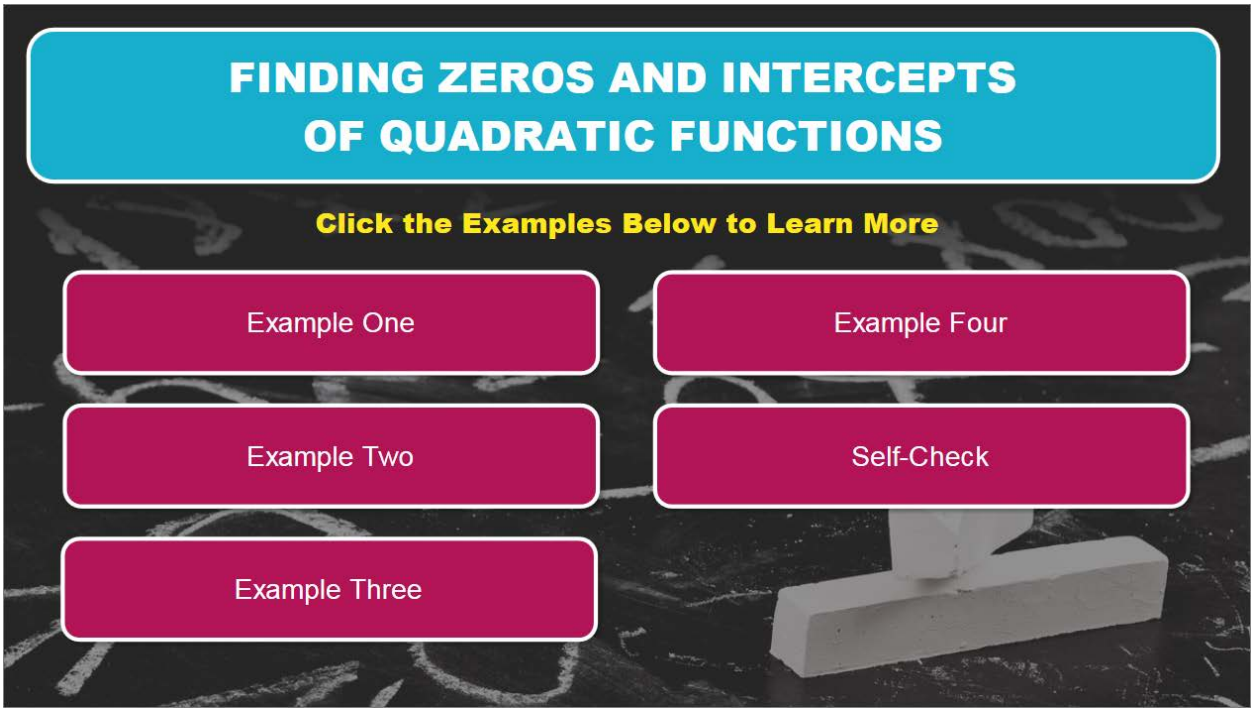
Module 10: Linear and Quadratic Function Families

Topic 2 Content: Finding Zeros and Intercepts of Quadratic Functions Notes

Introduction

Hi there! I'm so glad to have you here for this lesson in Algebra I. In this lesson, you will learn how to find the zeros and intercepts of a quadratic function.

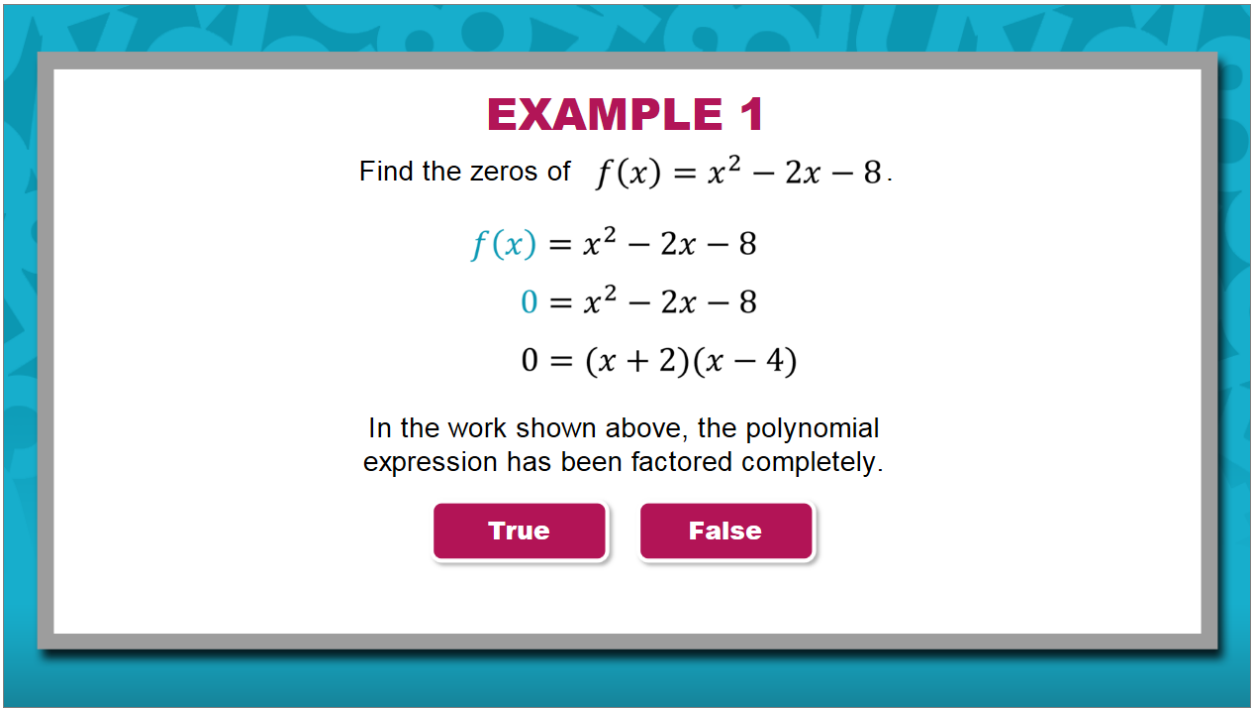
Finding Zeros and Intercepts of Quadratic Functions



Click the examples below to learn more.

- Example One
- Example Two
- Example Three
- Example Four
- Self-Check

Example One



Find the zeros of $f(x) = x^2 - 2x - 8$.

$$f(x) = x^2 - 2x - 8$$
$$0 = x^2 - 2x - 8$$
$$0 = (x + 2)(x - 4)$$

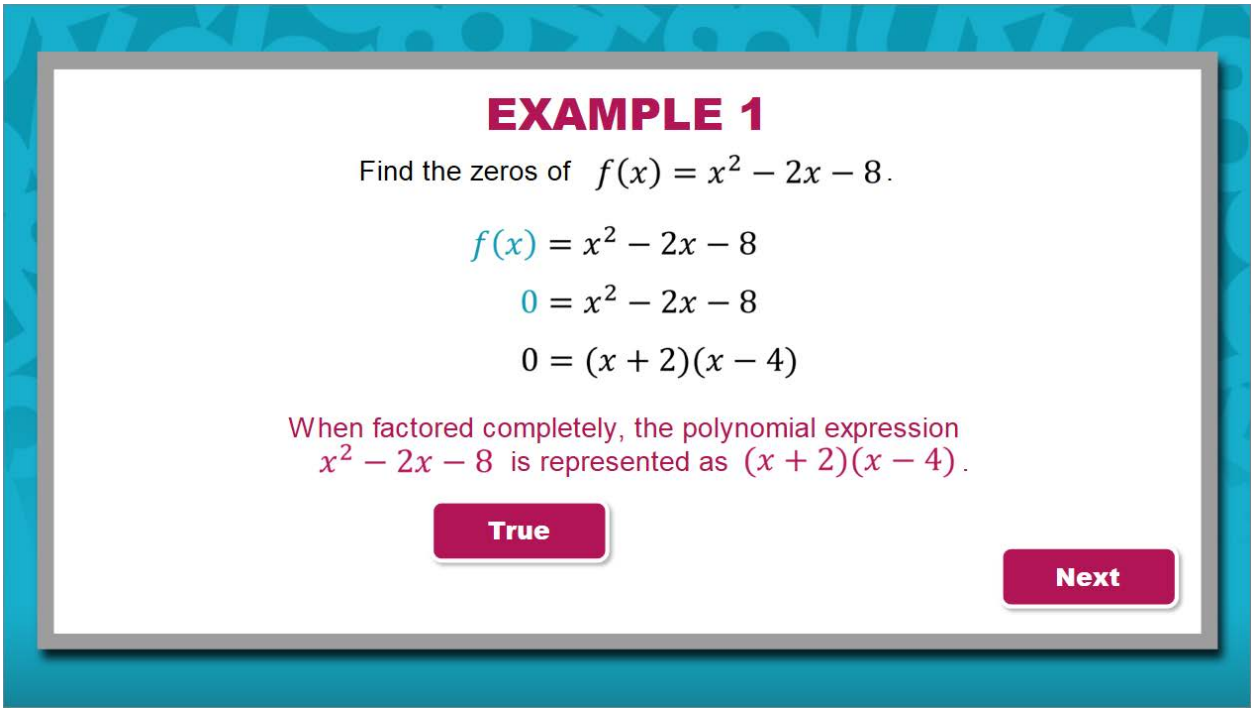
To determine the zero of the given function, begin by setting $f(x) = 0$. Then, solve for x.

You may choose to solve the resulting equation by factoring. To do so, you should begin by factoring the polynomial expression completely.

In the work shown below, the polynomial expression has been factored completely.

A) True
B) False

Example One (continued)

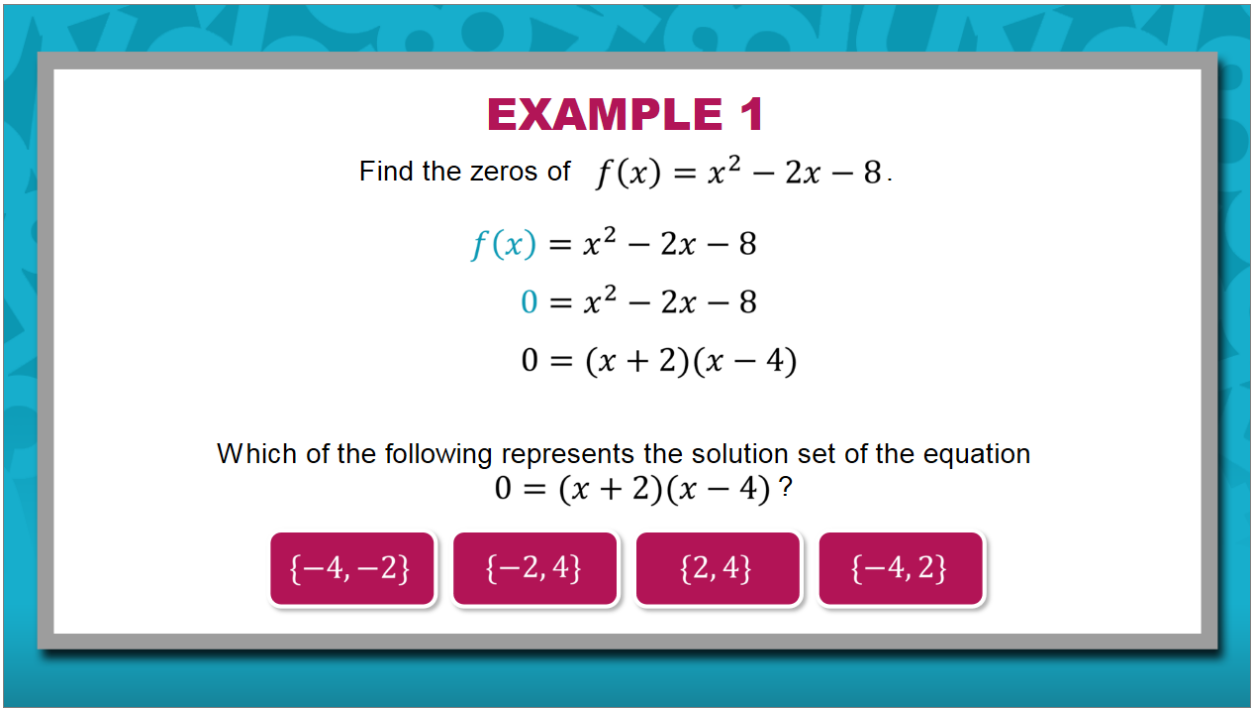


Find the zeros of $f(x) = x^2 - 2x - 8$.

$$f(x) = x^2 - 2x - 8$$
$$0 = x^2 - 2x - 8$$
$$0 = (x + 2)(x - 4)$$

When factored completely, the polynomial expression $x^2 - 2x - 8$ is represented as $(x + 2)(x - 4)$.

Example One (continued)



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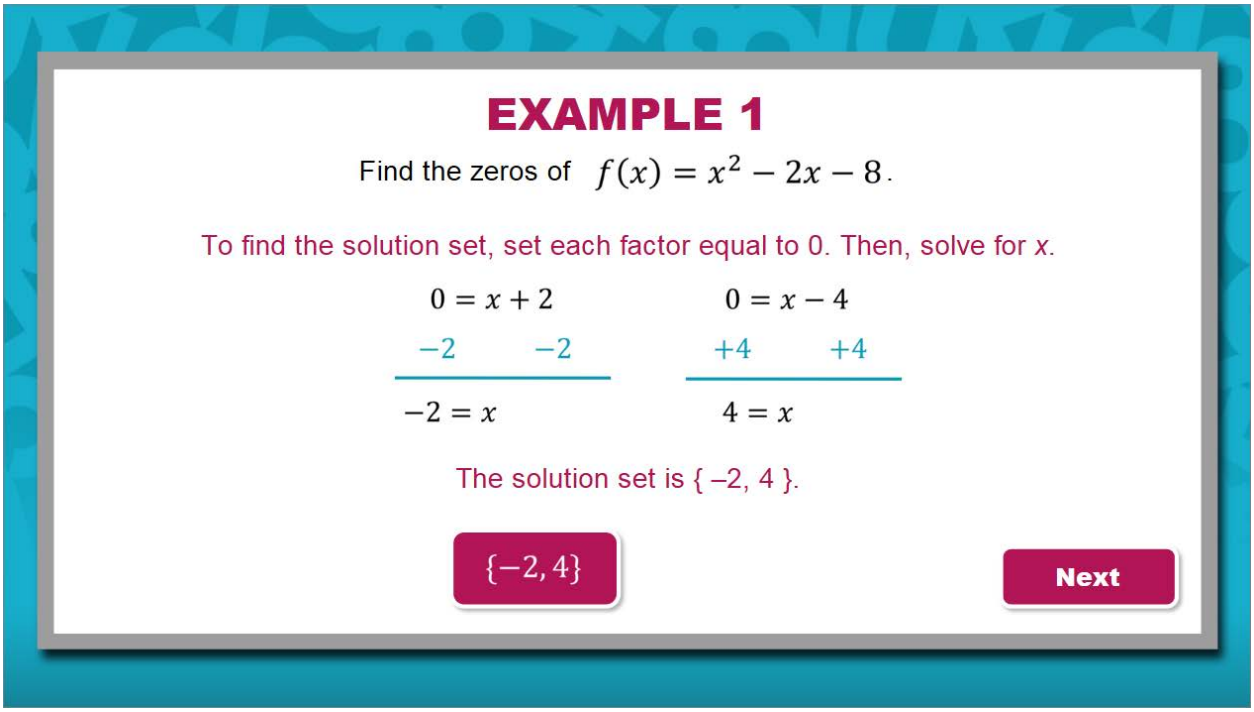
$$f(x) = x^2 - 2x - 8$$
$$0 = x^2 - 2x - 8$$
$$0 = (x + 2)(x - 4)$$

Find the solutions to the quadratic equation by setting each factor equal to 0.

Which of the following represents the solution set of the equation $0 = (x + 2)(x - 4)$?

A) $\{-4, -2\}$
B) $\{2, 4\}$
C) $\{-2, 4\}$
D) D)$\{-4, 2\}$

Example One (continued)



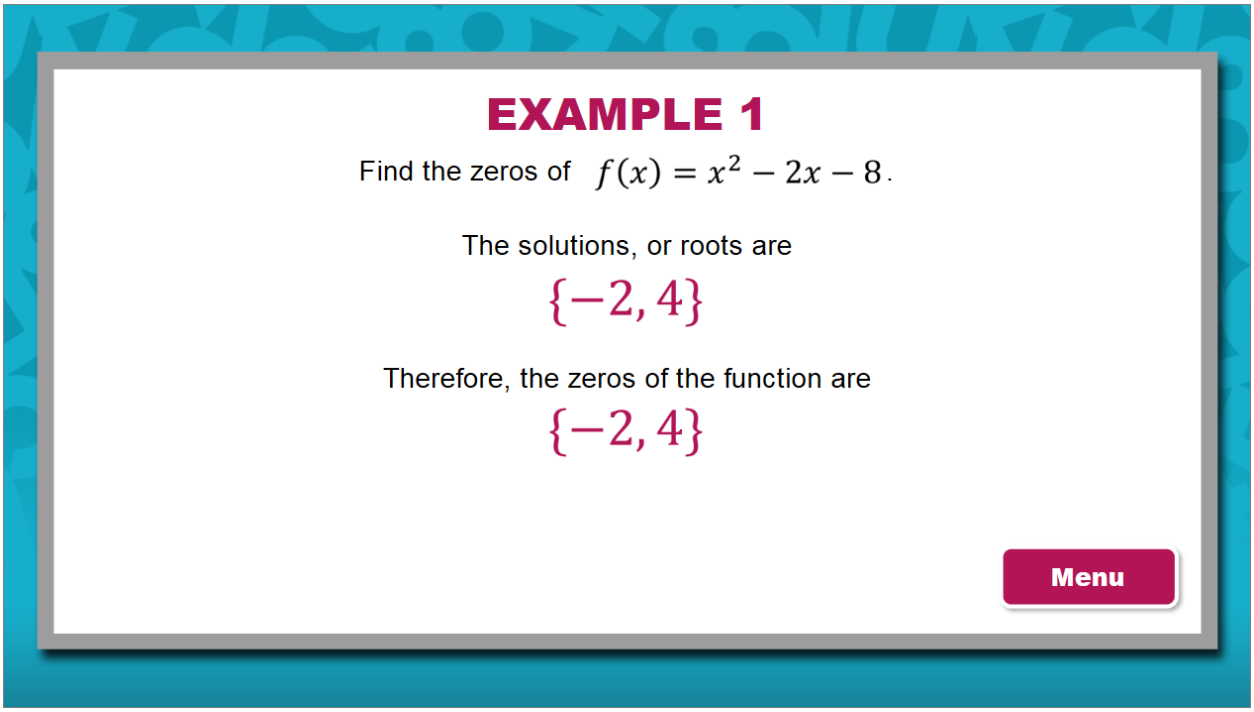
Find the zeros of $f(x) = x^2 - 2x - 8$.

