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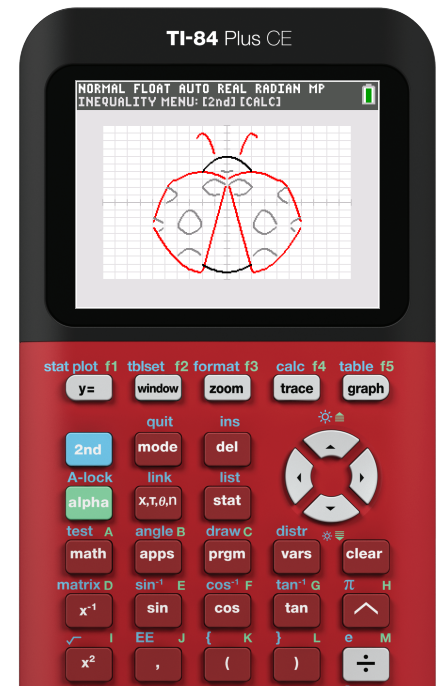
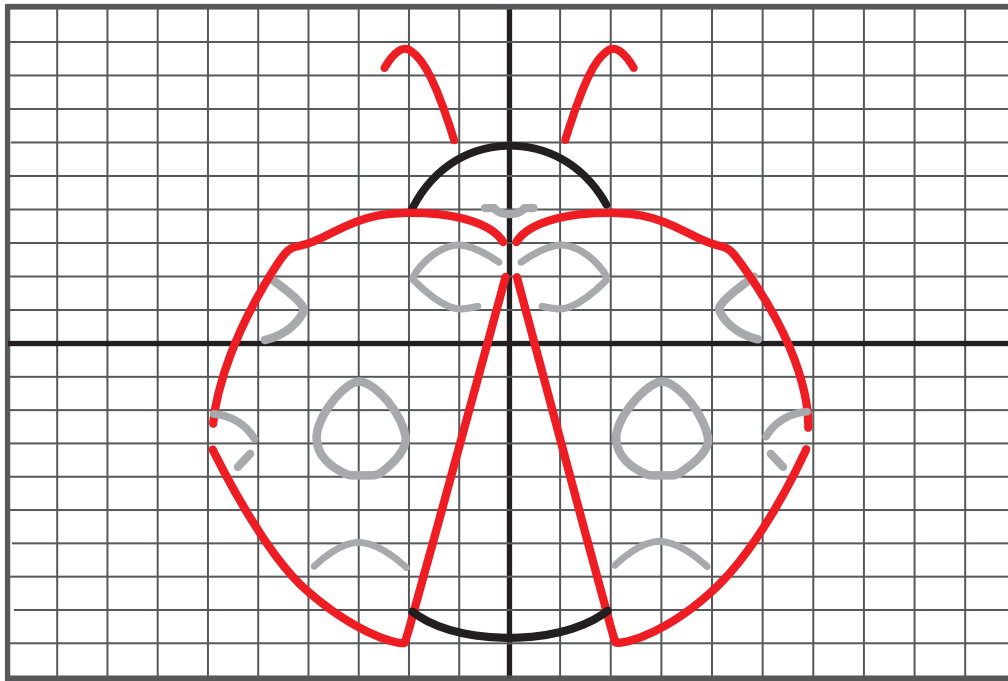
Lucky Ladybug - teacher notes

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

Buggy 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).

Spot the math - transformations

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

- » Use properties of function transformations to write the equations for the missing parts of the design.

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

Polka-dotted fun

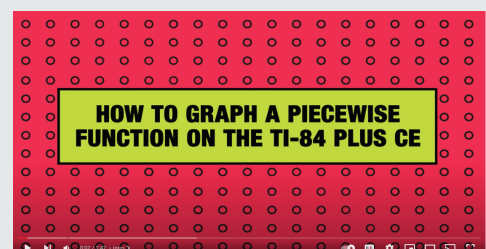
At the end of this activity, students should be able to:

