Spring Butterflies – 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 butterfly image.

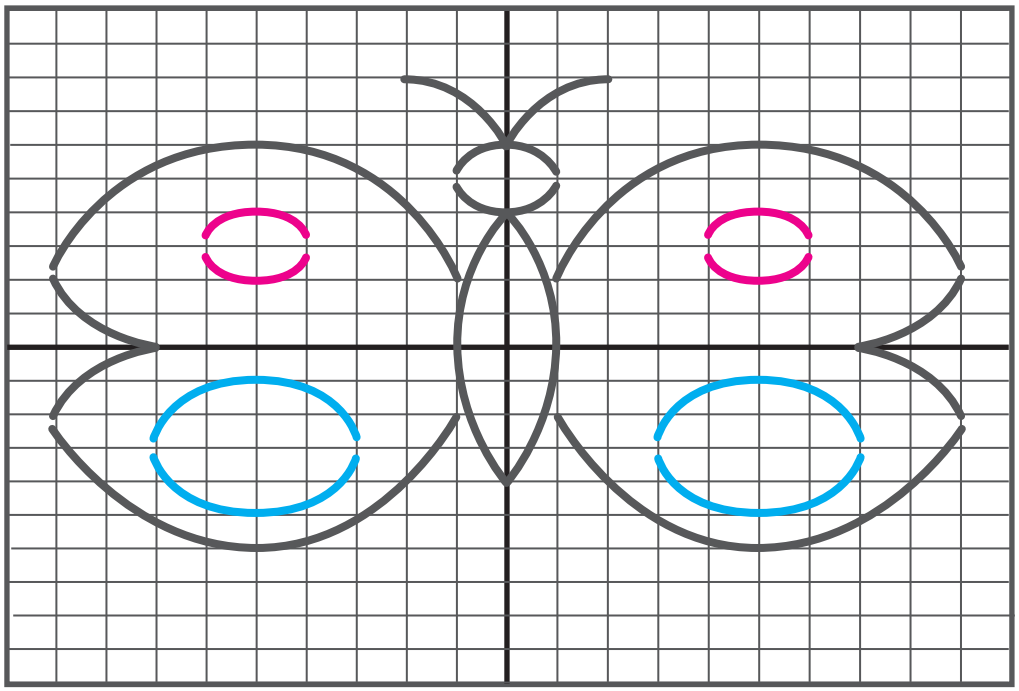
» Use their knowledge of transformations to produce the rest of the butterfly.

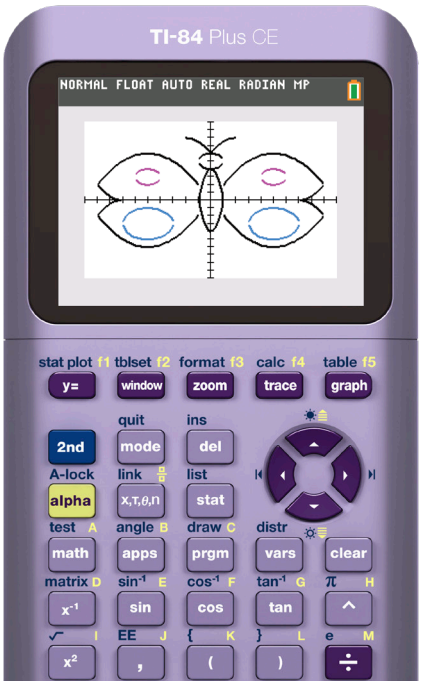
» Make their own butterfly design and write the corresponding equations.

Common Core Standards:

» CCSS.HSF.BF.B.3

» CCSS.HSF.IF.C





ACTIVITIES AND THEIR OBJECTIVES

Fluttery 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 in each piecewise function).

Metamorphosis - 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 butterfly.