To find the solution set, set each factor equal to 0. Then, solve for x.

$$\begin{array}{rcl} 0 & = & x + 2 \\ -2 & & -\ 2 \\ \hline -2 & = & x \end{array} \qquad \begin{array}{rcl} 0 & = & x - 4 \\ +4 & & +\ 4 \\ \hline 4 & = & x \end{array}$$

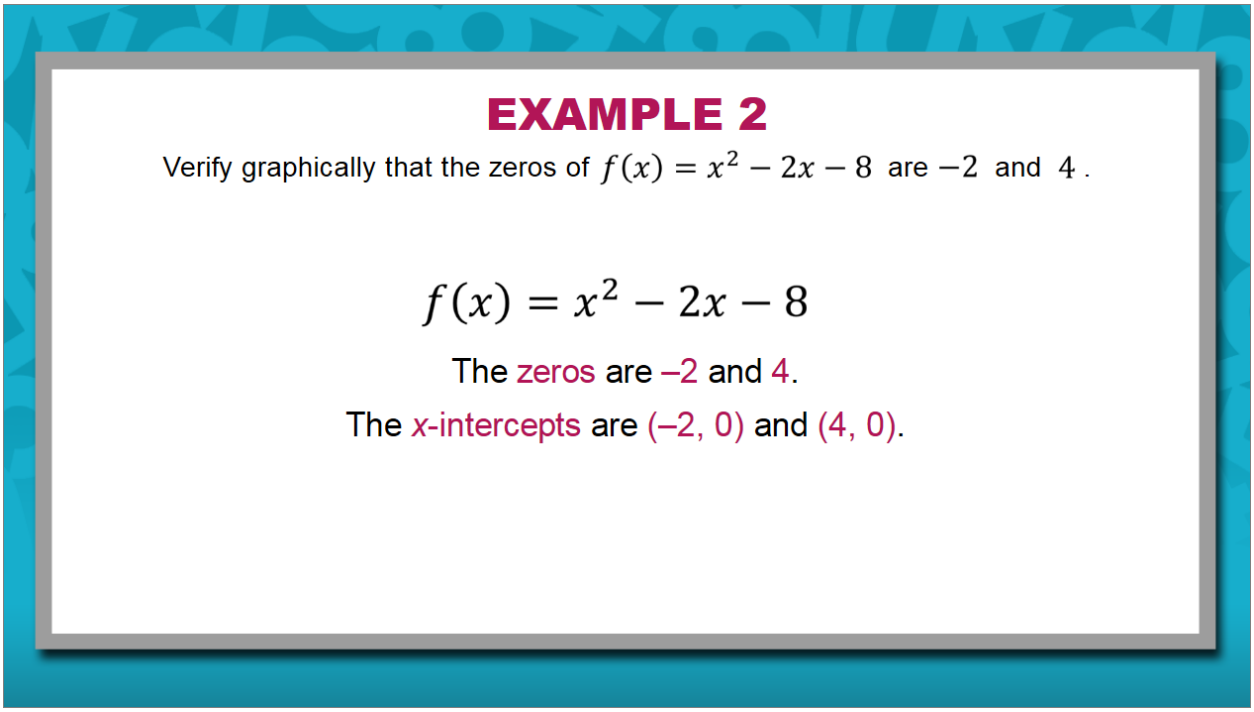
The solution set is $\{-2, 4\}$.

Example One (continued)



The solutions, or roots as they are also referred to, are -2 and 4. Therefore, you can conclude that the zeros of the function are -2 and 4.

Example Two

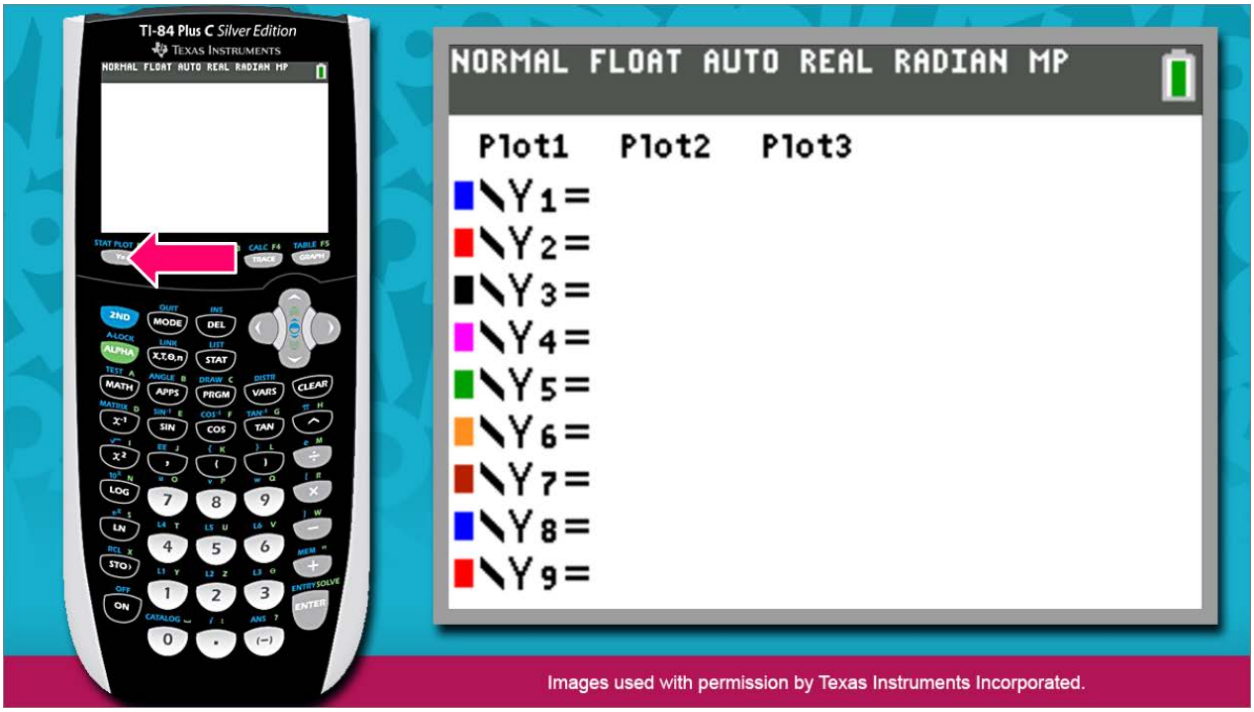


Verify graphically that the zeros of $f(x) = x^2 - 2x - 8$ are -2 and 4.

In the first example, you found the zeros of the given quadratic function algebraically.

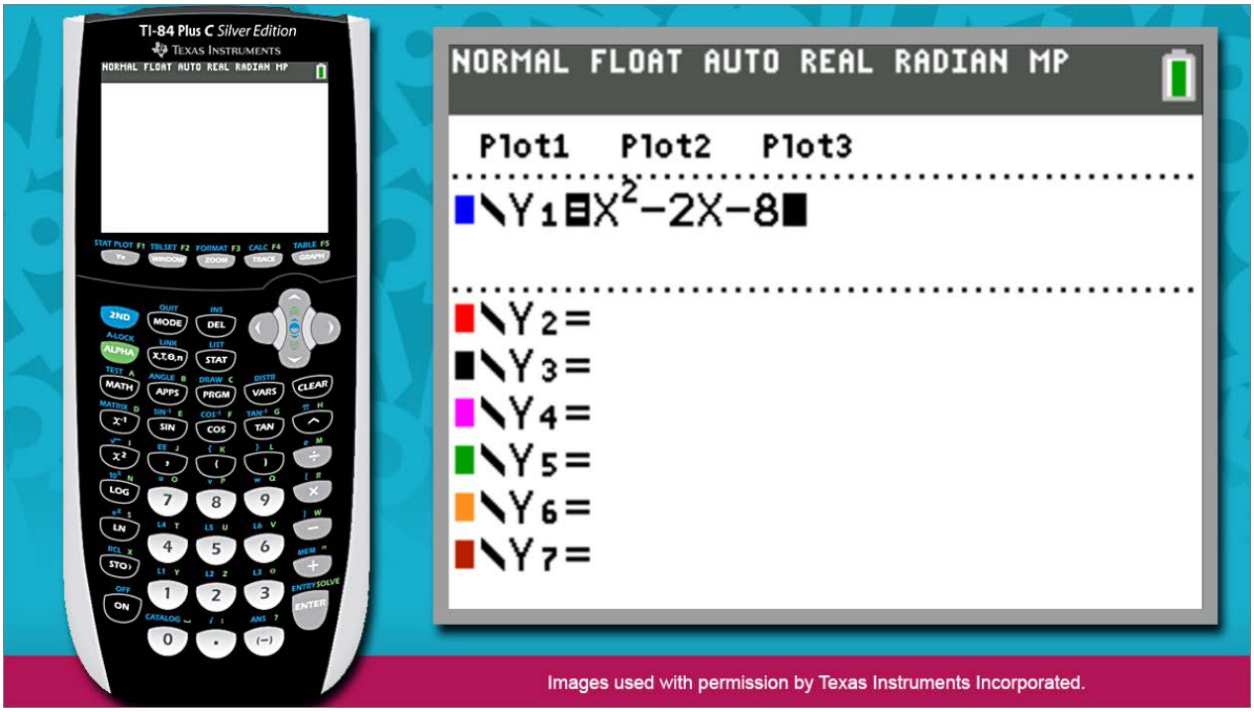
The zeros inform you of the locations of the function's x-intercepts. You can verify this using the graphing calculator.

Example Two (continued)



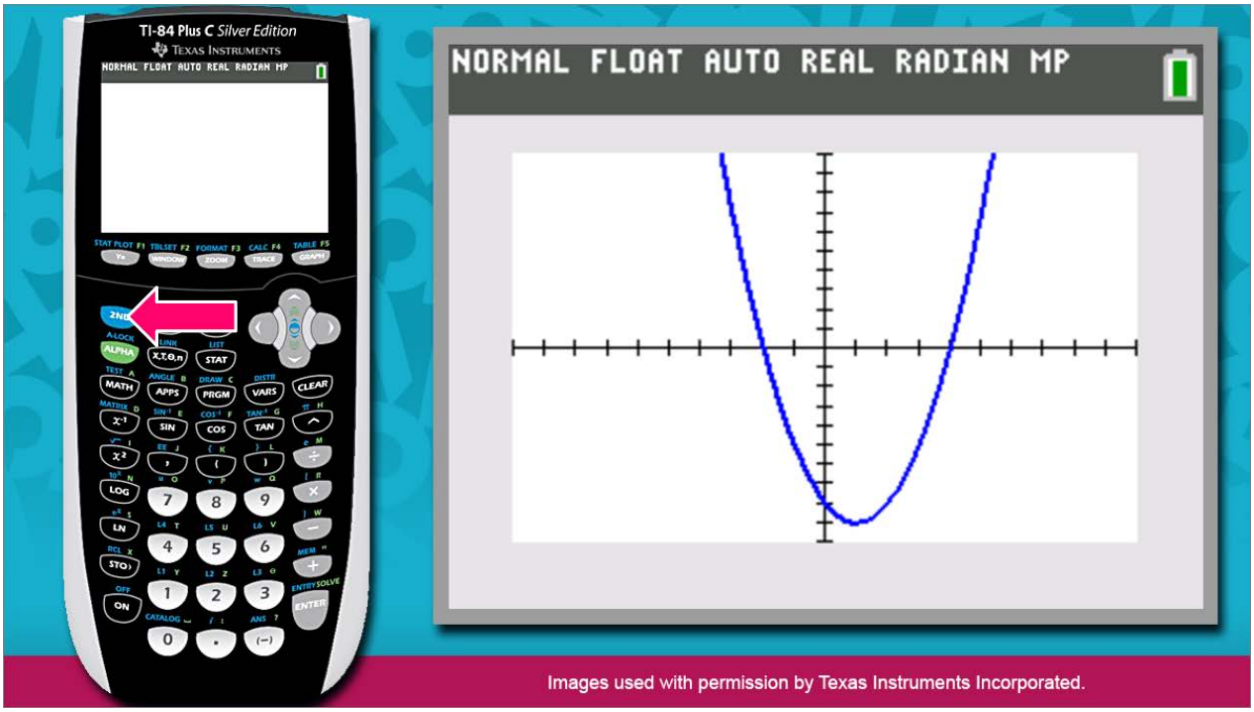
Press the Y= key.

Example Two (continued)



Now, enter the polynomial expression $x^2 - 2x - 8$ to the right of Y1.

Example Two (continued)

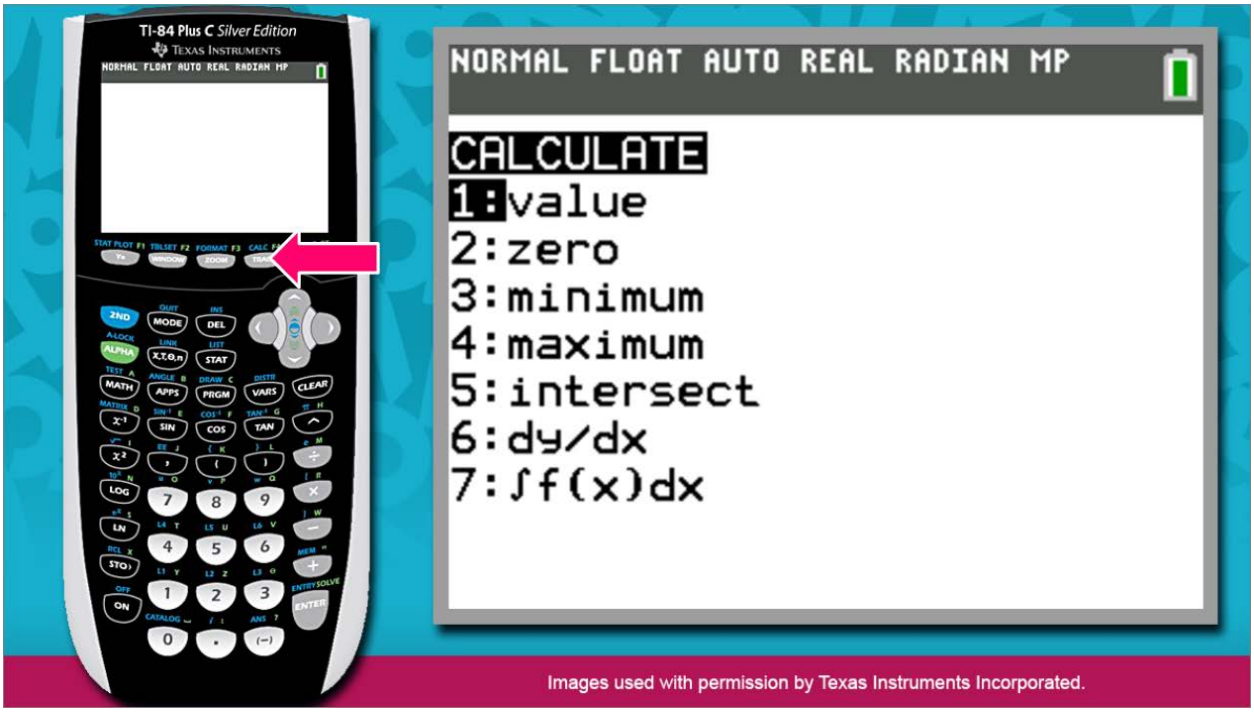


Now, press GRAPH.

You can now move on to identify the x-intercepts.