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



Lucky Ladybug - teacher notes

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

$$f(x) = \left\{ \begin{array}{l} -\frac{3}{2}(x+4)^2 + 3; -6 < x < -4 \\ -\frac{1}{4}(x+2)^2 + 4; -4 < x < 0 \\ -\frac{1}{4}(x-2)^2 + 4; 0 < x < 4 \\ -\frac{3}{2}(x-4)^2 + 3; 4 < x < 6 \end{array} \right\} \quad \left[\begin{array}{l} \text{Top of wings:} \\ \text{(red)} \end{array} \right]$$

$$f(x) = \left\{ \begin{array}{l} \frac{3}{8}(x+2)^2 - 9; -6 < x < -2 \\ \frac{3}{8}(x-2)^2 - 9; 2 < x < 6 \\ 6x + 3; -2 < x < 0 \\ -6x + 3; 0 < x < 2 \end{array} \right\} \quad \left[\begin{array}{l} \text{Bottom of wings:} \\ \text{(red)} \end{array} \right]$$

$$f(x) = \left\{ \begin{array}{l} \frac{1}{4}x^2 - 9; -2 < x < 2 \end{array} \right\} \quad \left[\begin{array}{l} \text{Bottom of body:} \\ \text{(black)} \end{array} \right]$$

$$f(x) = \left\{ \begin{array}{l} -\frac{1}{2}x^2 + 6; -2 < x < 2 \end{array} \right\} \quad \left[\begin{array}{l} \text{Head:} \\ \text{(black)} \end{array} \right]$$

$$f(x) = \left\{ \begin{array}{l} -3(x+2)^2 + 9; -\frac{5}{2} < x < -1 \\ -3(x-2)^2 + 9; 1 < x < \frac{5}{2} \end{array} \right\} \quad \left[\begin{array}{l} \text{Antennae:} \\ \text{(red)} \end{array} \right]$$

Lucky Ladybug - teacher notes (cont.)

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

$$f(x) = \left\{ \begin{array}{l} -(x + 5)^2 + 2; -5 < x < -4 \\ -2(x + 3)^2 - 1; -4 < x < -2 \\ -(x + 1)^2 + 3; -2 < x < 0 \\ -(x - 1)^2 + 3; 0 < x < 2 \\ -2(x - 3)^2 - 1; 2 < x < 4 \end{array} \right\}$$

Top of spots 1:
(gray)

$$f(x) = \left\{ \begin{array}{l} (x + 5)^2; -5 < x < -4 \\ (x + 3)^2 - 4; -4 < x < -2 \\ (x + 1)^2 + 1; -2 < x < -\frac{1}{2} \\ (x - 1)^2 + 1; \frac{1}{2} < x < 2 \\ (x - 3)^2 - 4; 2 < x < 4 \end{array} \right\}$$

Bottom of spots 1:
(gray)

$$f(x) = \left\{ \begin{array}{l} -(x + 6)^2 - 2; -6 < x < -5 \\ -(x + 3)^2 - 6; -4 < x < -2 \\ -(x - 3)^2 - 6; 2 < x < 4 \\ -(x - 5)^2 + 2; 4 < x < 5 \\ -(x - 6)^2 - 2; 5 < x < 6 \end{array} \right\}$$

Top of spots 2:
(gray)

$$f(x) = \left\{ \begin{array}{l} (x + 6)^2 - 4; -\frac{11}{2} < x < -5 \\ (x - 5)^2; 4 < x < 5 \\ (x - 6)^2 - 4; 5 < x < \frac{11}{2} \\ x^2 + 4; -\frac{1}{2} < x < \frac{1}{2} \end{array} \right\}$$

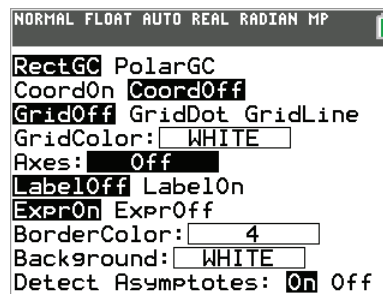
Bottom of spots 2
/smile:
(gray)

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:



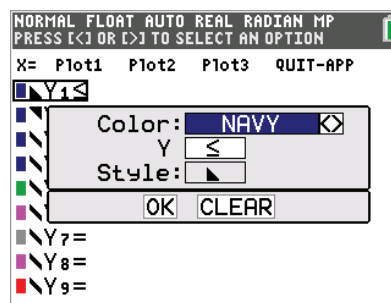
Select: 5: Inequalz

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.