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

Spread your wings

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

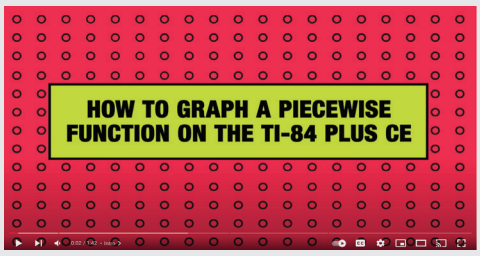
» Use their extensive knowledge of functions to write equations to create a unique graph of a butterfly.

» Identify the domain of each equation (identify the domains for 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**



Spring Butterflies – teacher notes

$$f(x) = \begin{cases} -4x^2 + 4; -1 < x < 1 \\ -\left(\frac{1}{4}\right)(x+5)^2 + 6; -9 \le x < -1 \\ -\left(\frac{1}{4}\right)(x-5)^2 + 6; 1 \le x < 9 \end{cases}$$

Top of wings and body (black):

$$f(x) = \begin{cases} 4x^2 + 4; -1 < x < 1 \\ \left(\frac{1}{4}\right)(x+5)^2 - 6; -9 \le x \le -1 \\ -\left(\frac{1}{4}\right)(x-5)^2 - 6; 1 \le x < 9 \end{cases}$$

Bottom of wings and body (black):

$$f(x) = \begin{cases} \left(\frac{1}{2}\right)(x+7)^2; -9 \le x \le -7 \\ \sqrt{1-x^2} + 5; -1 \le x \le 1 \\ \left(\frac{1}{2}\right)(x-7)^2; 7 \le x \le 9 \end{cases}$$

Top side wing and top of head (black):

$$f(x) = \begin{cases} -\left(\frac{1}{2}\right)(x+7)^2; -9 \le x \le -7 \\ -\sqrt{1-x^2} + 5; -1 \le x \le 1 \\ -\left(\frac{1}{2}\right)(x-7)^2; 7 \le x \le 9 \end{cases}$$

Bottom side wing and bottom of head (black):

$$f(x) = \begin{cases} -\left(\frac{1}{2}\right)(x+2)^2 + 8; -2 \le x \le 0 \\ -\left(\frac{1}{2}\right)(x-2)^2 + 8; 0 < x \le 2 \end{cases}$$

Antennae:

Spring Butterflies – teacher notes

$$f(x) = \left\{ \begin{array}{l} \sqrt{1-(x+5)^2}+3;\ -6 \le x \le -4 \\ \sqrt{1-(x-5)^2}+3;\ 4 \le x \le 6 \end{array} \right\}$$

Top spots on
top wings (Magenta):

$$f(x) = \left\{ \begin{array}{l} -\sqrt{1-(x+5)^2}+3;\ -6 \le x \le -4 \\ -\sqrt{1-(x-5)^2}+3;\ 4 \le x \le 6 \end{array} \right\}$$

Bottom spots on
top wings (Magenta):

$$f(x) = \left\{ \begin{array}{l} \sqrt{4-(x+5)^2}-3;\ -7 \le x \le -3 \\ \sqrt{4-(x-5)^2}-3;\ 3 \le x \le 7 \end{array} \right\}$$

Top of spots on
bottom wings (Blue):