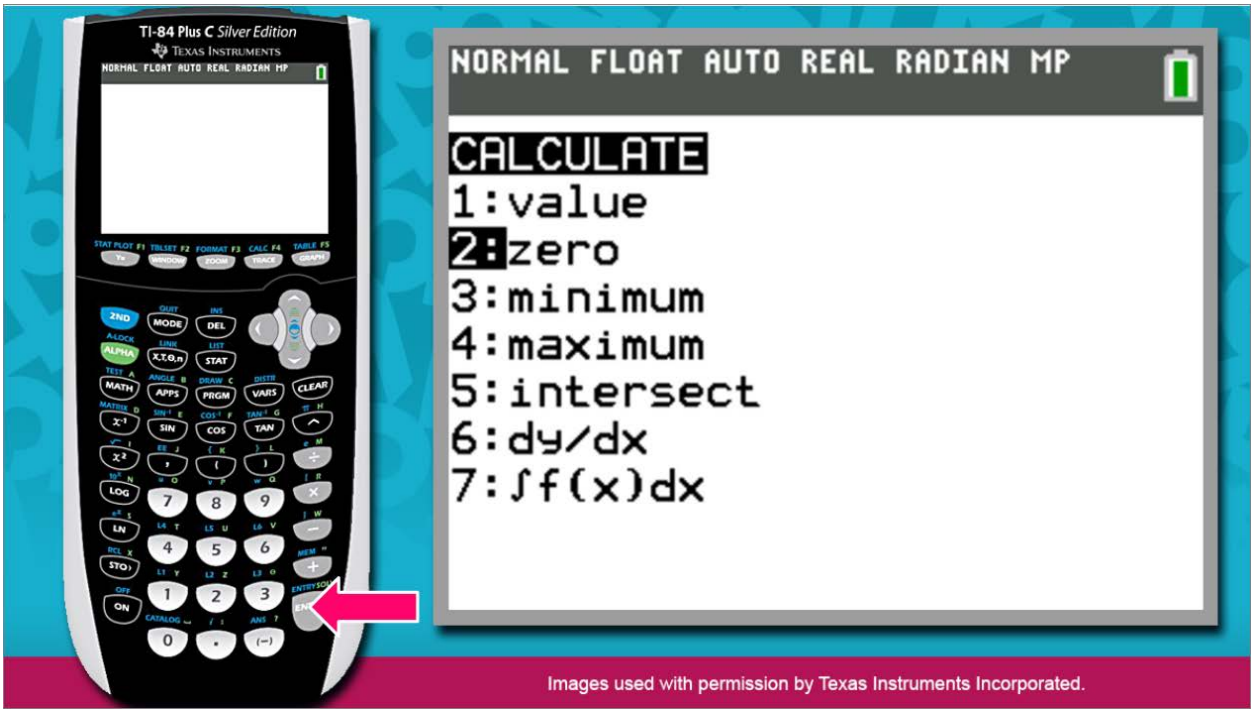
Press 2nd. This key is located directly above the green ALPHA key. It allows you to access a function stamped above a calculator key.

Example Two (continued)



Next, press TRACE, to access the CALCULATE menu. You'll notice a list of options appear on the screen.

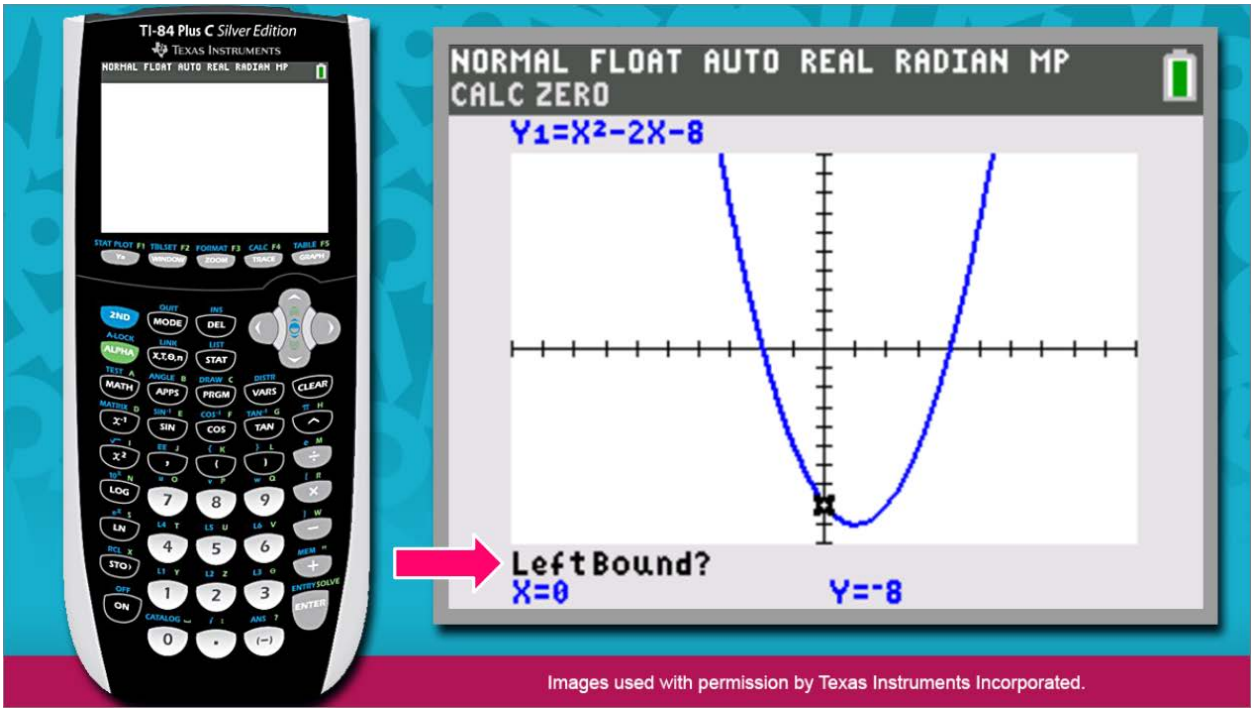
Example Two (continued)



Press the down arrow so that the cursor moves to the second option in the list, the zero option.

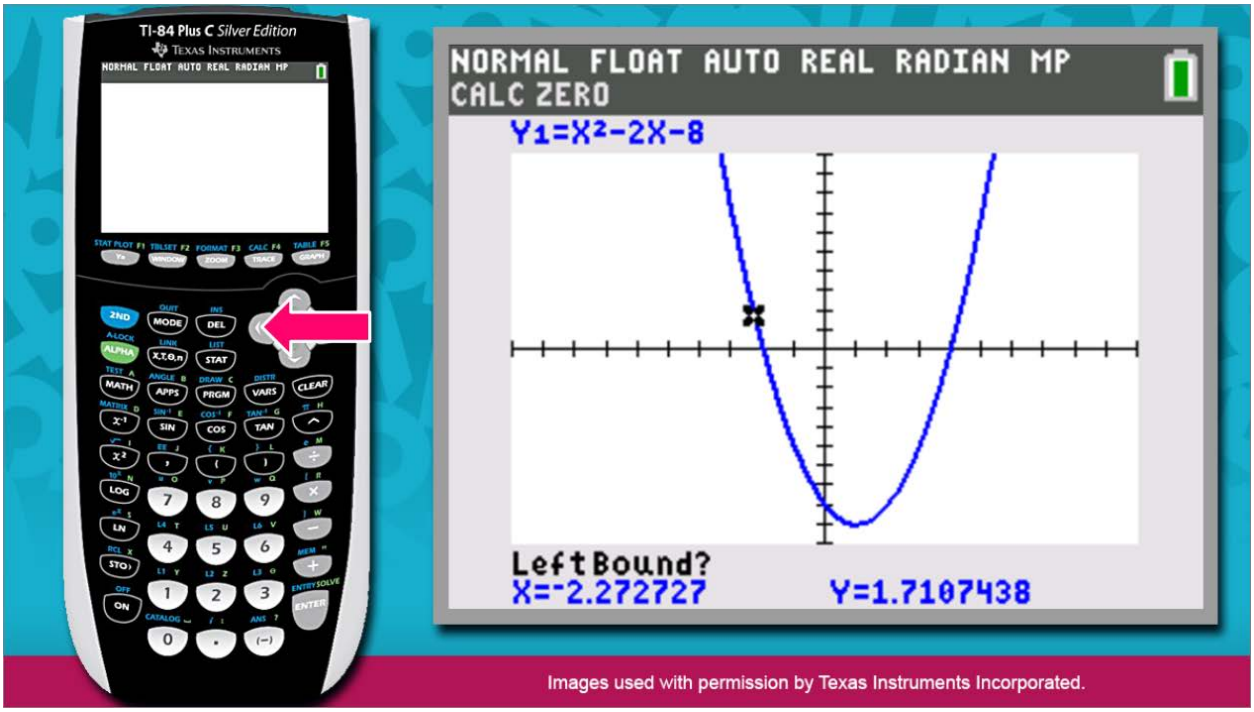
Now, press ENTER.

Example Two (continued)



The calculator is now prepared to identify an x-intercept. You'll notice a question appear in the bottom left corner of the window. The calculator is prompting you to set a left boundary for the region in which you would like for it to search for an x-intercept.

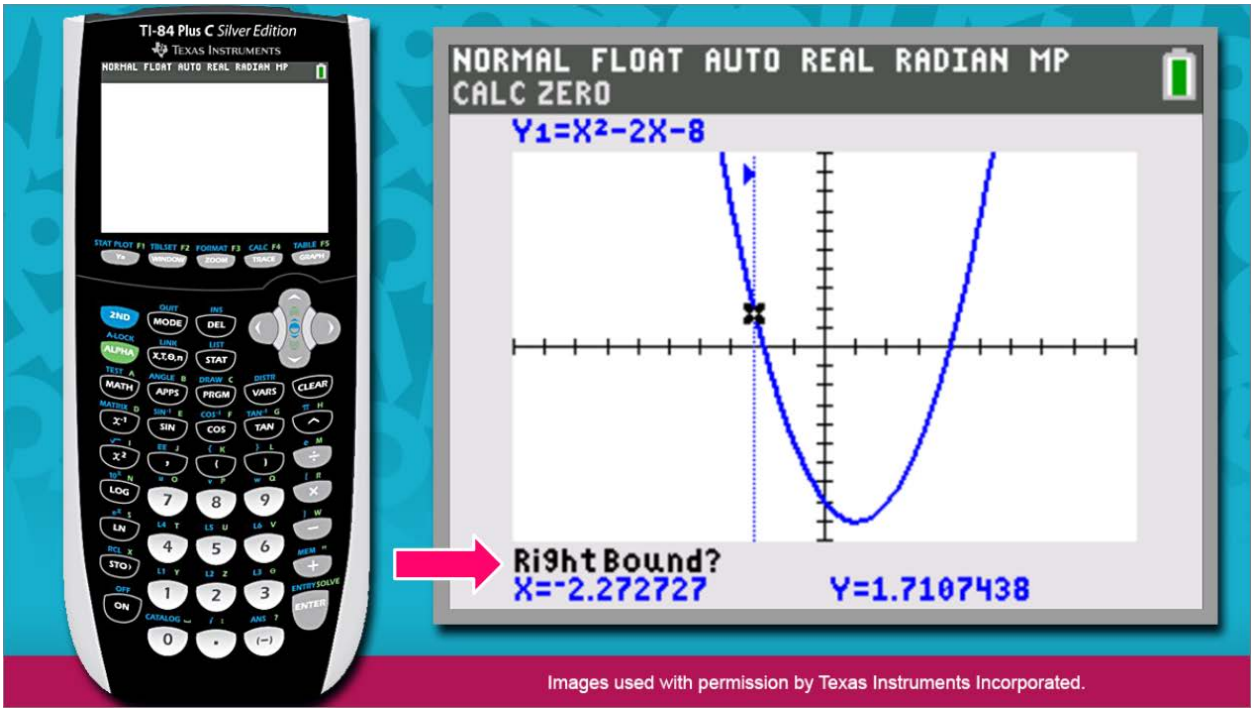
Example Two (continued)



Start by calculating the x-intercept on the left side of the graph.

Press the left arrow key until the cursor is blinking just slightly to the left of this x-intercept.

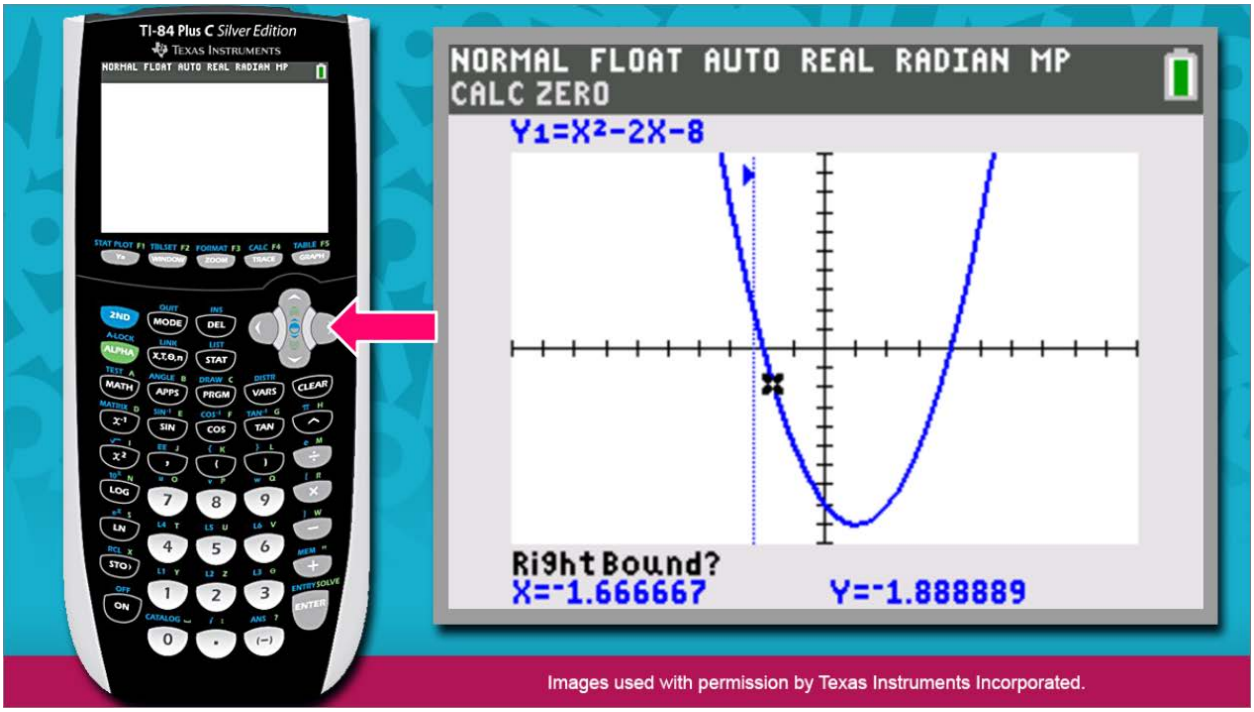
Example Two (continued)



Then, press ENTER.

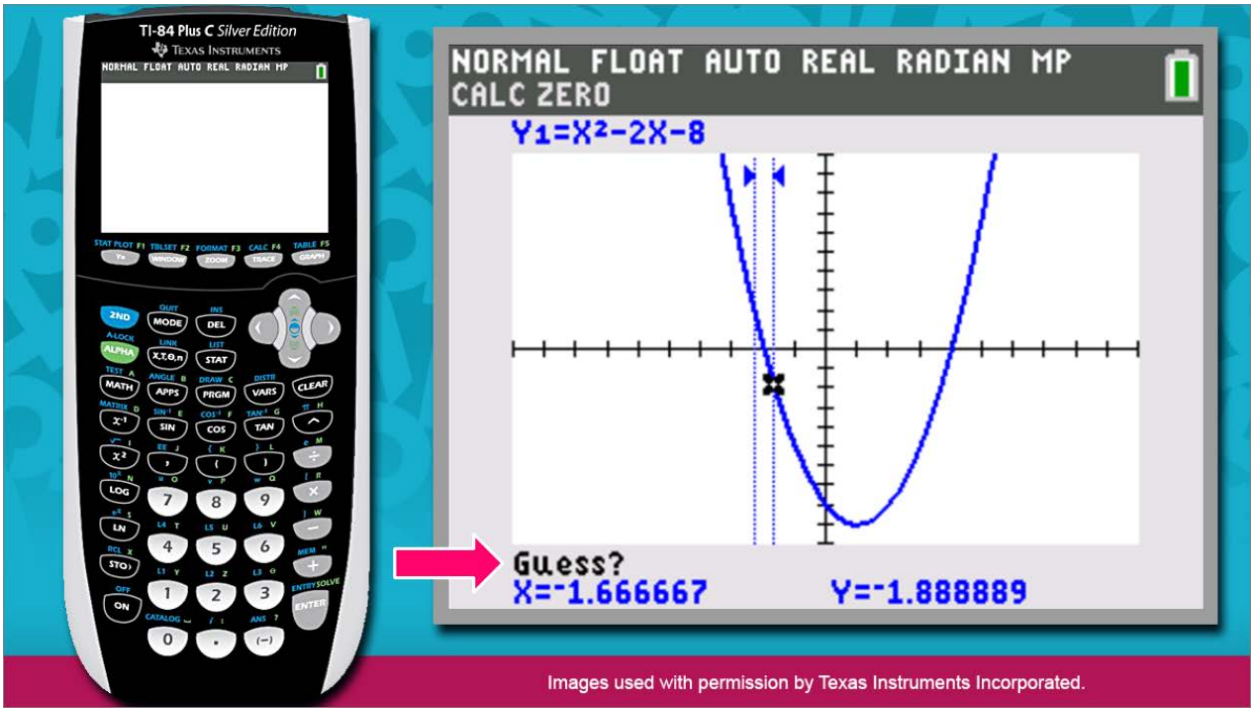
You'll notice that a vertical line now appears at the location of the left boundary. The calculator now prompts you to set the right boundary.