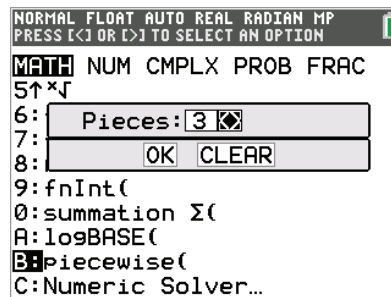
Use the dialogue box to select settings.



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

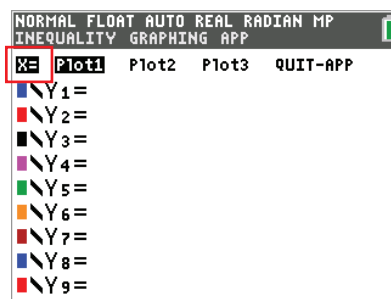


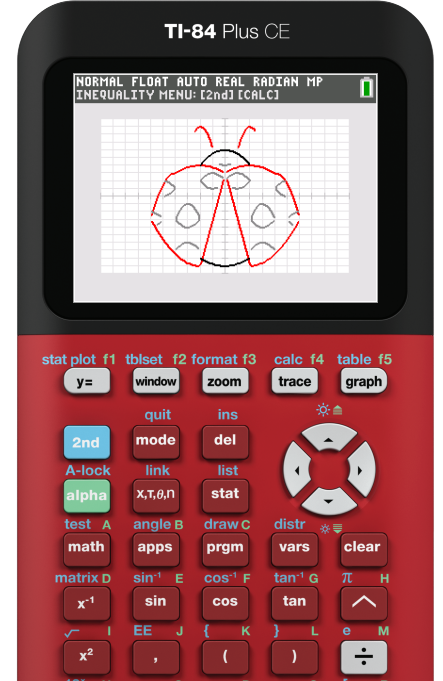
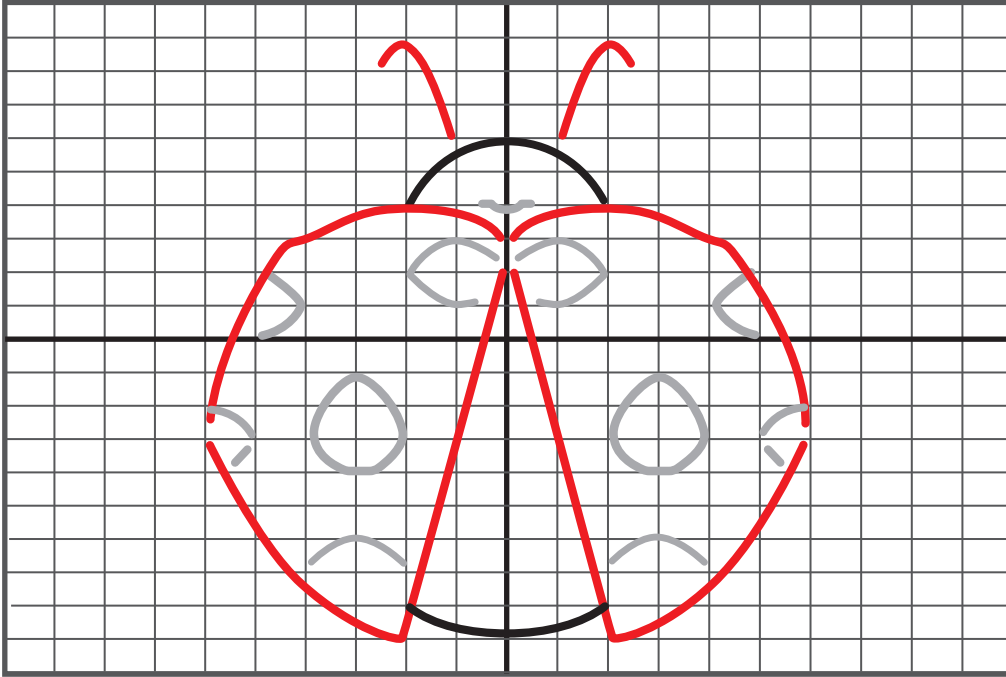
table f5

