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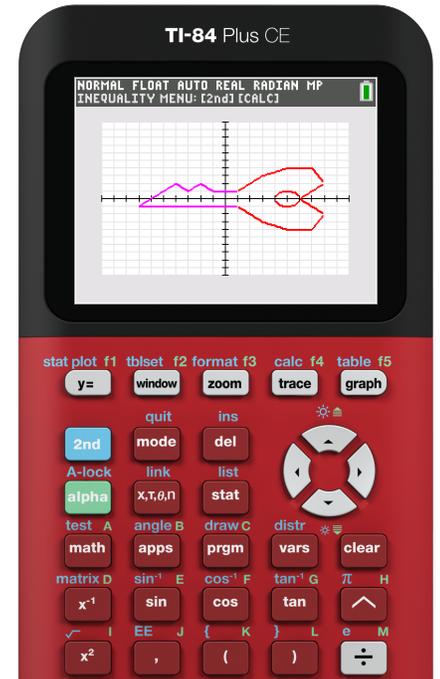
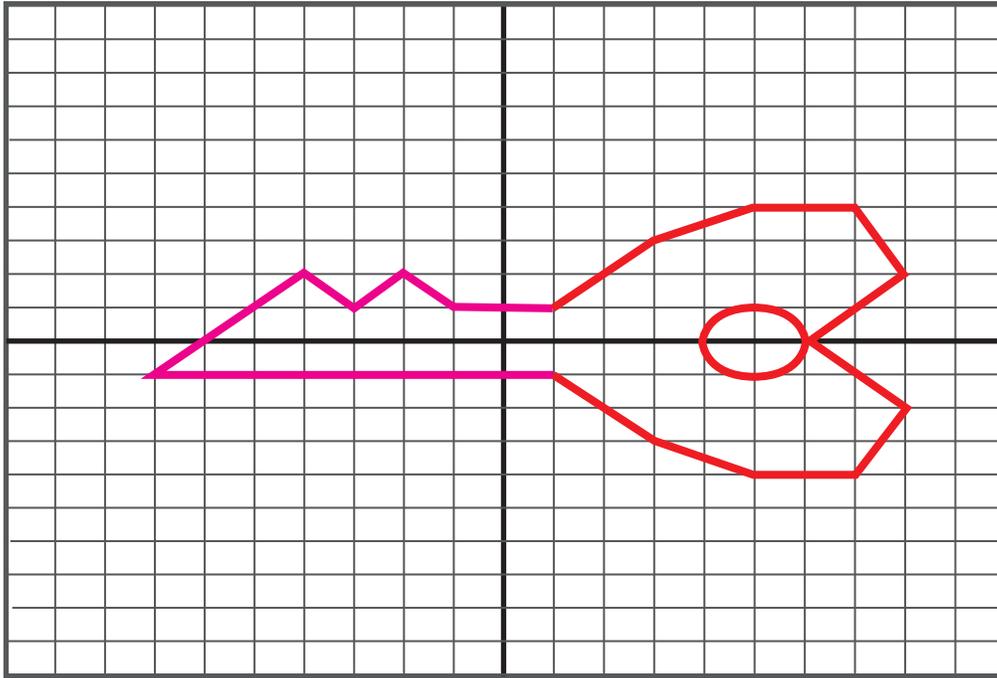
Math is key – teacher notes

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 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

Key to the heart of 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).

The right fit - 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 key.

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

The key to math love

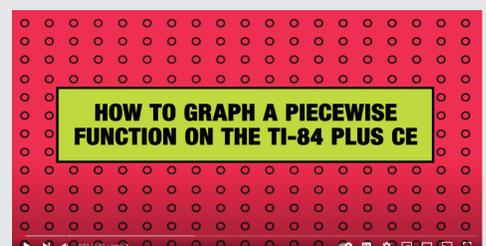
At the end of this activity, students should be able to:

- » Use their extensive knowledge of functions to write equations to create a unique graph of a key.
- » 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>