Example Two (continued)



Press the right arrow key until the cursor is blinking just slightly to the right of the x-intercept.

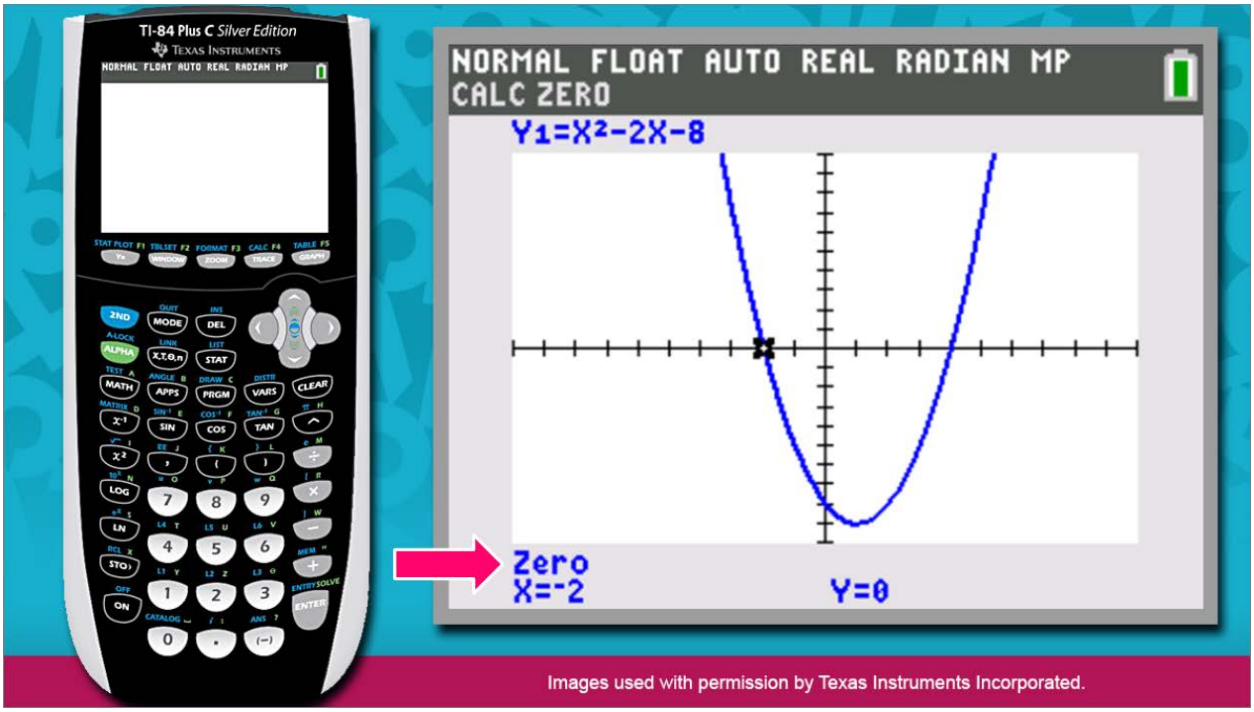
Example Two (continued)



Now, press ENTER.

You'll notice that a vertical line now appears at the location of the right boundary. In the bottom left corner of the window, you'll notice that the calculator is prompting you to confirm that you are ready for it to determine the location of the x-intercept.

Example Two (continued)



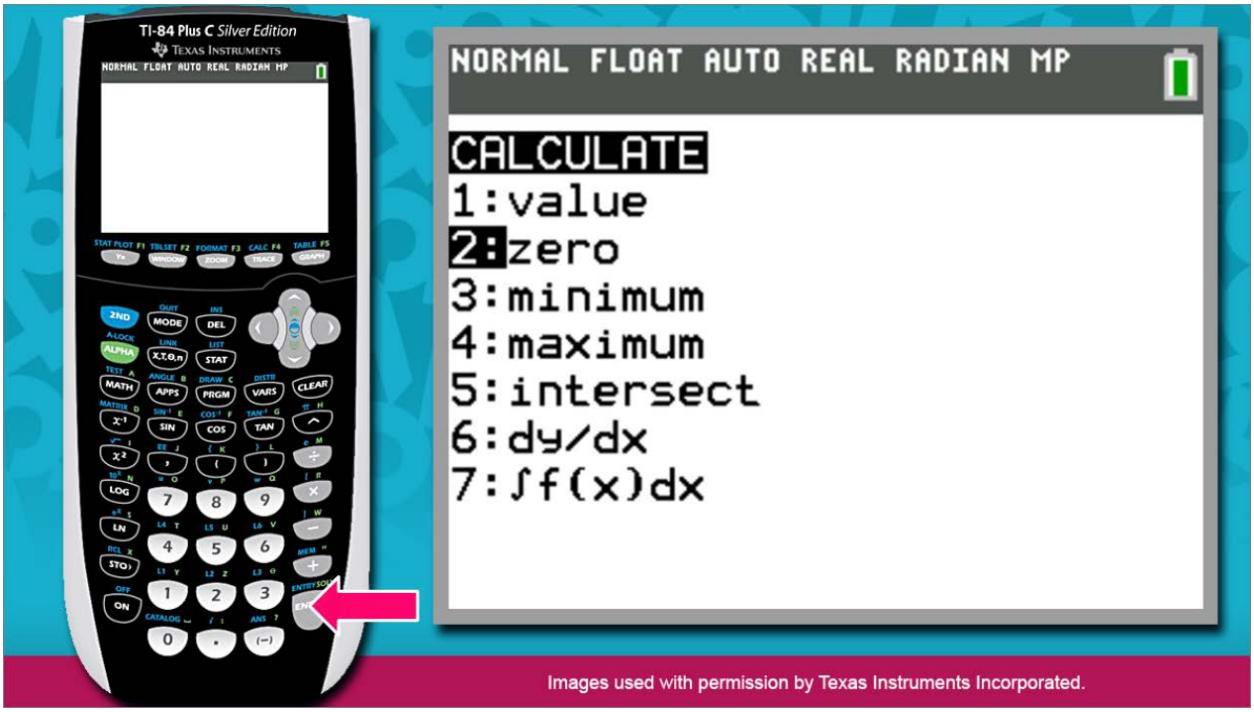
Press ENTER.

The cursor is now blinking at the location of the x-intercept: $(-2, 0)$.

Notice that at the bottom of the window, the calculator informs you that a zero of the function is -2.

Now, move on to determine the location of the x-intercept on the right side of the polynomial.

Example Two (continued)

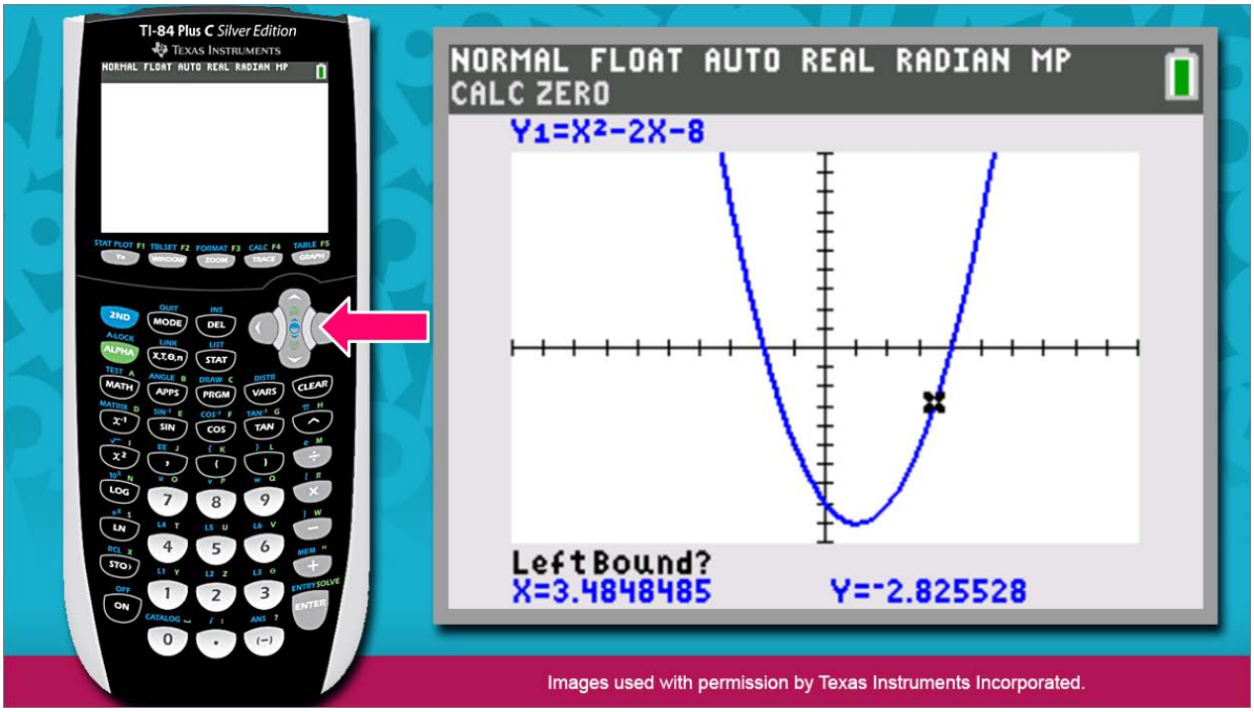


Press 2nd and then press trace, to access the CALCULATE menu.

Then, press the down arrow, so that the cursor moves to the zero option.

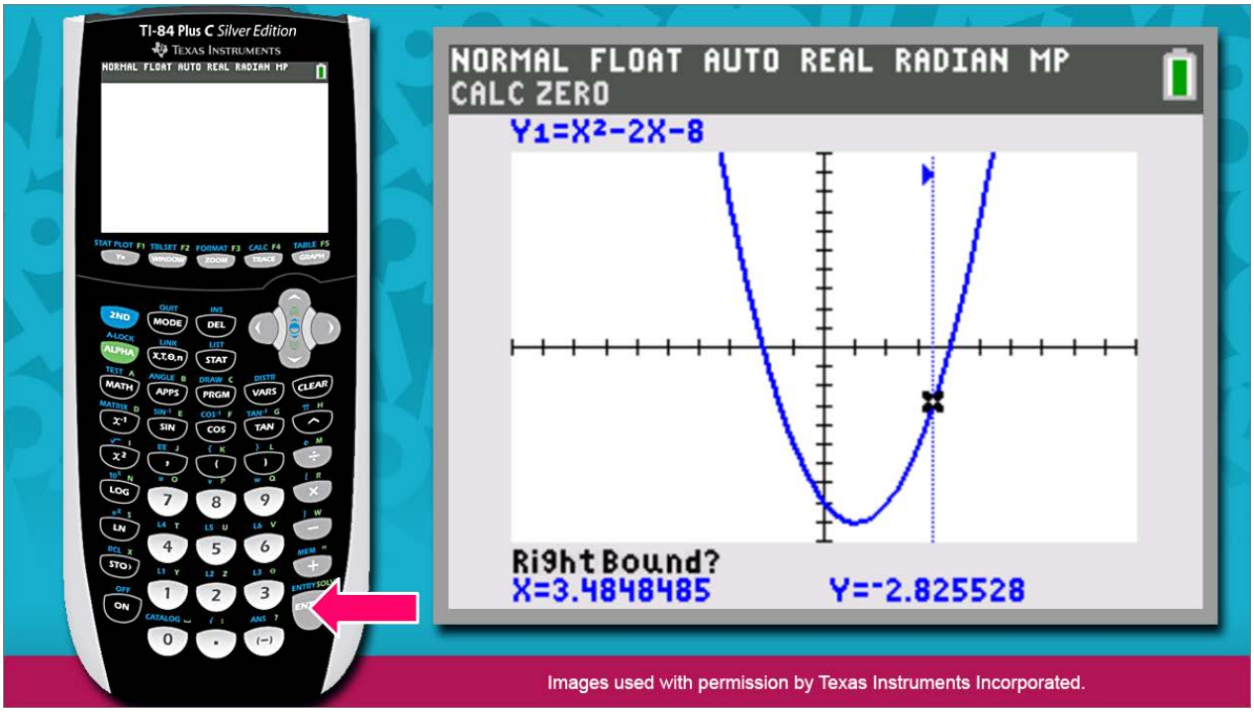
Press ENTER.

Example Two (continued)



Press the right arrow key until the cursor is slightly to the left of the x-intercept on the opposite side of the graph.

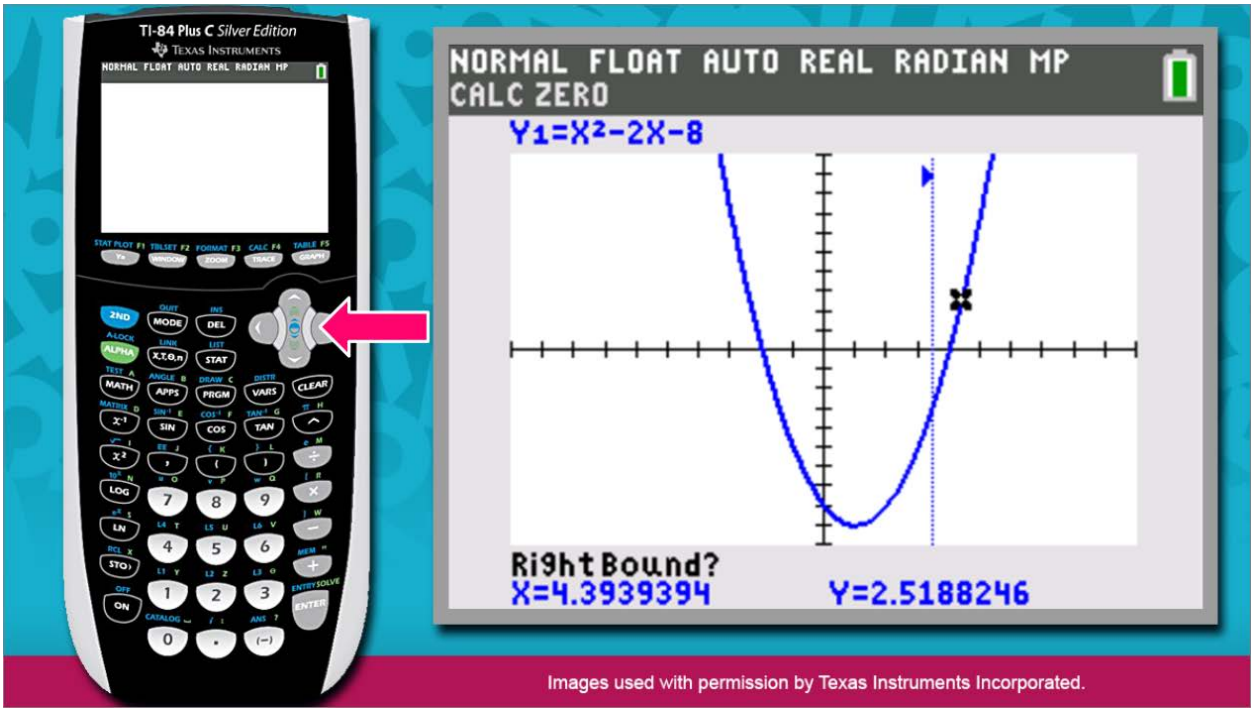
Example Two (continued)



Then, press ENTER.

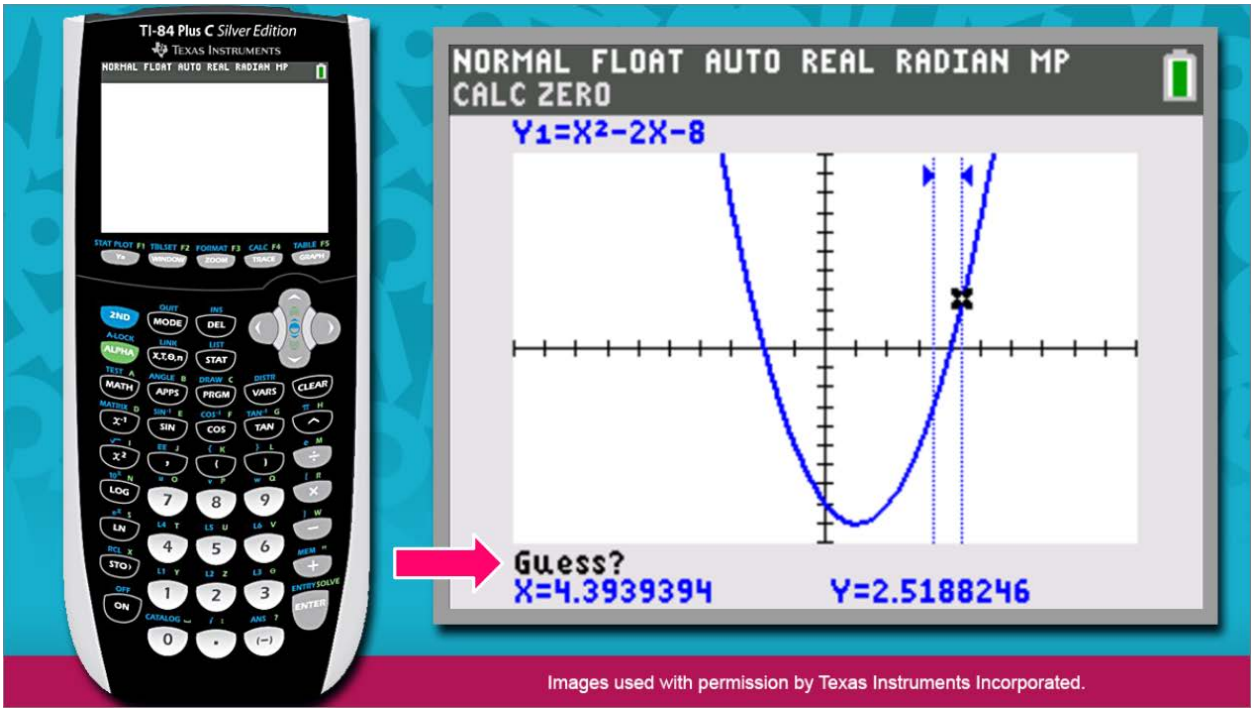
You'll notice that a vertical line now appears at the location of the left boundary. The calculator now prompts you to set the right boundary.