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

Name: _____ Date: _____

Buggy functions

Let's draw a fluttery-fun design of a lucky ladybug! 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 wings (4):

Bottom of wings (2):

Bottom of body: (1):

Head (1):

Antennae (2):

Top of spots 1 (5):

Bottom of spots 1 (5):

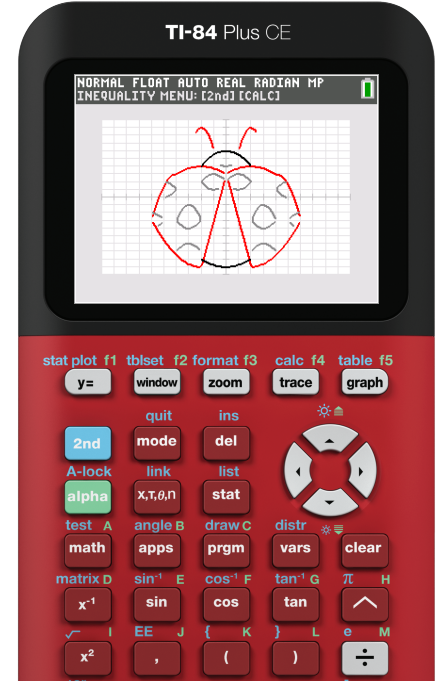
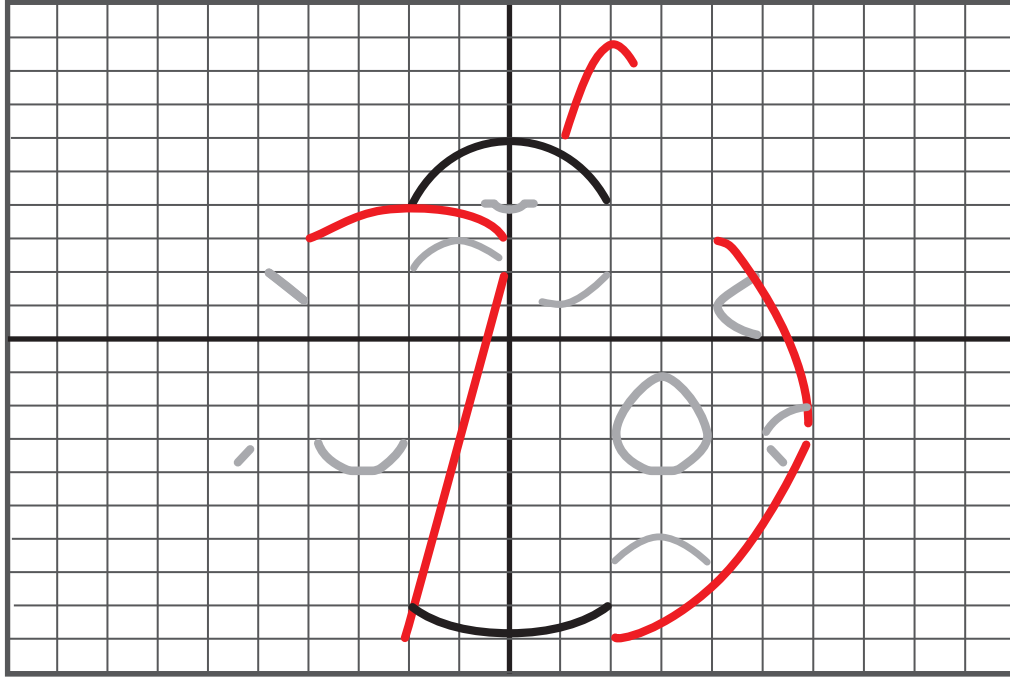
Top of spots 2 (5):

Bottom of spots 2/Smile (5):

Name: _____ Date: _____

Spot the math - transformations

This ladybug needs its spots back in the right places! Determine the equations needed to finish the picture. Next, enter the equations into your calculator to finish the transformation.