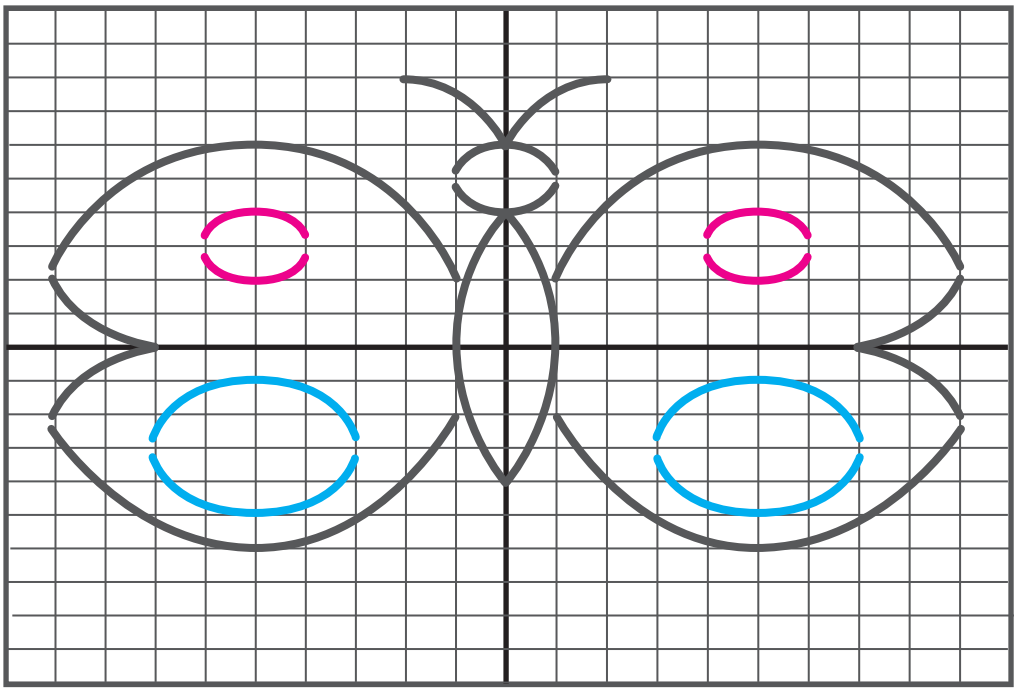
$$f(x) = \left\{ \begin{array}{l} -\sqrt{4-(x+5)^2}-3;\ -7 \le x \le -3 \\ -\sqrt{4-(x-5)^2}-3;\ 3 \le x \le 7 \end{array} \right\}$$

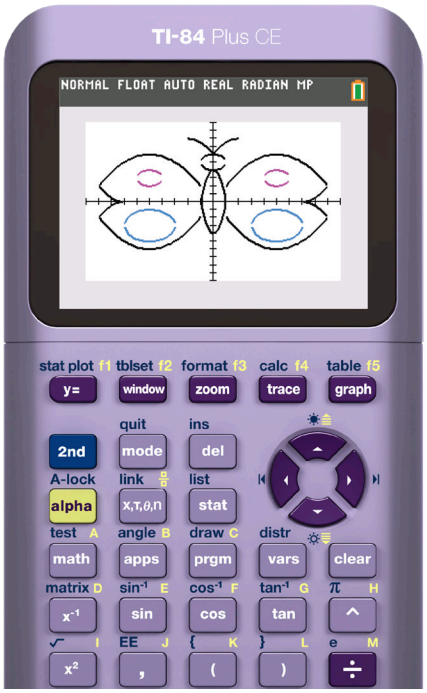
Bottom of spots
on bottom wings (Blue):

Name: _____ Date: _____

Fluttery 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 the equations all together!





Top of wings and body (3):

Bottom side wing and bottom of head (3):

Bottom spots on top wings (2):

Bottom of wings and body (3):

Antennae (2):

Top of spots on bottom wings (2):

Top side wing and top of head (3):