Example Two (continued)



Press the right arrow key until the cursor is slightly to the right of the x-intercept.

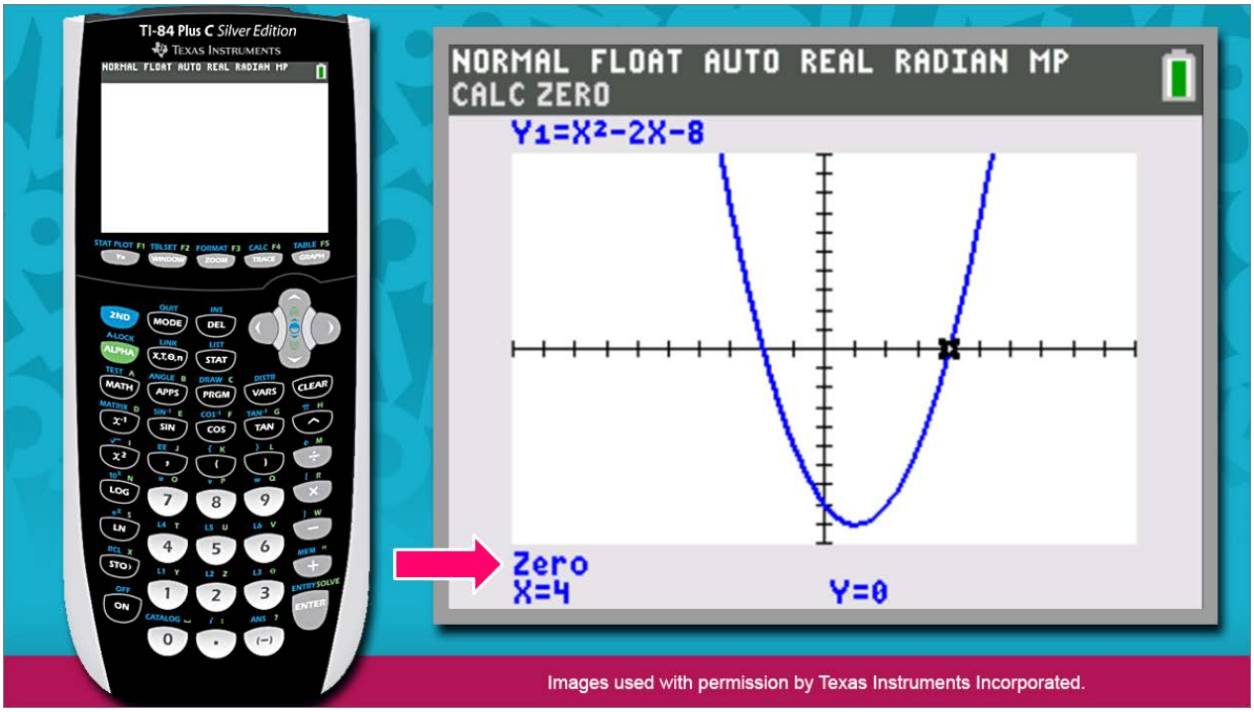
Example Two (continued)



Now, press ENTER.

You'll notice that a vertical line now appears at the location of the right boundary. The calculator now prompts you to confirm that you ready for it to determine the location of the x-intercept.

Example Two (continued)

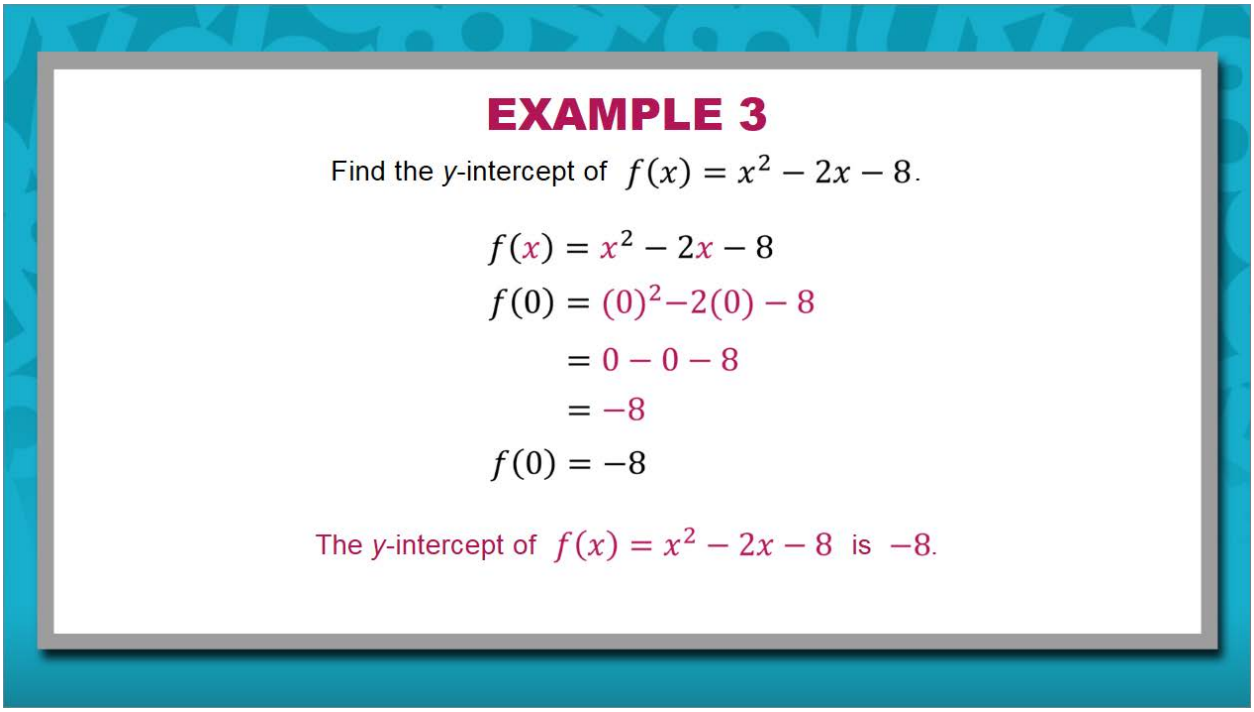


Press ENTER.

You'll notice the cursor is blinking at the location of the x-intercept $(4, 0)$.

At the bottom of the window, you'll also notice that the calculator informs you that this zero is located at $x = 4$.

Example Three



Find the y-intercept of $f(x) = x^2 - 2x - 8$

$$f(x) = x^2 - 2x - 8$$

$$f(0) = (0)^2 - 2(0) - 8$$

To determine the y-intercept of the given function algebraically, find $f(0)$. Begin by substituting 0 for x. Then, simplify the expression on the right side of the equation.

$$\begin{aligned} f(0) &= (0)^2 - 2(0) - 8 \\ &= 0 - 0 - 8 \\ &= -8 \end{aligned}$$

$0^2 = 0$. Bring down the subtraction sign.
$2 \cdot 0 = 0$.
Bring down the subtraction sign and 8.
$0 - 0 - 8 = -8$.

$f(0) = -8$

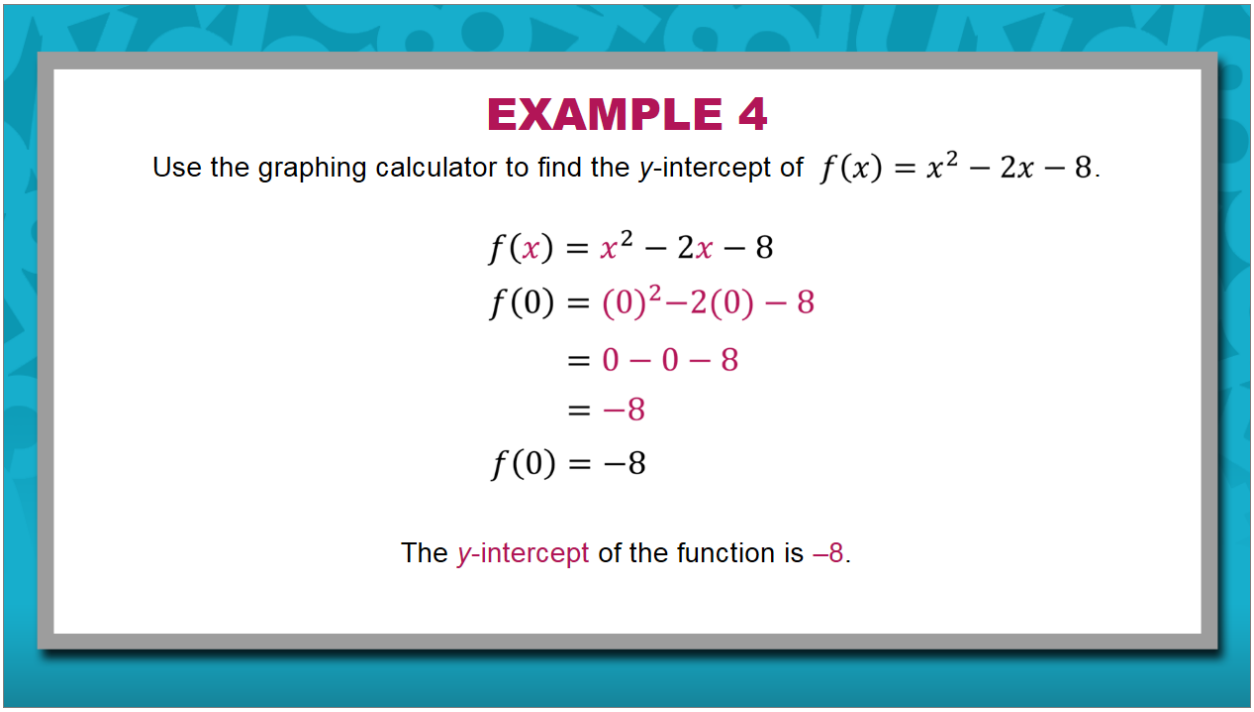
The y-intercept of $f(x) = x^2 - 2x - 8$ is -8.

Your work is complete.

$f(0) = -8$.

Therefore, the y-intercept of the function is -8.

Example Four

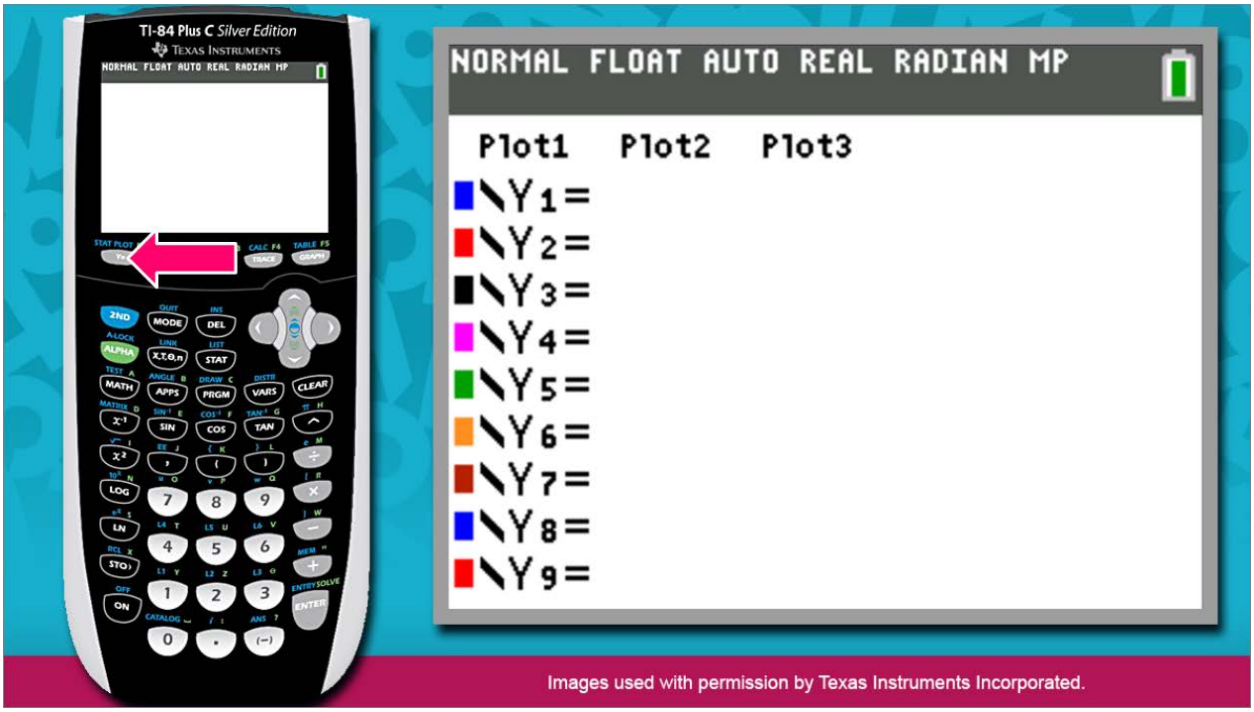


Use the graphing calculator to find the y-intercept of $f(x) = x^2 - 2x - 8$.

$$f(x) = x^2 - 2x - 8$$
$$f(0) = (0)^2 - 2(0) - 8$$
$$= 0 - 0 - 8$$
$$= -8$$

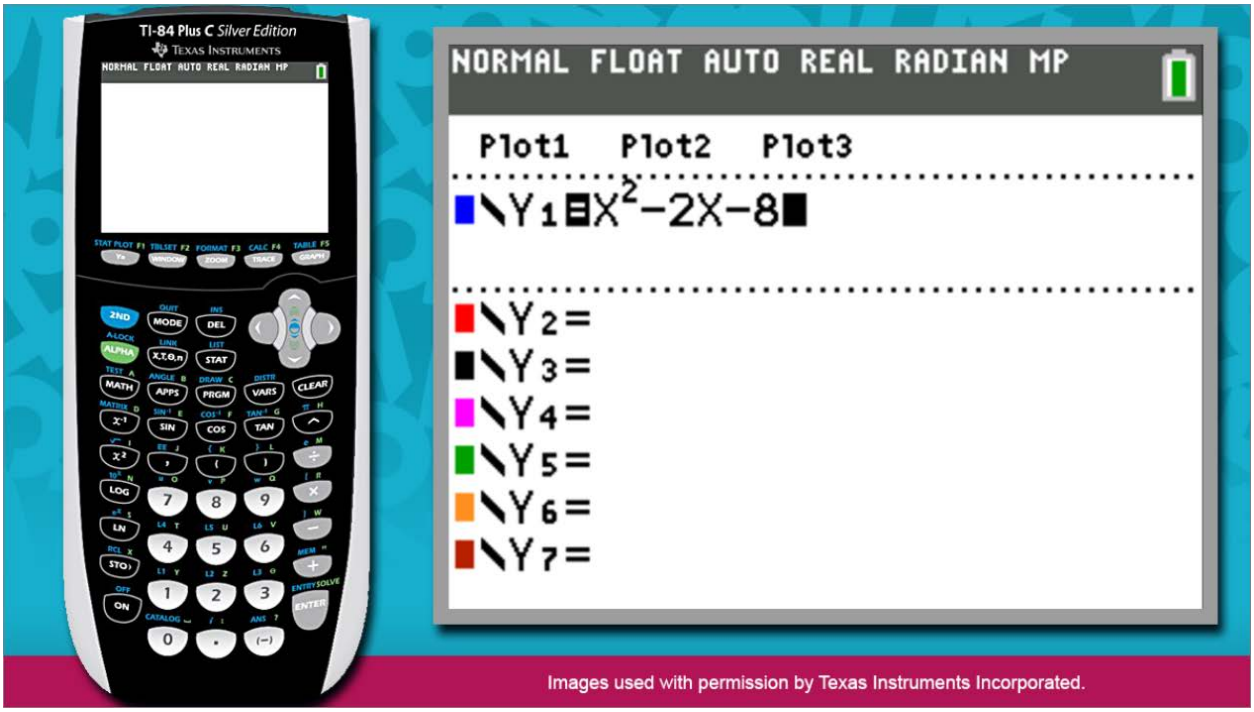
In Example 3, you evaluated $f(0)$ to determine that the y-intercept of the function is -8. You can use the graphing calculator to confirm your results.