Top of wings (4):

Bottom of wings (2):

Bottom of body: (1):

Head (1):

Antennae (2):

Top of spots 1 (5):

Bottom of spots 1 (5):

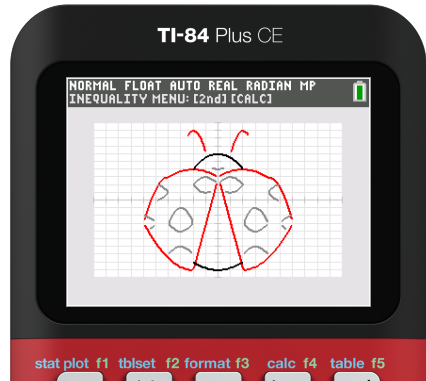
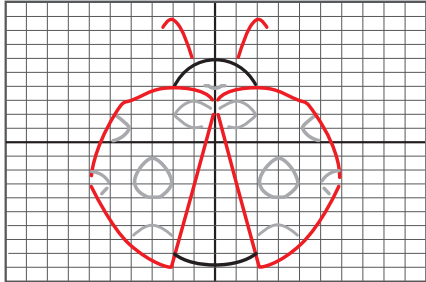
Top of spots 2 (5):

Bottom of spots 2/Smile (5):

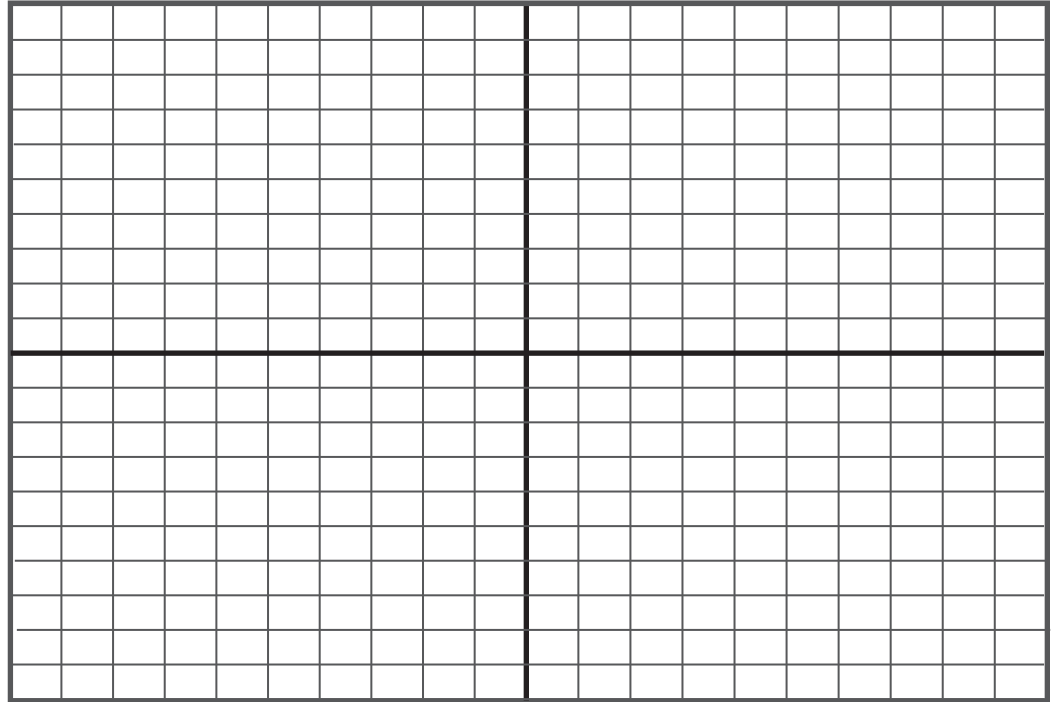
Polka-dotted fun

Is your knowledge of functions spot on? Make a ladybug design of your own using the provided image as inspiration. 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 design.



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