponding equations.

Common Core Standards:

- » CCSS.HSF.BF.B.3
- » CCSS.HSF.IF.C



ACTIVITIES AND THEIR OBJECTIVES

Math loves functions

At the end of this activity, students should be able to:

- » Write equations from a graph.
- » Identify the domain of each equation (identify the domains of each piecewise function).

Fixing a broken heart - transformations

At the end of this activity, students should be able to:

- » Use properties of function transformations to write the equations for the missing pieces of the heart lock.

For this activity, use personal discretion on whether to share some, all, or none of the equations to students.

Locking in functions

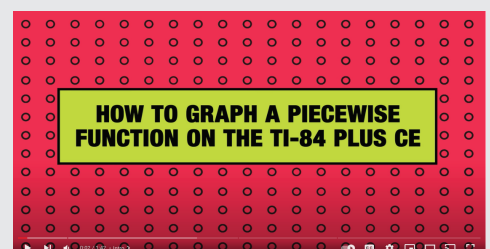
At the end of this activity, students should be able to:

- » Use their extensive knowledge of functions to write equations to create a unique graph of a heart lock.
- » Identify the domain of each equation (identify the domains of each piecewise function).

Introduction to piecewise functions

For these activities, students will need to know how to enter piecewise functions into their calculators.

You can play this quick how-to video for your class: <https://bit.ly/3SCT1fq>



Unlocking math functions – teacher notes

Highlighted equations are the missing parts or altered domains for the transformations activity.

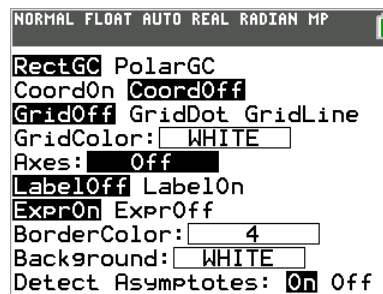
$f(x) = \left\{ \begin{array}{l} -4(x+8)^2 + 6; -9 \leq x < -8 \\ \left(-\frac{1}{8}\right)(x+4)^2 + 8; -8 \leq x < 0 \\ \left(-\frac{1}{8}\right)(x-4)^2 + 8; 0 \leq x < 8 \\ -4(x-8)^2 + 6; 8 \leq x \leq 9 \end{array} \right\}$	$\left. \vphantom{f(x)} \right\}$	Top of heart: (red)
$f(x) = \left\{ \begin{array}{l} 4(x+8)^2 - 2; -9 \leq x \leq -8 \\ 4(x-8)^2 - 2; 8 \leq x \leq 9 \end{array} \right\}$	$\left. \vphantom{f(x)} \right\}$	Sides of heart: (red)
$f(x) = \left\{ \begin{array}{l} -x - 10; -8 \leq x < 0 \\ x - 10; 0 \leq x \leq 8 \\ \text{OR} \\ x - 10; -8 \leq x \leq 8 \end{array} \right\}$	$\left. \vphantom{f(x)} \right\}$	Bottom of heart: (red)
$f(x) = \left\{ \left(-\frac{1}{8}\right)x^2 + 10; -4 \leq x \leq 4 \right\}$	$\left. \vphantom{f(x)} \right\}$	Top of lock: (gray)
$f(x) = \left\{ \left(-\frac{1}{3}\right)x^2 + 9; -2 < x < 2 \right\}$	$\left. \vphantom{f(x)} \right\}$	
$f(x) = \left\{ \begin{array}{l} 3x + 2; -2 \leq x \leq -1 \\ -3x + 2; 1 \leq x \leq 2 \end{array} \right\}$	$\left. \vphantom{f(x)} \right\}$	Bottom of keyhole: (magenta)
$f(x) = \left\{ -4; -2 \leq x \leq 2 \right\}$	$\left. \vphantom{f(x)} \right\}$	
$f(x) = \left\{ \begin{array}{l} 2(x+1)^2 - 1; -2 \leq x \leq -1 \\ 2(x-1)^2 - 1; 1 \leq x \leq 2 \end{array} \right\}$	$\left. \vphantom{f(x)} \right\}$	Sides of keyhole: (magenta)
$f(x) = \left\{ \sqrt{4-x^2} + 1; -2 \leq x \leq 2 \right\}$	$\left. \vphantom{f(x)} \right\}$	Top of keyhole: (magenta)

Graphing tips

To prep/modify your graph screen:



You can customize colors and visibility of various graph labeling and style choices. Toggle to selections. Press enter to activate your desired setting. Experiment and discover how to customize your display.