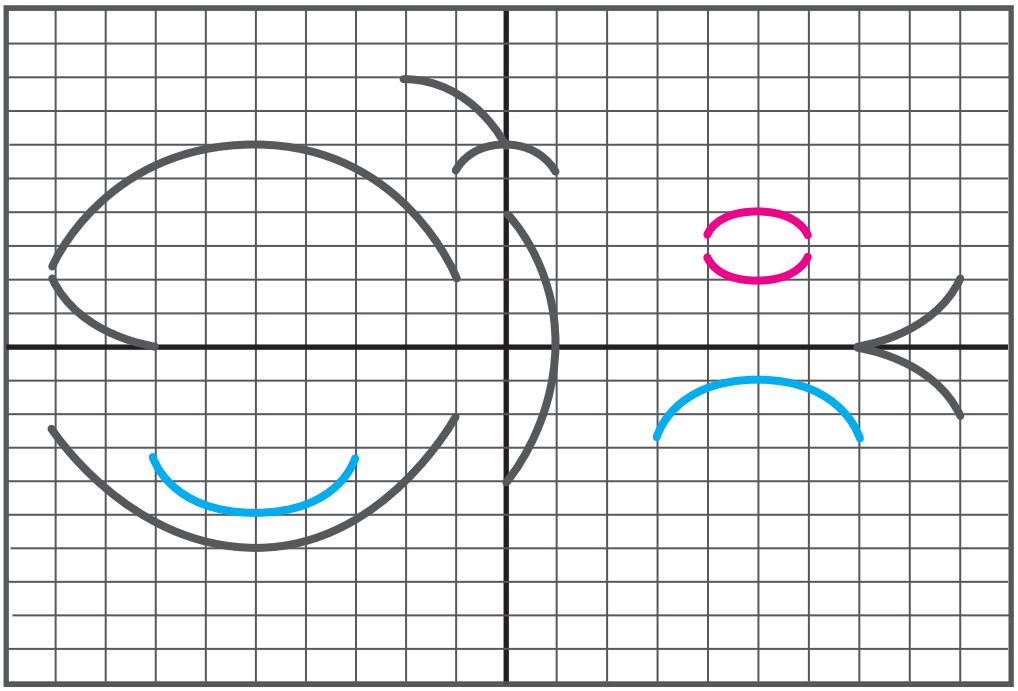
Top spots on top wings (2):

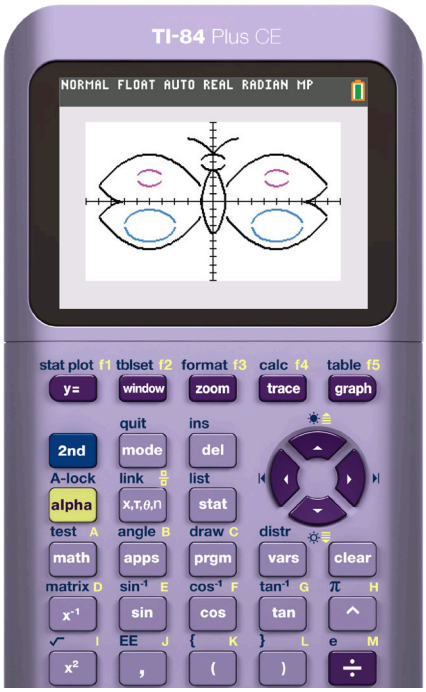
Bottom of spots on bottom wings (2):

Name: _____ Date: _____

Metamorphosis - transformations

This butterfly is in the middle of it's metamorphosis - help it finish! Determine the equations needed to finish the picture. Next, enter the equations into your calculator to finish the transformation.





Top of wings and body (3):

Bottom side wing and bottom of head (3):

Bottom spots on top wings (2):

Bottom of wings and body (3):

Antennae (2):

Top of spots on bottom wings (2):

Top side wing and top of head (3):

Top spots on top wings (2):

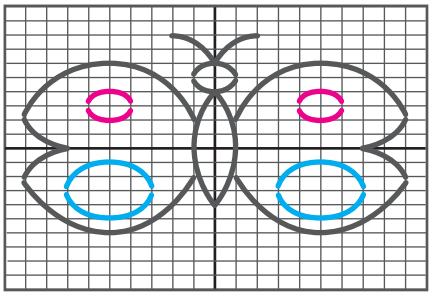
Bottom of spots on bottom wings (2):

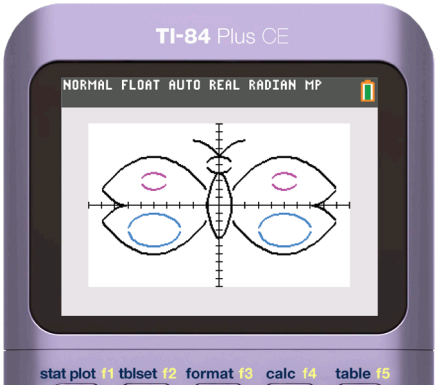
Name: _____ Date: _____

Spread your wings

It's time to fly with your own design! Use the provided image as inspiration to make your own butterfly. Draw your own design, then try breaking it down into parts. Next, enter the equations into your calculator to visualize the equations all together!