Example Four (continued)



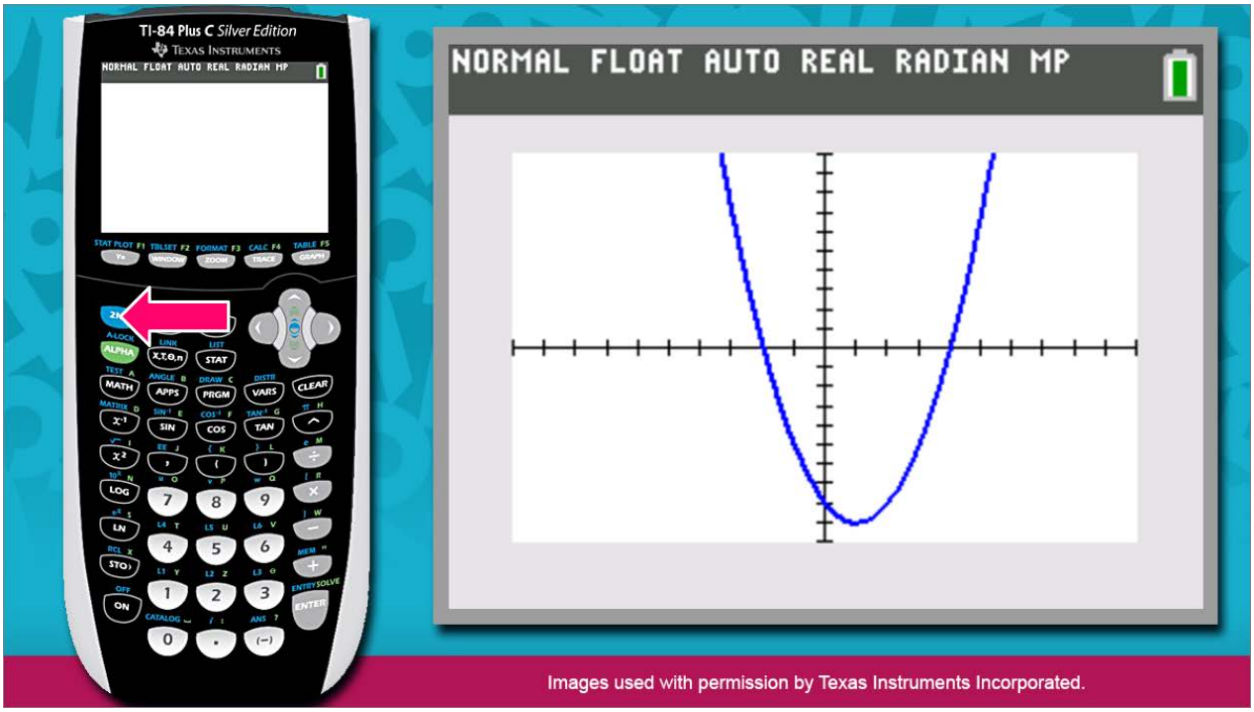
Press the Y= key.

Example Four (continued)



Enter the expression $x^2 - x - 8$ to the right of Y1.

Example Four (continued)

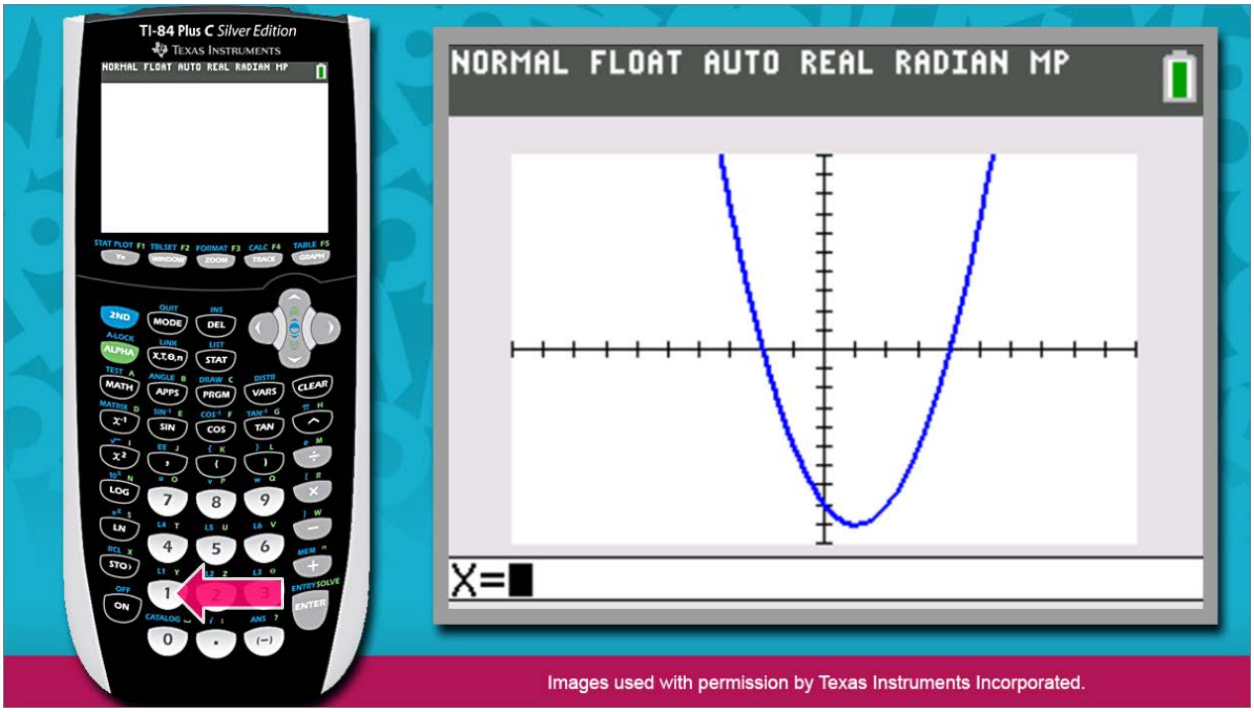


Now, press GRAPH.

You can now move on to identify the y-intercept.

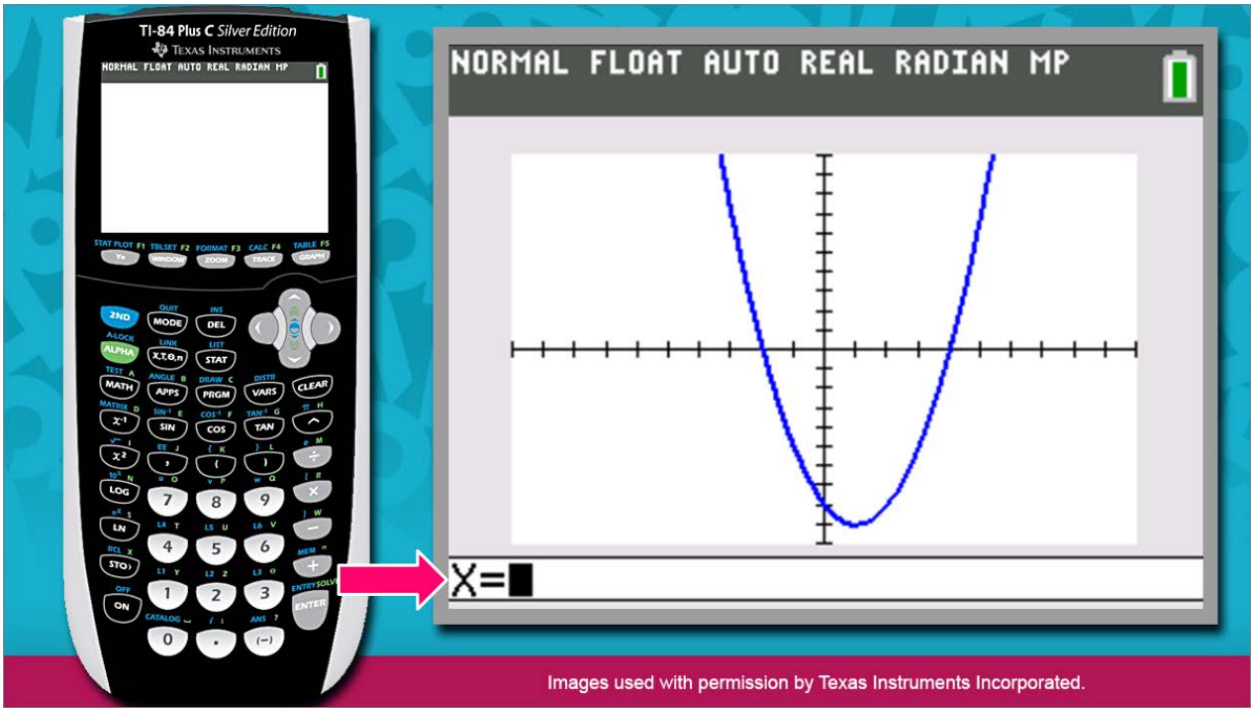
Press 2nd.

Example Four (continued)



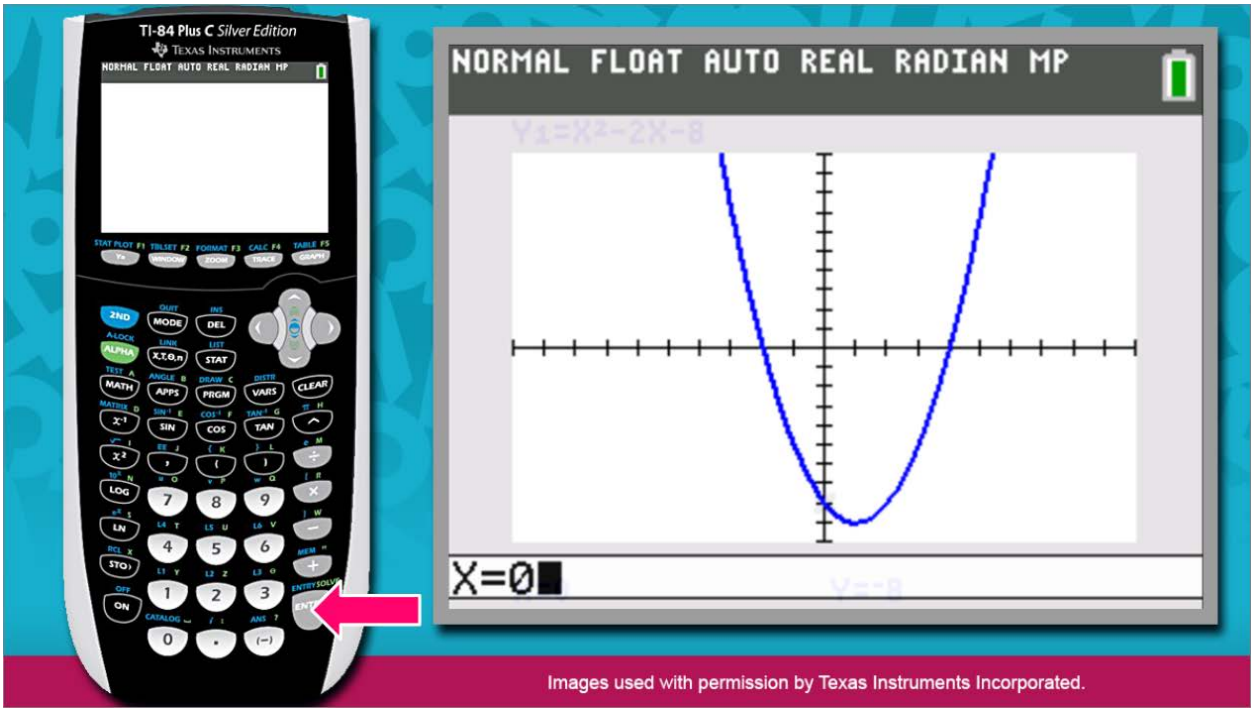
Next, press TRACE to access the CALCULATE menu. Press 1 to select the value option. This option allows you to enter an input value.

Example Four (continued)



Notice in the bottom left corner of the window that the calculator is prompting you to enter a value for x.

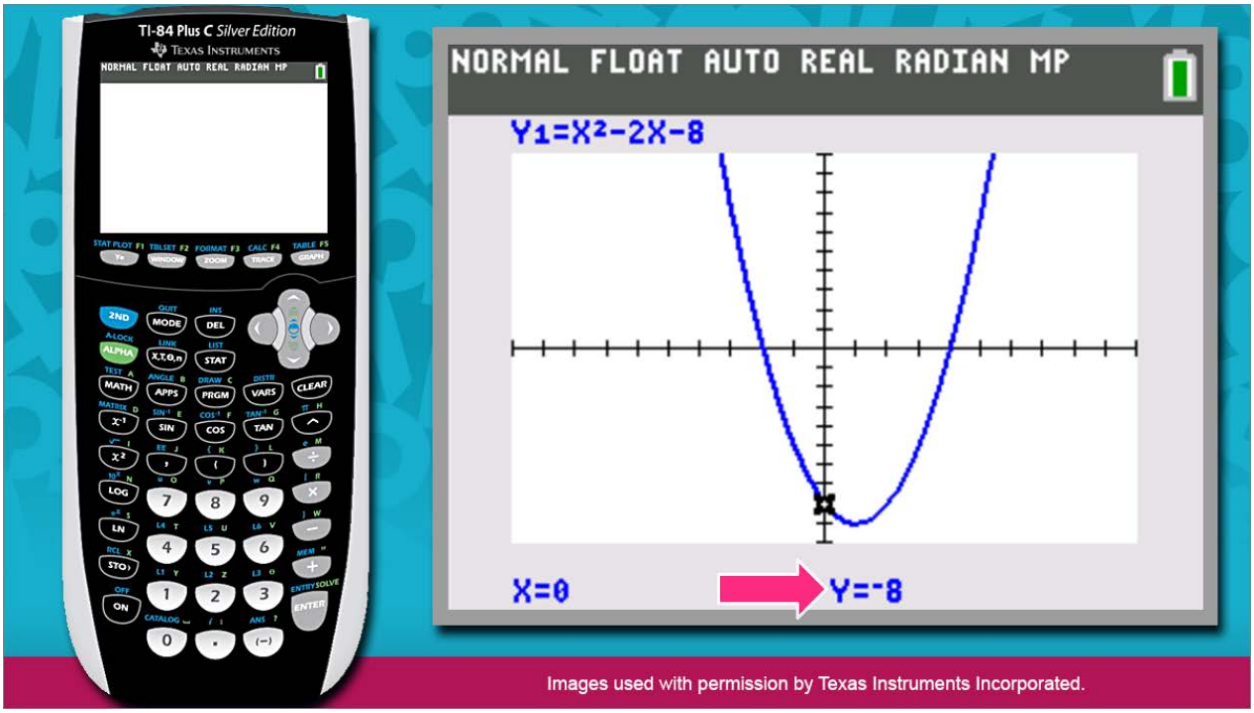
Example Four (continued)



Recall that the y-intercept is the output value that results when the input value is 0.

Press 0. Then, press ENTER.

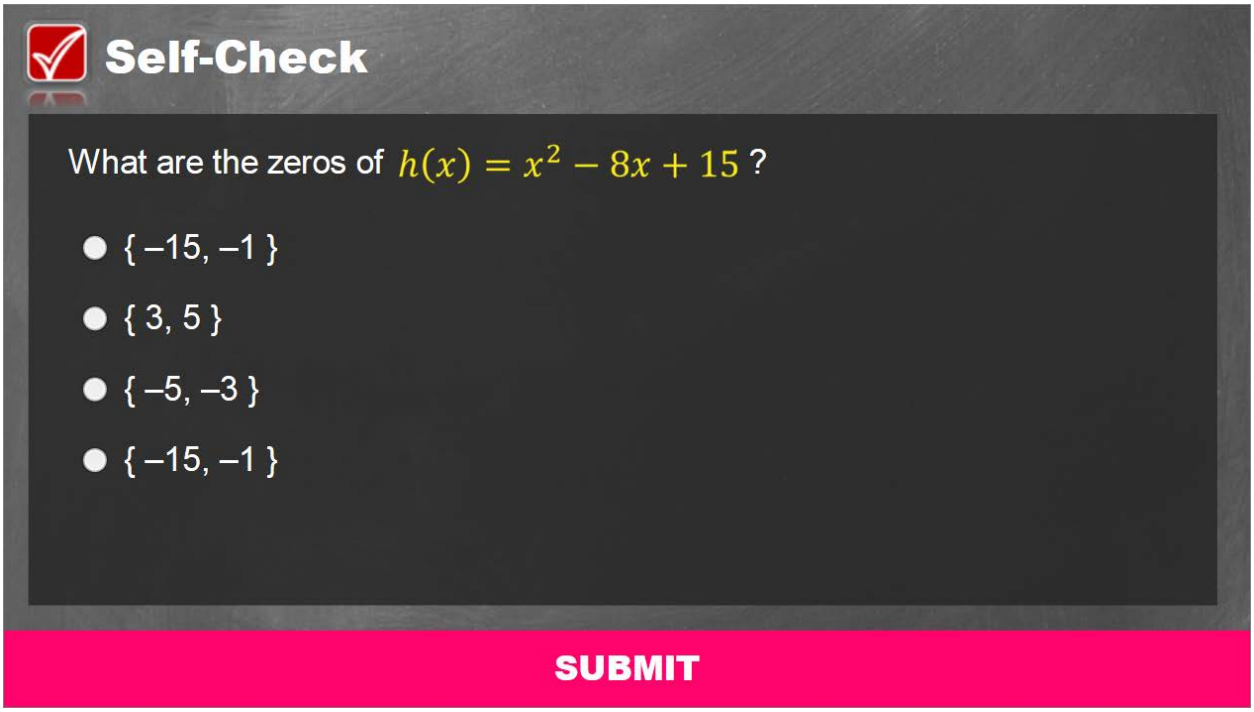
Example Four (continued)



The cursor is blinking at the location of the y-intercept $(0, -8)$.