Math is key functions – teacher notes

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

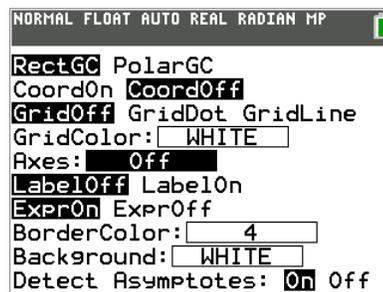
$f(x) = \left\{ \begin{array}{l} -1; -7 \leq x < 1 \end{array} \right\}$	$\left. \begin{array}{l} \phantom{f(x) = \left\{ \right.} \end{array} \right\}$	Bottom of key: (magenta)
$f(x) = \left\{ \begin{array}{l} x + 6; -7 \leq x < -4 \\ -x - 2; -4 \leq x < -3 \\ x + 4; -3 \leq x < -2 \\ -x; -2 \leq x < -1 \\ 1; -1 \leq x < 1 \end{array} \right\}$	$\left. \begin{array}{l} \phantom{f(x) = \left\{ \right.} \end{array} \right\}$	Teeth of key: (magenta)
$f(x) = \left\{ \begin{array}{l} -x; 1 \leq x < 3 \\ \left(-\frac{1}{2}\right)x - \frac{3}{2}; 3 \leq x < 5 \\ -4; 5 \leq x < 7 \\ 2x - 18; 7 \leq x \leq 8 \end{array} \right\}$	$\left. \begin{array}{l} \phantom{f(x) = \left\{ \right.} \end{array} \right\}$	Bottom of key head: (red)
$f(x) = \left\{ \begin{array}{l} x; 1 \leq x < 3 \\ \frac{1}{2}x + \frac{3}{2}; 3 \leq x < 5 \\ 4; 5 \leq x < 7 \\ -2x + 18; 7 \leq x < 8 \end{array} \right\}$	$\left. \begin{array}{l} \phantom{f(x) = \left\{ \right.} \end{array} \right\}$	Top right of key head: (red)
$f(x) = \left\{ \begin{array}{l} x - 6; 6 \leq x \leq 8 \end{array} \right\}$	$\left. \begin{array}{l} \phantom{f(x) = \left\{ \right.} \end{array} \right\}$	Key indent: (red)
$f(x) = \left\{ \begin{array}{l} -x + 6; 6 \leq x \leq 8 \end{array} \right\}$	$\left. \begin{array}{l} \phantom{f(x) = \left\{ \right.} \end{array} \right\}$	
$f(x) = \left\{ \begin{array}{l} \sqrt{1 - (x - 5)^2}; 4 \leq x \leq 6 \end{array} \right\}$	$\left. \begin{array}{l} \phantom{f(x) = \left\{ \right.} \end{array} \right\}$	Key head hole: (red)
$f(x) = \left\{ \begin{array}{l} -\sqrt{1 - (x - 5)^2}; 4 \leq x \leq 6 \end{array} \right\}$	$\left. \begin{array}{l} \phantom{f(x) = \left\{ \right.} \end{array} \right\}$	

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:



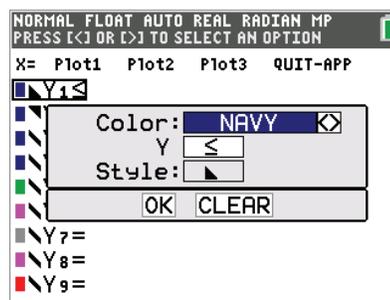
Select: 5: Inequalz

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.

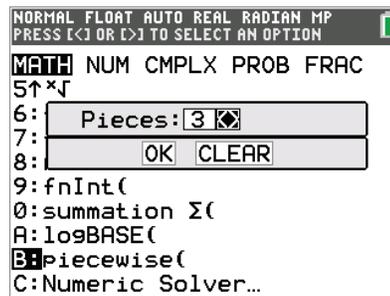
Use the dialogue box to select settings.