Example:





Draw your own Butterfly design.

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

Spring showers – 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 umbrella design.

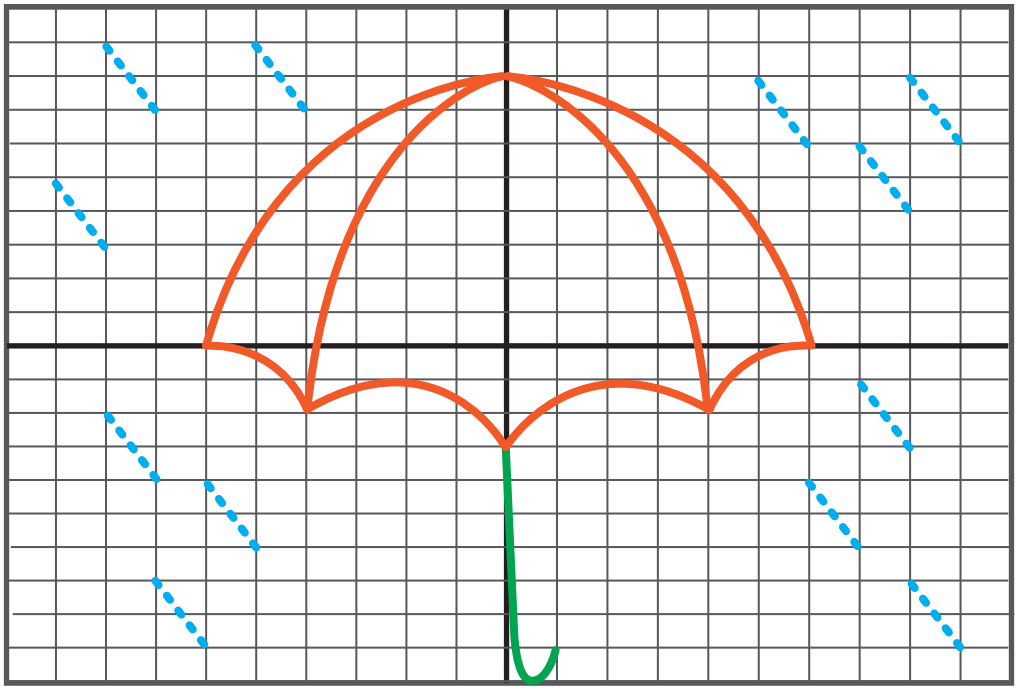
» Use their knowledge of transformations to produce the umbrella.

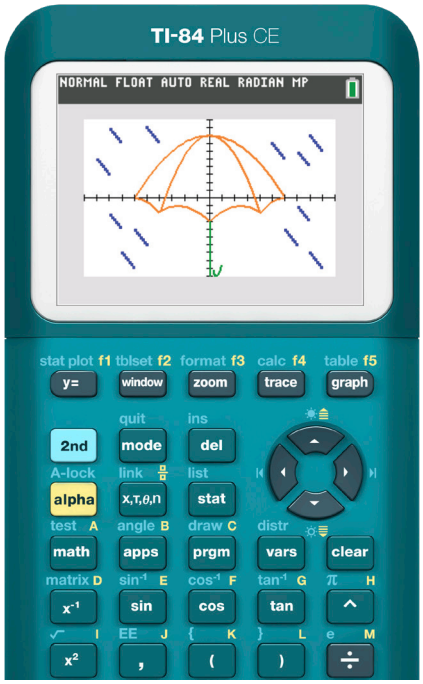
» Make their own rainy day umbrella and write the corresponding equations.

Common Core Standards:

» CCSS.HSF.BF.B.3

» CCSS.HSF.IF.C





ACTIVITIES AND THEIR OBJECTIVES

Sprinkles 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 in each piecewise function).