If working with Inequalities, turn on the Inequalities Application:



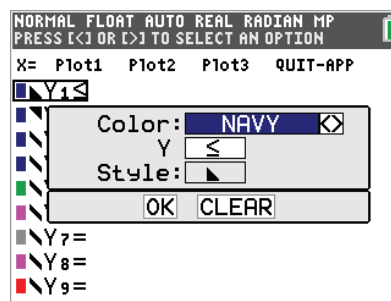
Select: 5: Inequalz

Enter equations into the stat plot f1 **y=** screen

To change colors and inequality symbols: Arrow left until the desired $Yx =$ line is outlined with a box. Press enter.

Hint: pay attention to the inequality symbols.

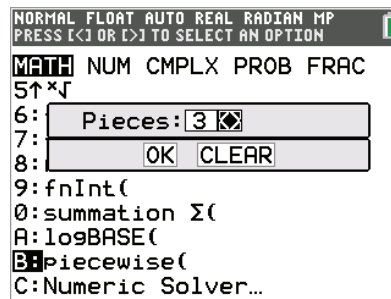
Use the dialogue box to select settings.



To enter multiple functions in a $Yx =$ row, use the

piecewise template: test A **math** Select: B: piecewise(

Use dialogue box to select quantity of pieces per $Yx =$ line.



For $x=$ go to the top left corner of the functions menu and select $x=$ to toggle between the functions

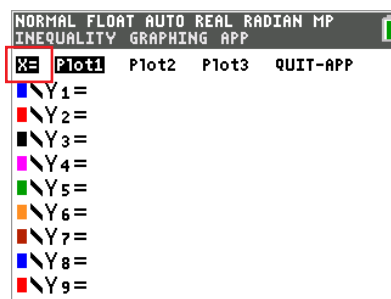
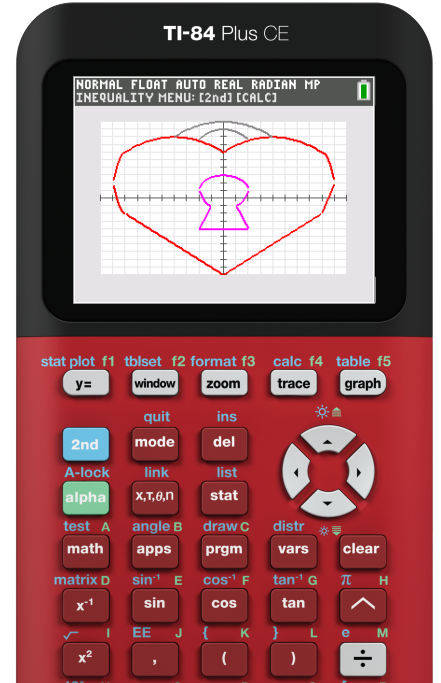
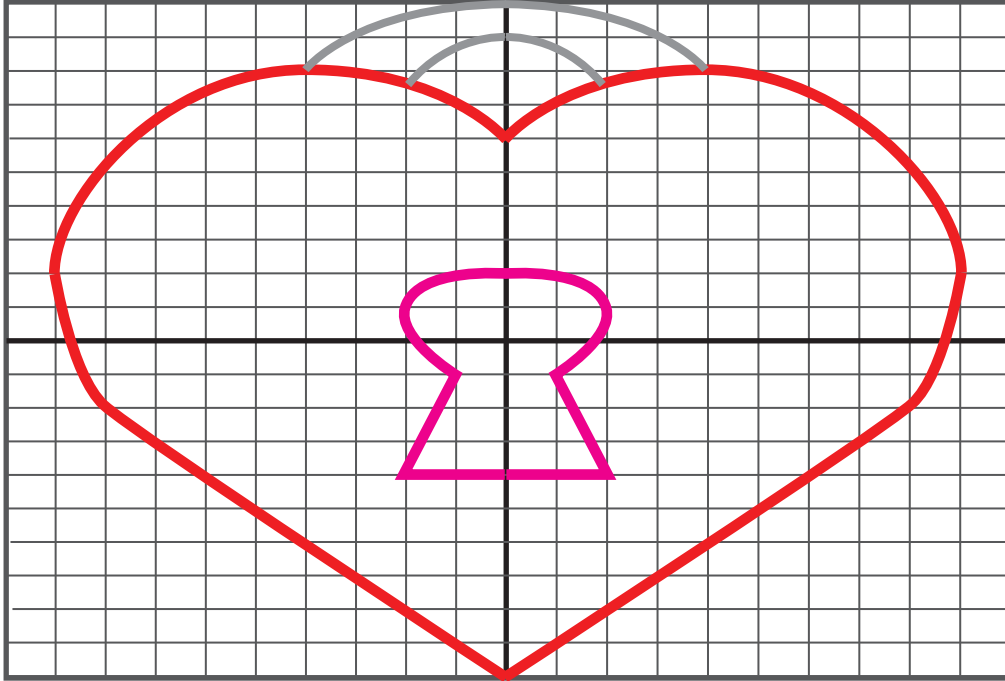