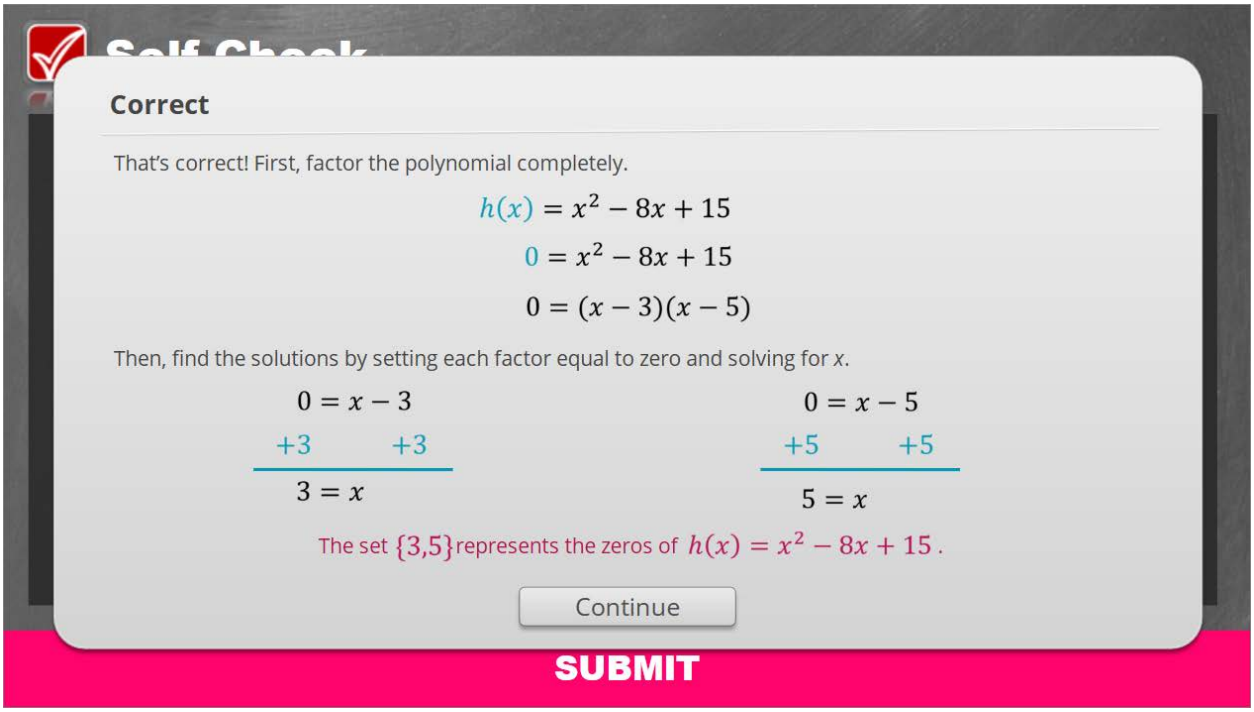
At the bottom of the window, notice that the calculator now informs you that when $x = 0$, $y = -8$.

Self-Check 1



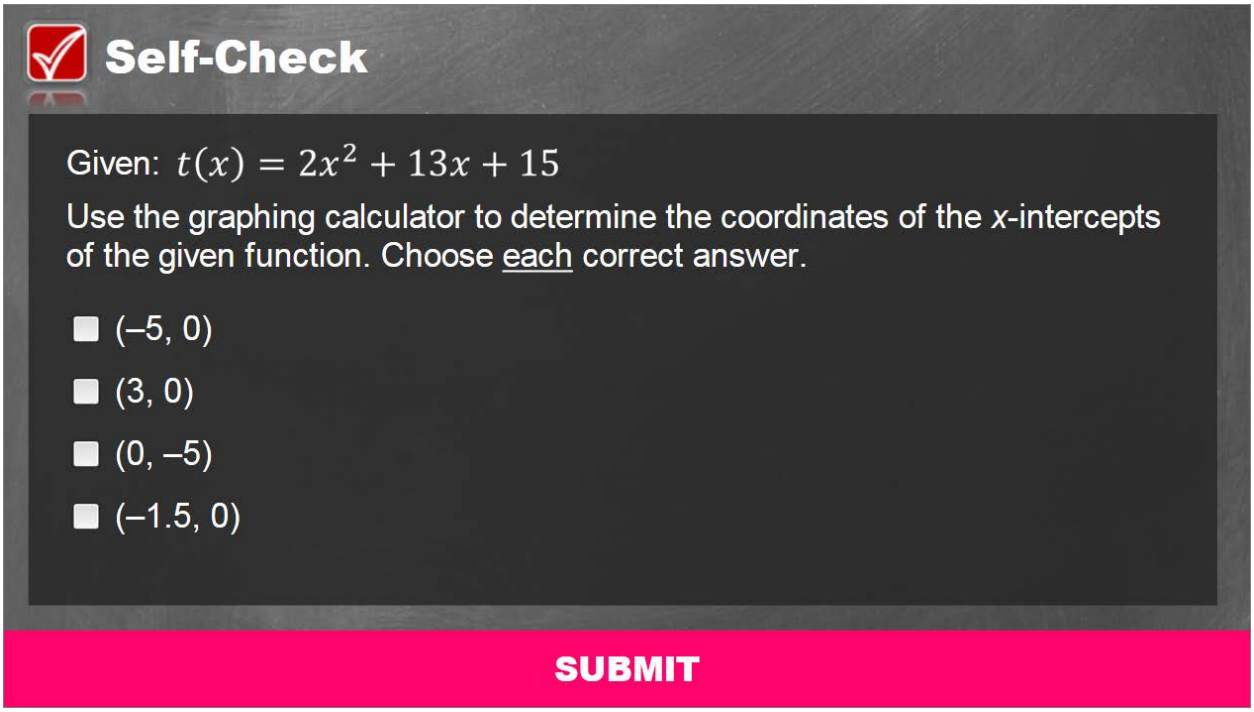
Solve the problem in the image above to check your understanding of the content.

Self-Check 1: Answer



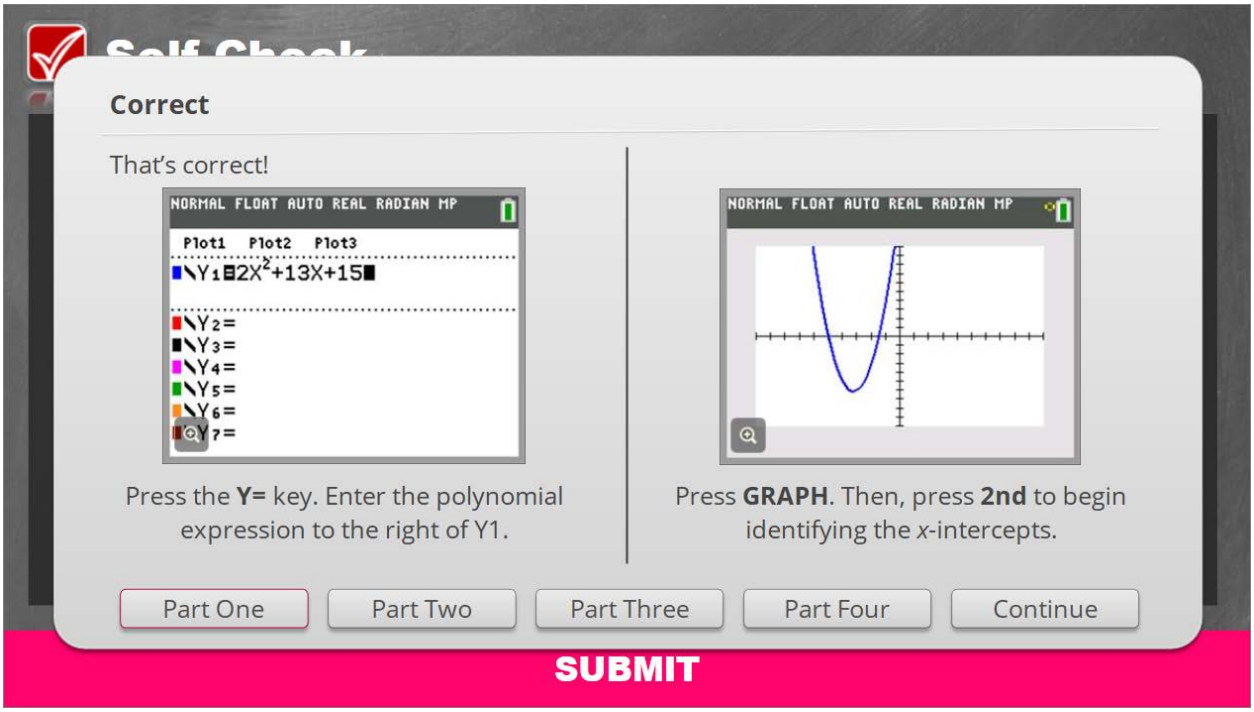
For your reference, the image above shows the correct solution to the self-check problem.

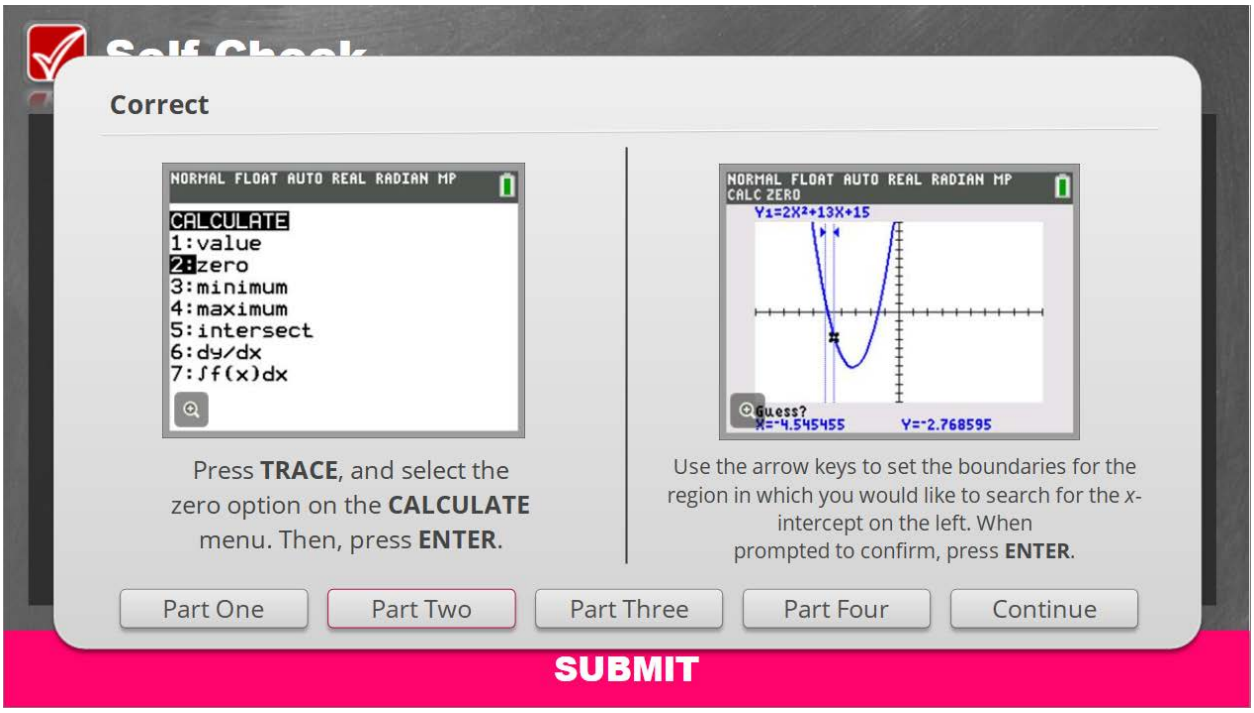
Self-Check 2



Solve the problem in the image above to check your understanding of the content.

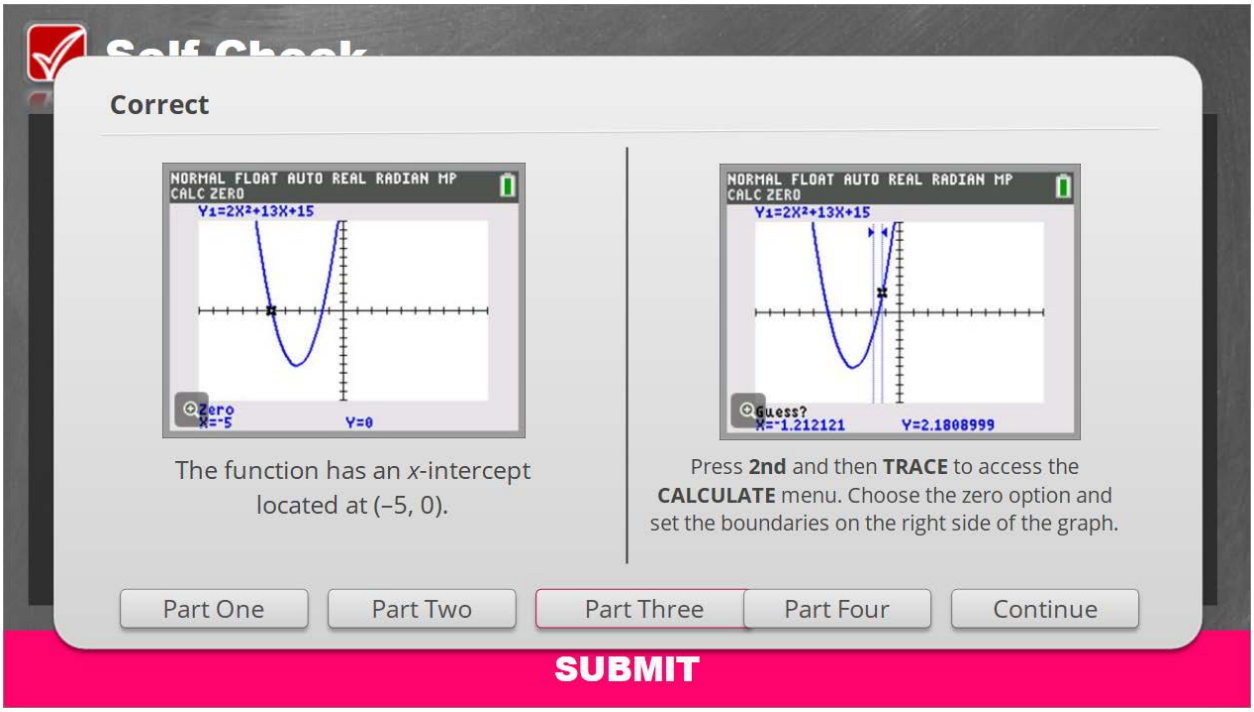
Self-Check 2: Answer

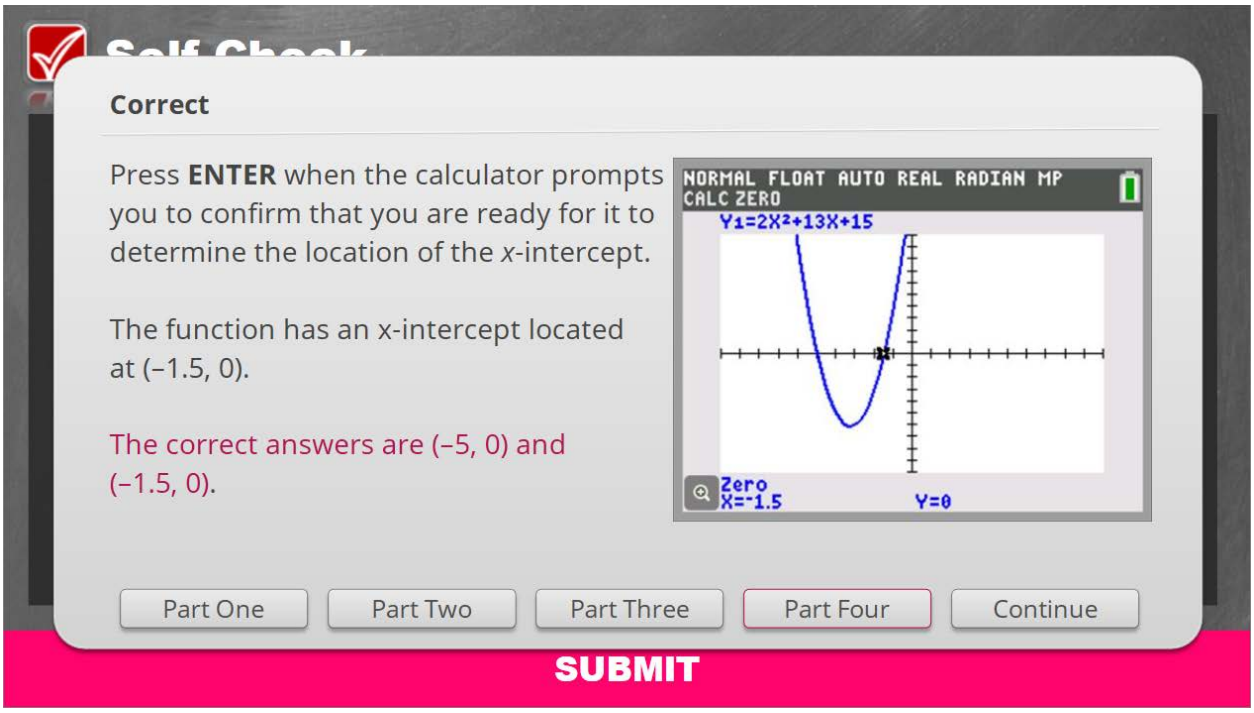




For your reference, the images above show the correct solution to the self-check problem.