A leaky umberella - 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 umbrella.

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

It's raining math and fun

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

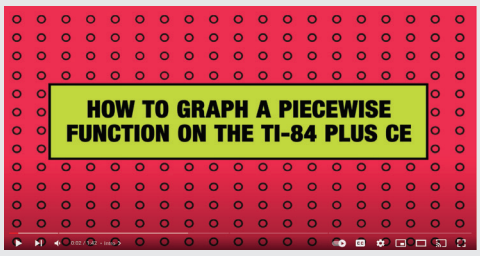
» Use their extensive knowledge of functions to write equations to create a unique graph of a rainy day umbrella scene.

» Identify the domain of each equation (identify the domains for each piecewise function).

Introduction into piecewise function

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**



Spring showers – teacher notes

$f(x) = \left\{ \left(-\frac{2}{9}\right) x^2 + 8;\ -6 \le x \le 6 \right\}$

Top of umbrella (orange):

$f(x) = \left\{ \left(-\frac{5}{8}\right) x^2 + 8;\ -4 \le x \le 4 \right\}$

Middle of umbrella (orange):

$$f(x) = \begin{cases} \left(-\frac{1}{2}\right)(x+6)^2;\ -6 \le x < -4 \\ \left(-\frac{8}{25}\right)(x+2.5)^2 - 1;\ -4 \le x < 0 \\ \left(-\frac{8}{25}\right)(x-2.5)^2 - 1;\ 0 \le x < 4 \\ \left(-\frac{1}{2}\right)(x-6)^2;\ 4 \le x \le 6 \end{cases}$$

Bottom of umbrella (orange):

$$f(x) = \begin{cases} -999x - 3;\ 0 \le x \le .2 \\ 8(x-0.5)^2 - 10;\ 0 \le x \le 1 \end{cases}$$

Umbrella Handle (green):

$$f(x) = \begin{cases} -2x + 17;\ 5 \le x \le 6 \\ -2x + 20;\ 7 \le x < 8 \\ -2x + 24;\ 8 \le x \le 9 \end{cases}$$

Raindrops quadrant I (blue)
(use dotted lines for drizzle!):

$$f(x) = \begin{cases} -2x - 13;\ -9 \le x < -8 \\ -2x - 7;\ -8 \le x \le -7 \\ -2x - 1;\ -5 \le x \le -4 \end{cases}$$

Raindrops quadrant II (blue)
(use dotted lines for drizzle!):

$$f(x) = \begin{cases} -2x - 18;\ -8 \le x < -7 \\ -2x - 21;\ -7 \le x < -6 \\ -2x - 16;\ -6 \le x \le -5 \end{cases}$$

Raindrops quadrant III (blue)
(use dotted lines for drizzle!):