table f5

graph your work when all math is entered. Double check your equations.

Math loves functions

Let's draw a heart shaped lock! First, determine the equations used to make this image. Try breaking down the image into the parts below. Hint: The number of functions used is indicated in the parentheses. Next, enter the equations into your calculator to visualize them all together!



Top of lock (2):

Sides of heart (2):

Top of heart (4):

Bottom of heart (2 or 1):

Bottom of the keyhole (2):

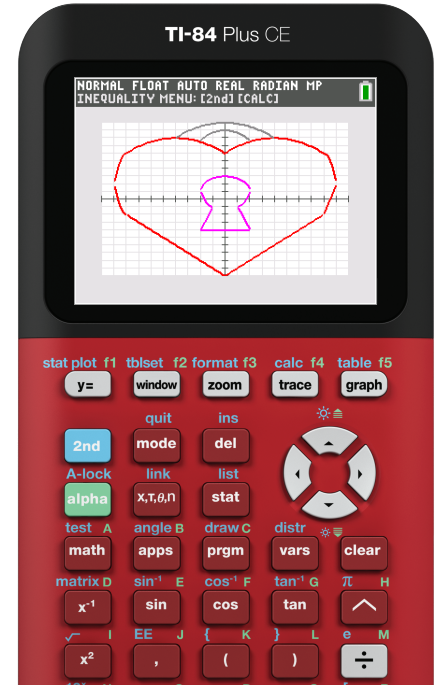
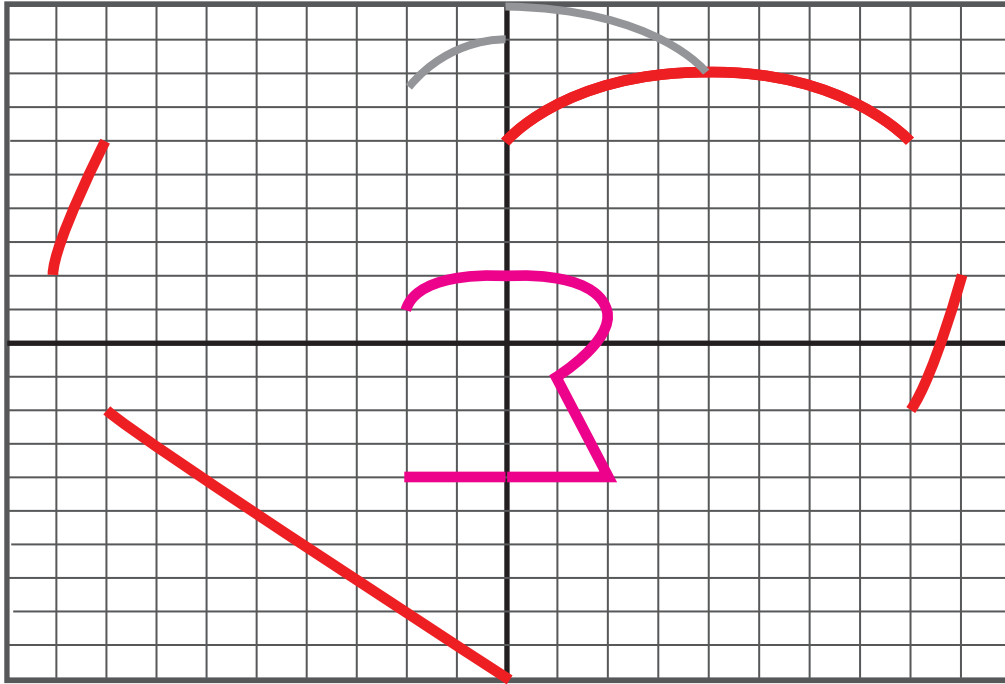
Sides of keyhole (2):

Top of keyhole (1):

Name: _____ Date: _____

Fixing a broken heart – transformations

This heart lock has broken, but it can be fixed! Determine the equations needed to finish the picture. Next, enter the equations into your calculator to finish the transformation.