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

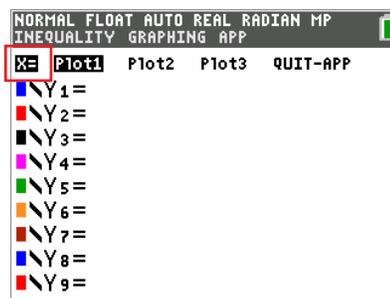


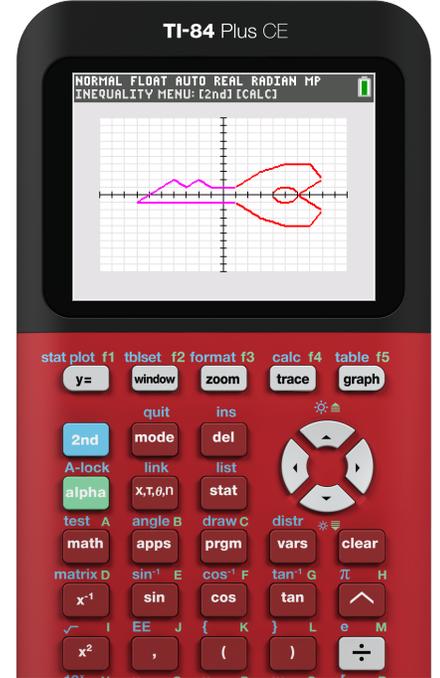
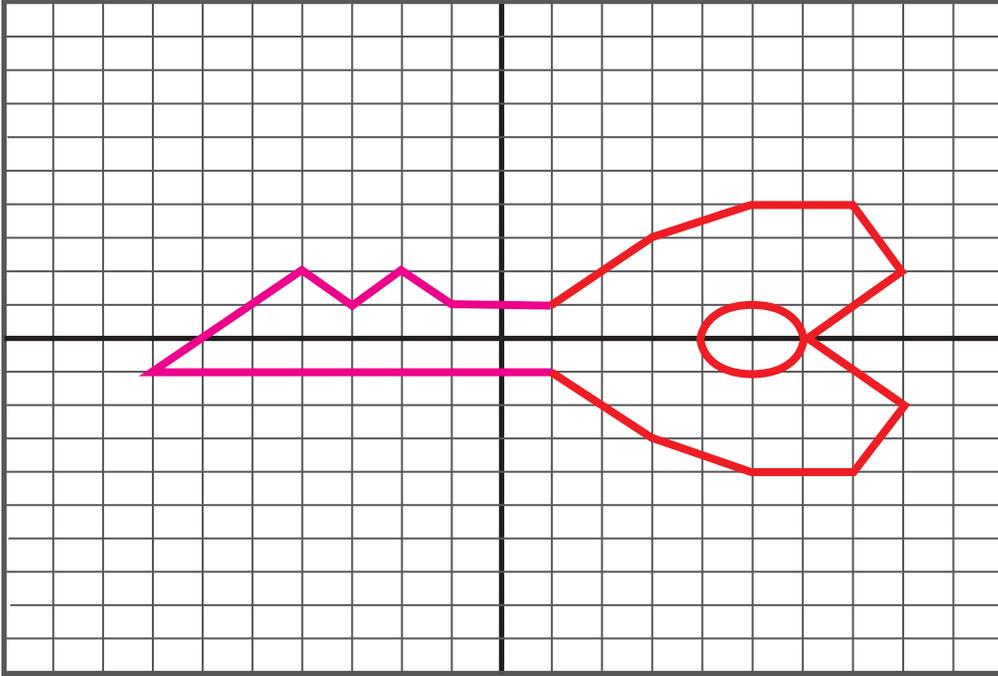
table f5

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

Key to the heart of functions

Let's draw a key! 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!



Bottom of key (5):

Key teeth (5):

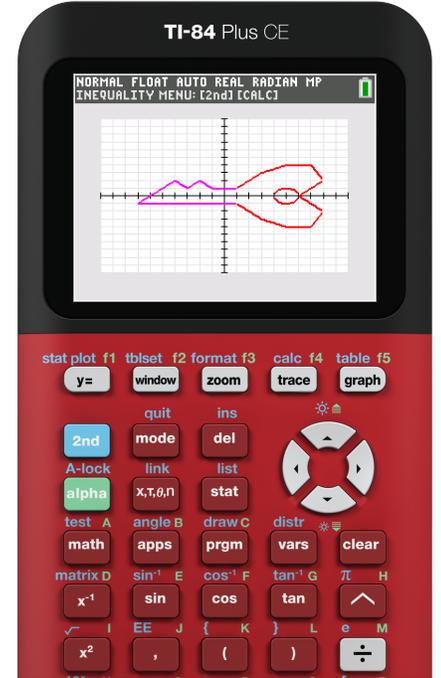
Top right of key (4):

Key indent (2):

Key ring hole (2):

The right fit - transformations

This key is missing its pieces. Let's find the right equations that fit. Determine the equations needed to finish the picture. Next, enter the equations into your calculator to finish the transformation.