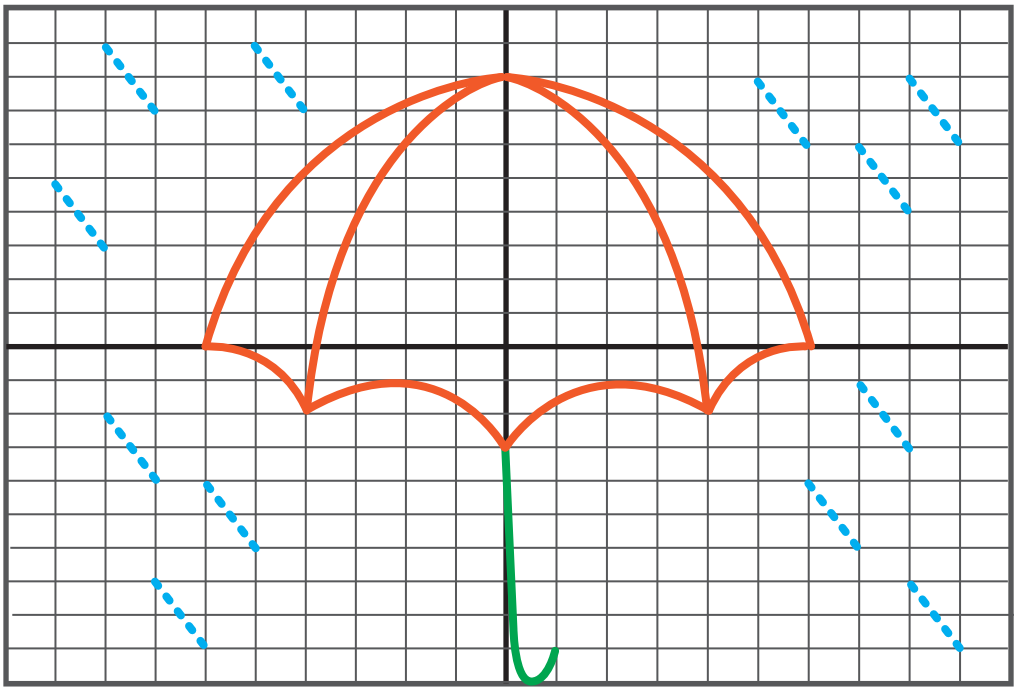
$$f(x) = \begin{cases} -2x + 8;\ 6 \le x < 7 \\ -2x + 13;\ 7 \le x < 8 \\ -2x + 9;\ 8 \le x \le 9 \end{cases}$$

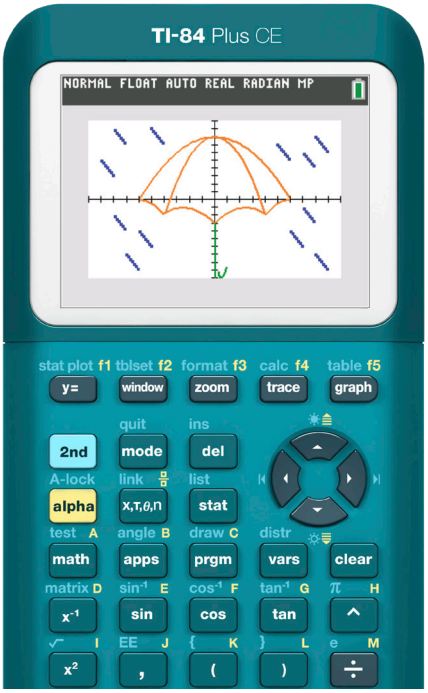
Raindrops quadrant IV (blue)
(use dotted lines for drizzle!):

Name: _____ Date: _____

Sprinkles of functions

Spring showers call for a sturdy umbrella. 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 the equations all together!





Top of umbrella (1):

Middle of umbrella (1):

Bottom of umbrella (4):

Umbrella handle (2):

$-999x - 3;\ 0 \le x \le .2$

Raindrops quad. I (3):

Raindrops quad. II (3):