Top of lock (2):

Sides of heart (2):

Top of heart (4):

Bottom of heart (2 or 1):

Bottom of the keyhole (2):

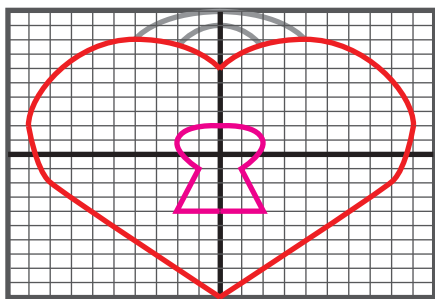
Sides of keyhole (2):

Top of keyhole (1):

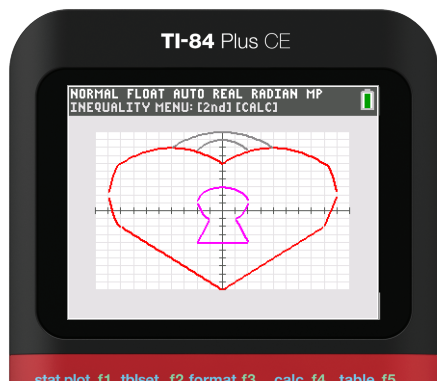
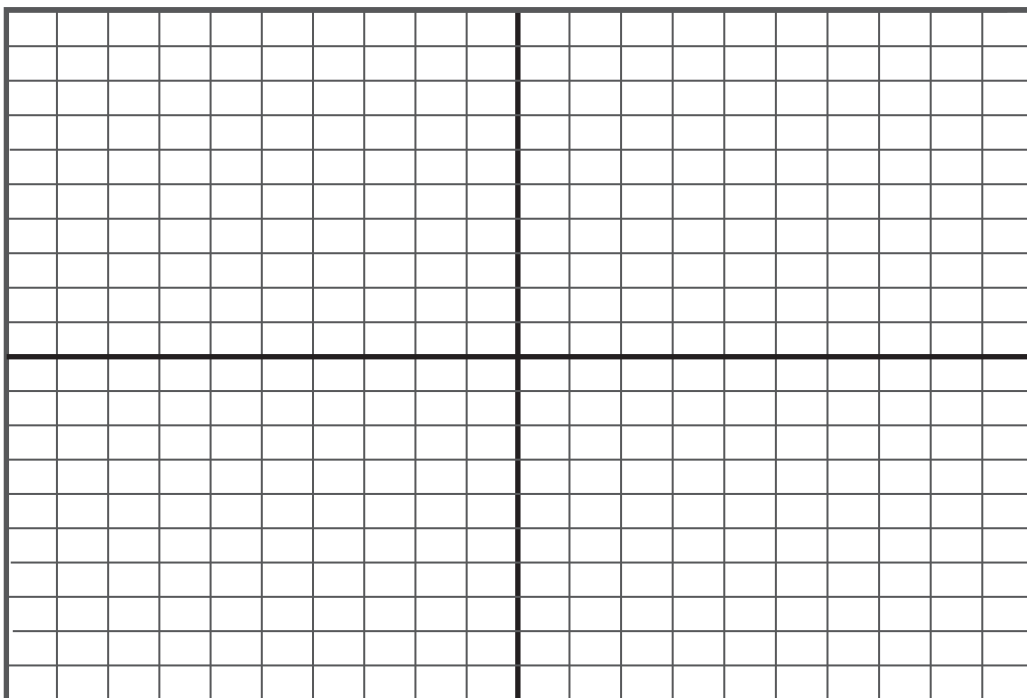
Locking in functions

Let's lock in our knowledge of functions! Use the provided image as inspiration to make your own heart lock. Draw your own design, then try breaking it down into parts. Next, enter the equations into your calculator to visualize them all together!

Example:



Draw your own heart lock.



Determine your functions below. Graph them on your calculator to check your work.