Bottom of key (5):

Key teeth (5):

Top right of key (4):

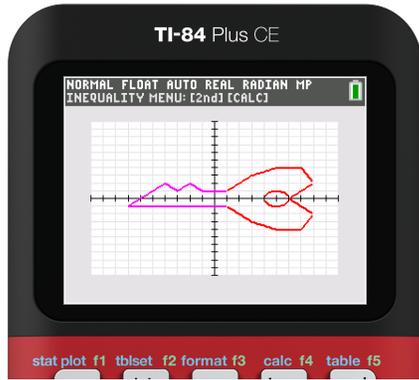
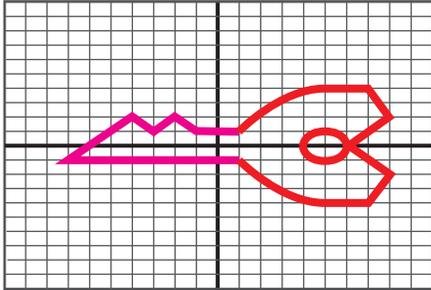
Key indent (2):

Key ring hole (2):

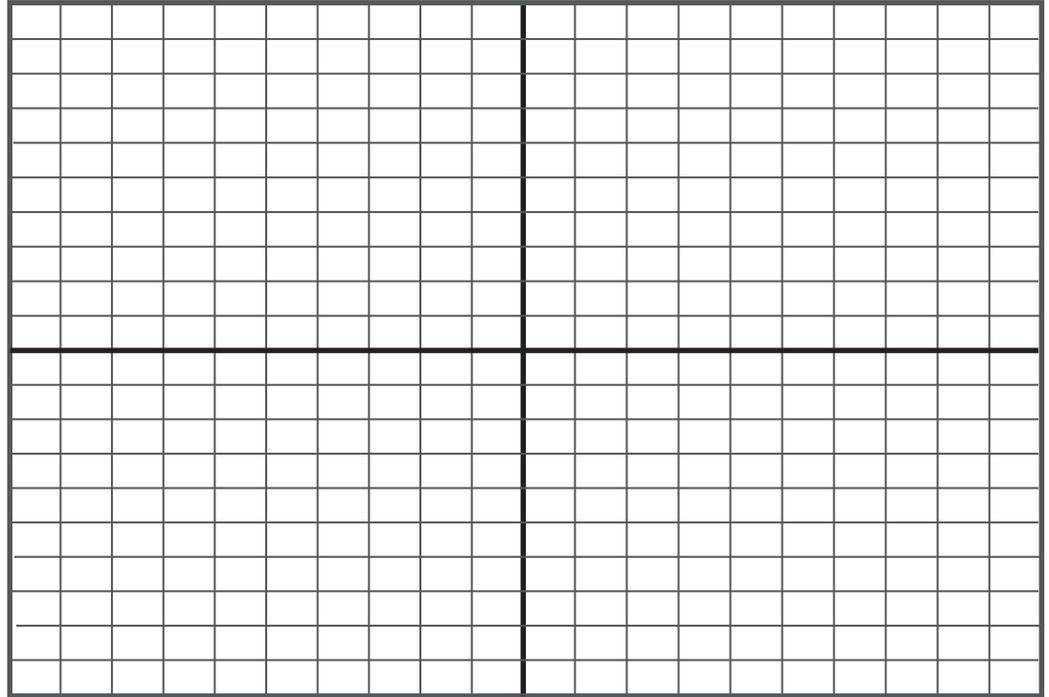
The key to math love

Unlock your creative math skills with your knowledge of functions. Use the provided image as inspiration to make your own heart key. 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 key.



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