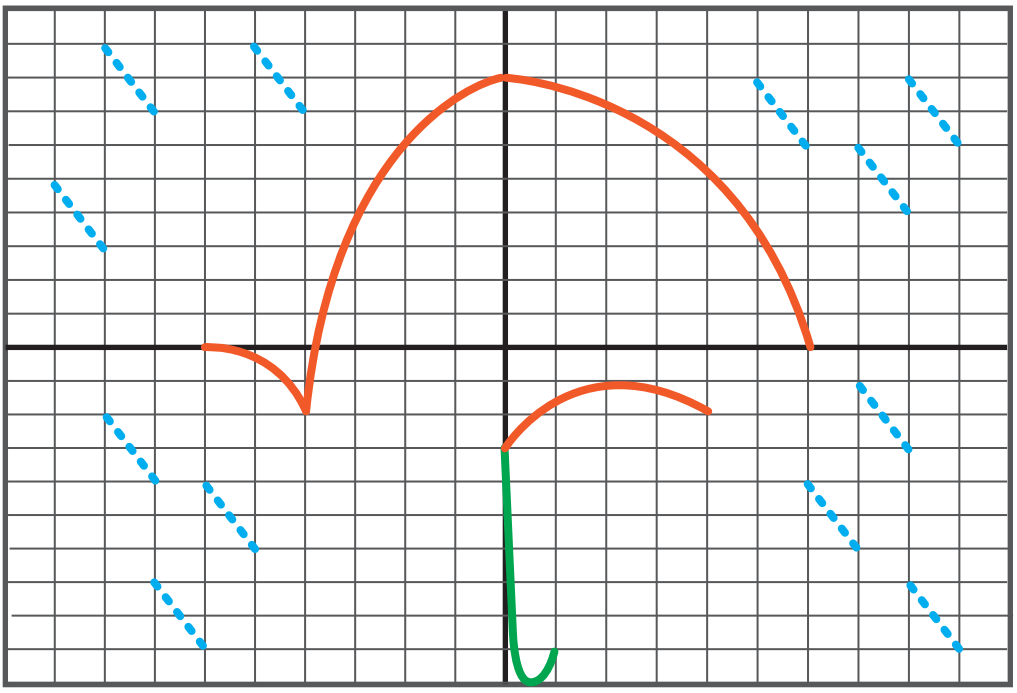
Raindrops quad. III (3):

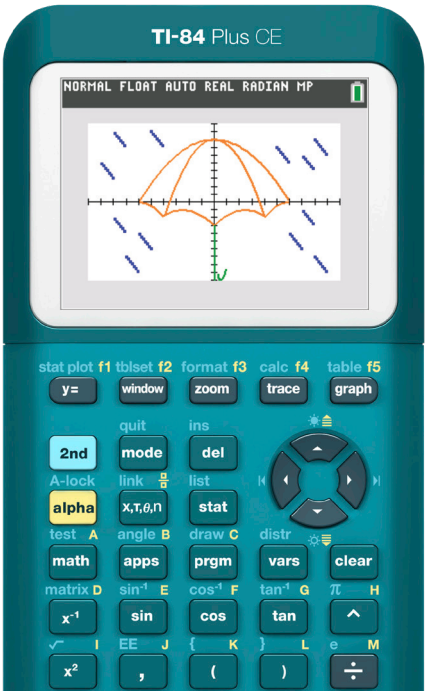
Raindrops quad. IV (3):

Name: _____ Date: _____

A leaky umbrella - transformations

This umbrella is leaky. Let's fix it with the right equatioins. Determine the equations needed to finish the picture. Next, enter the equations into your calculator to finish the transformation.





Top of umbrella (1):

Middle of umbrella (1):

Bottom of umbrella (4):

Umbrella handle (2):

$-999x - 3;\ 0 \le x \le .2$

Raindrops quad. I (3):

Raindrops quad. II (3):

Raindrops quad. III (3):

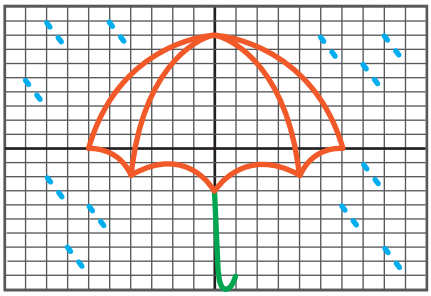
Raindrops quad. IV (3):

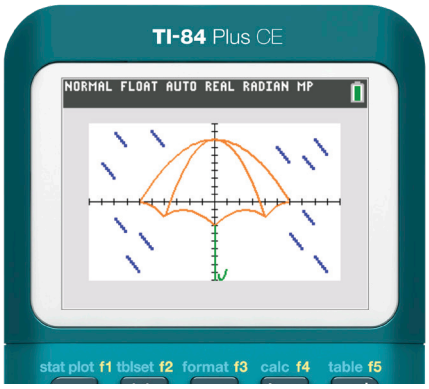
Name: _____ Date: _____

It's raining math and fun

Let's draw our own rainy day umbrella scene 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 the equations all together!

Example





Draw your own rainy day umbrella scene

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