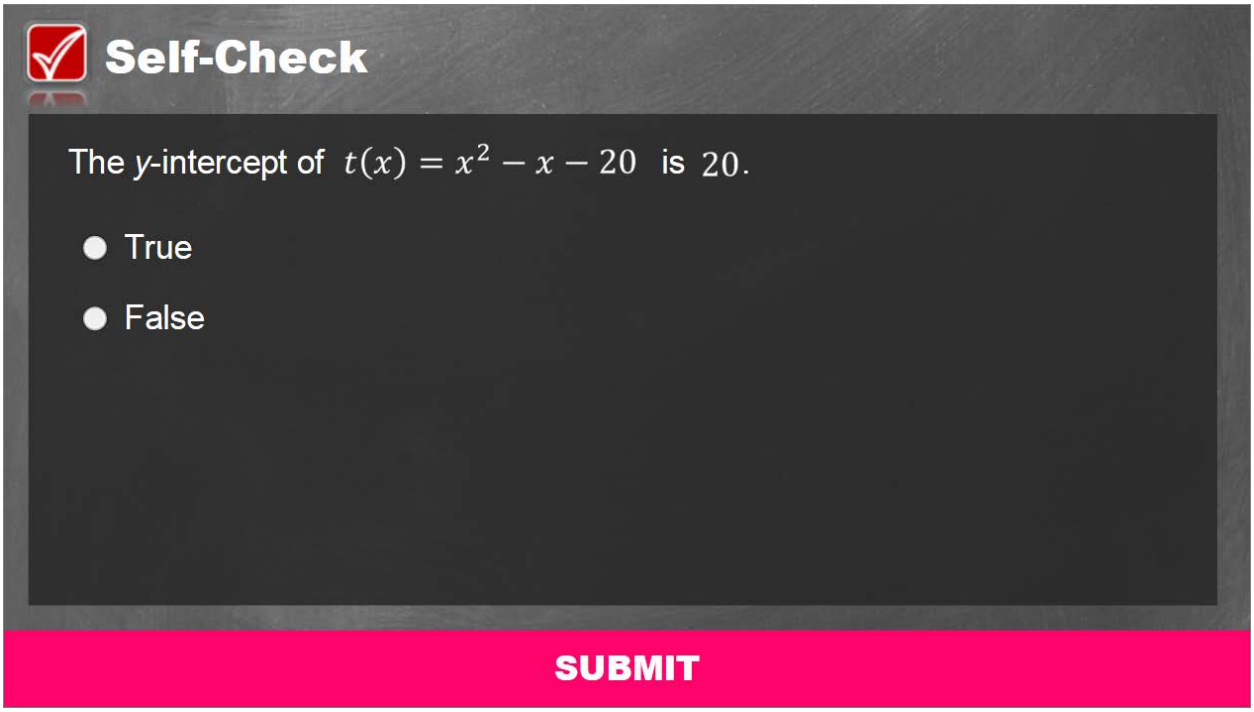
Self-Check 2: Answer (continued)





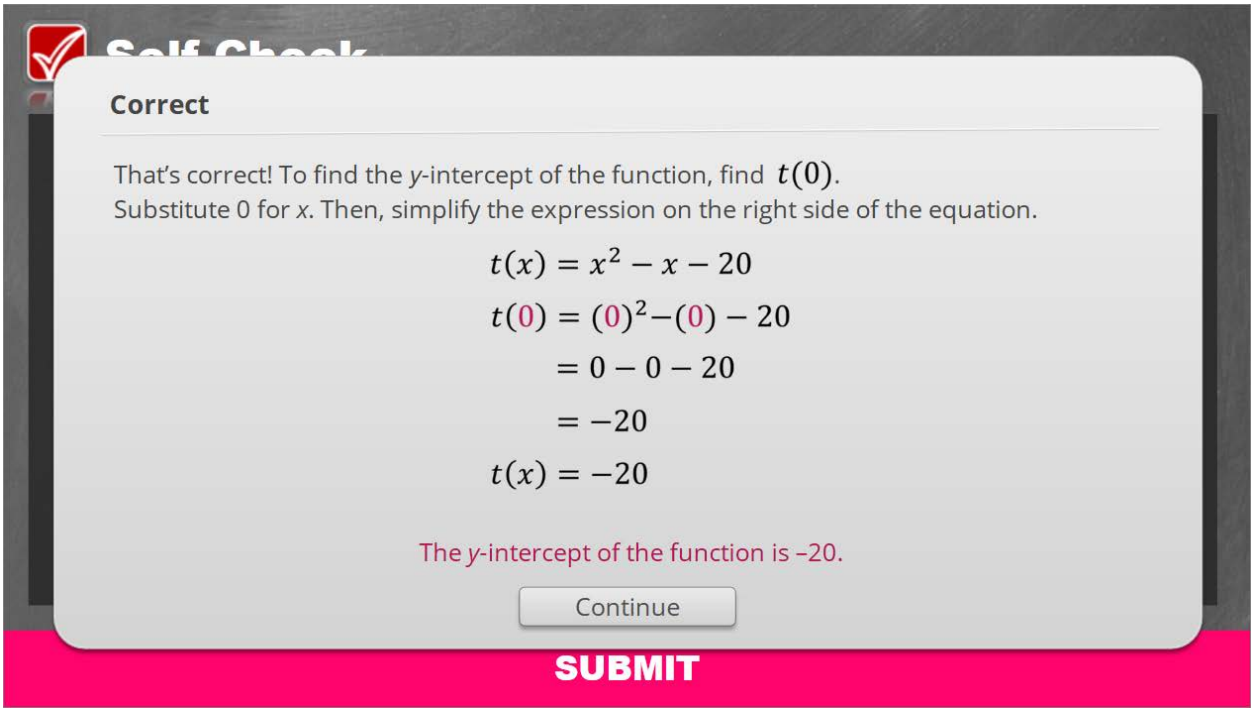
For your reference, the images above show the correct solution to the self-check problem.

Self-Check 3



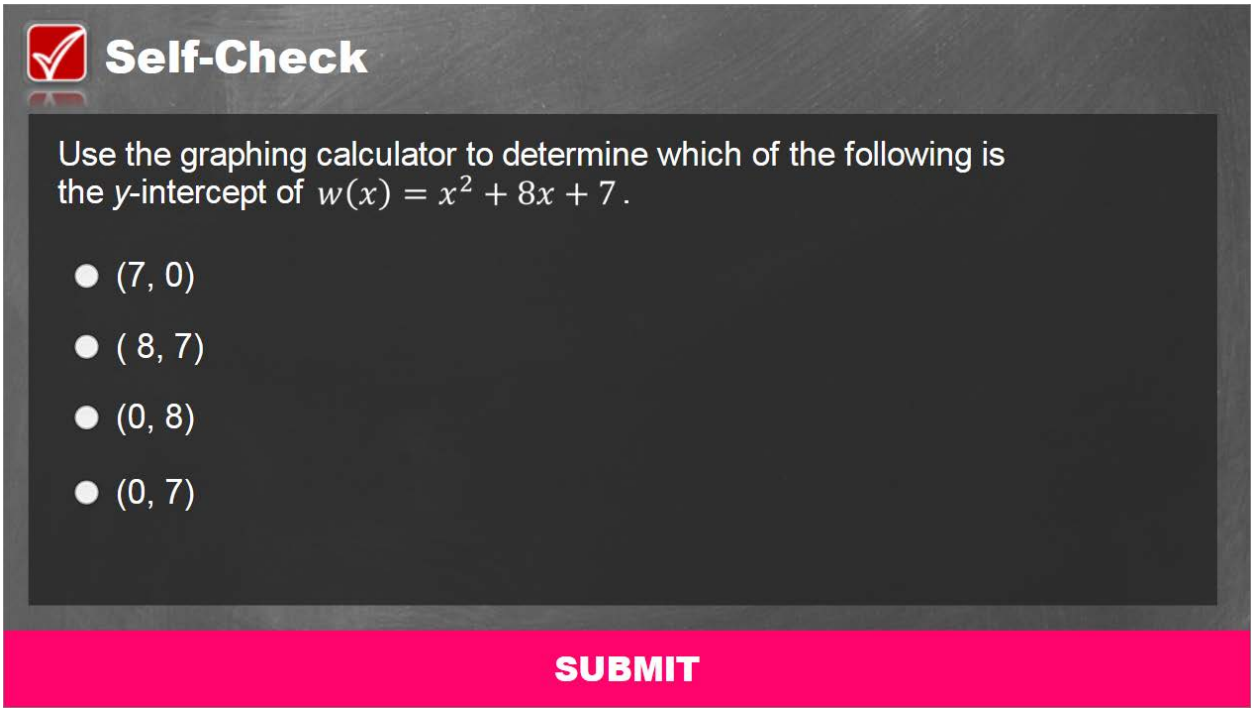
Solve the problem in the image above to check your understanding of the content.

Self-Check 3: Answer



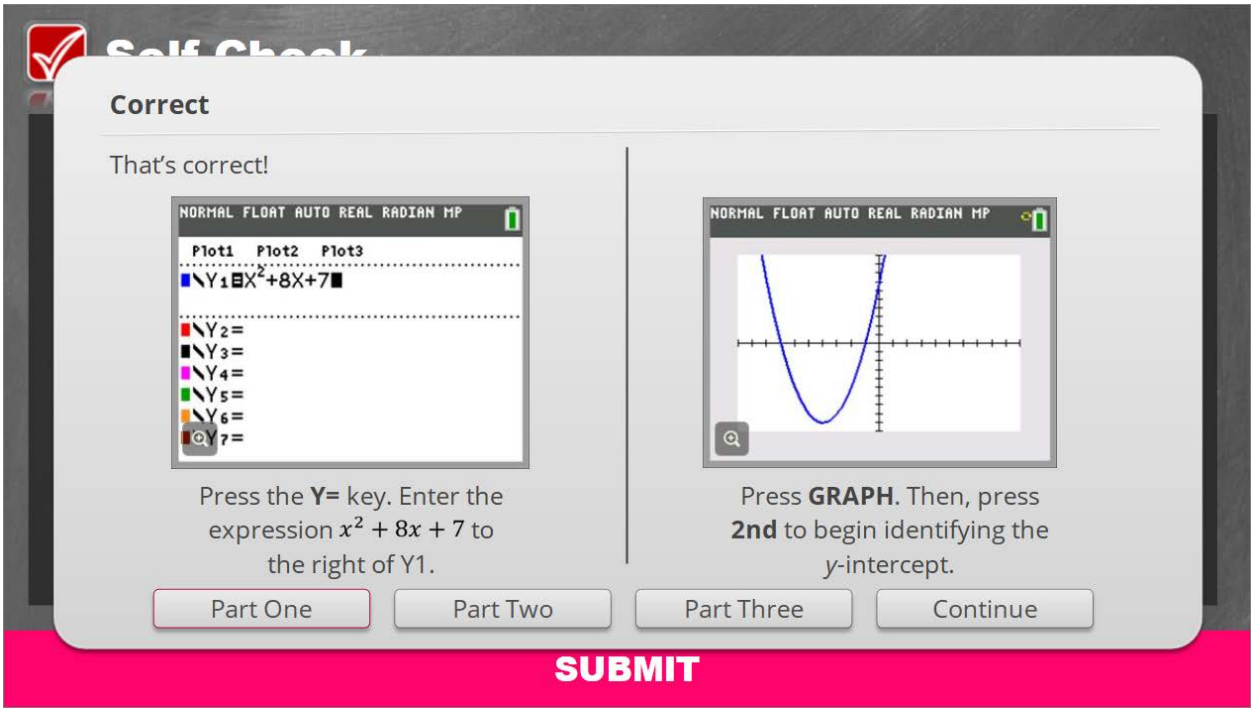
For your reference, the image above shows the correct solution to the self-check problem.

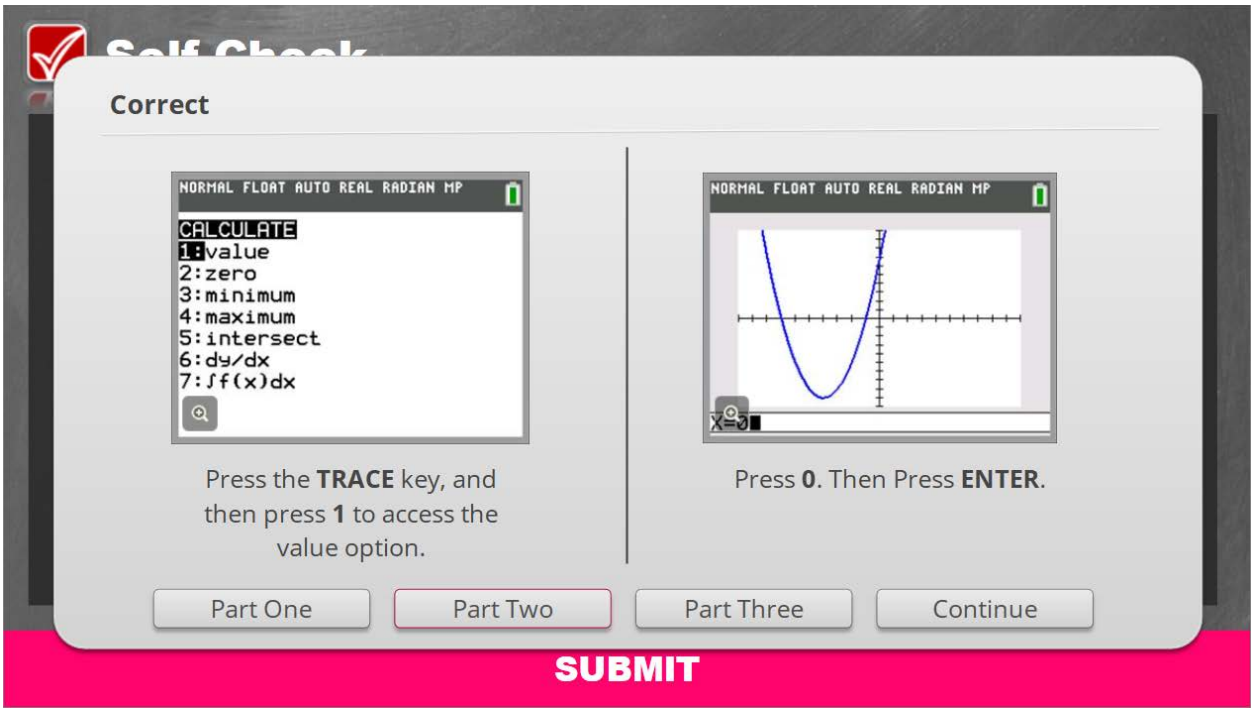
Self-Check 4



Solve the problem in the image above to check your understanding of the content.

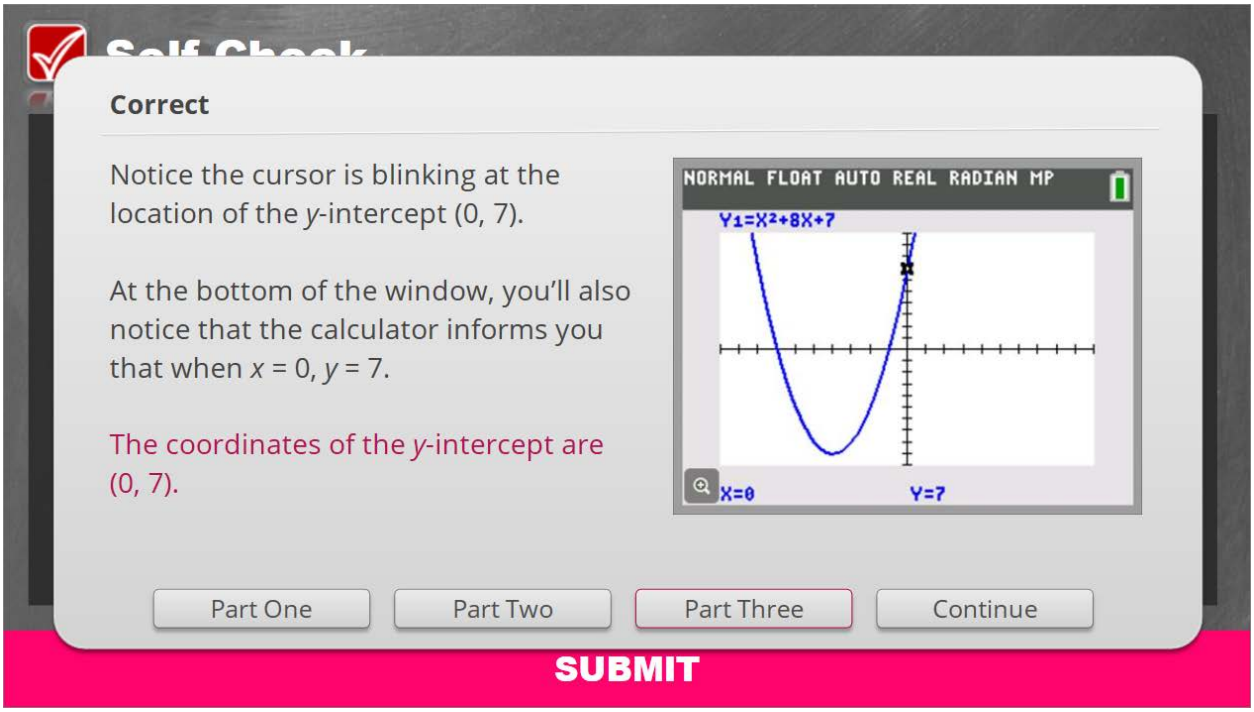
Self-Check 4: Answer





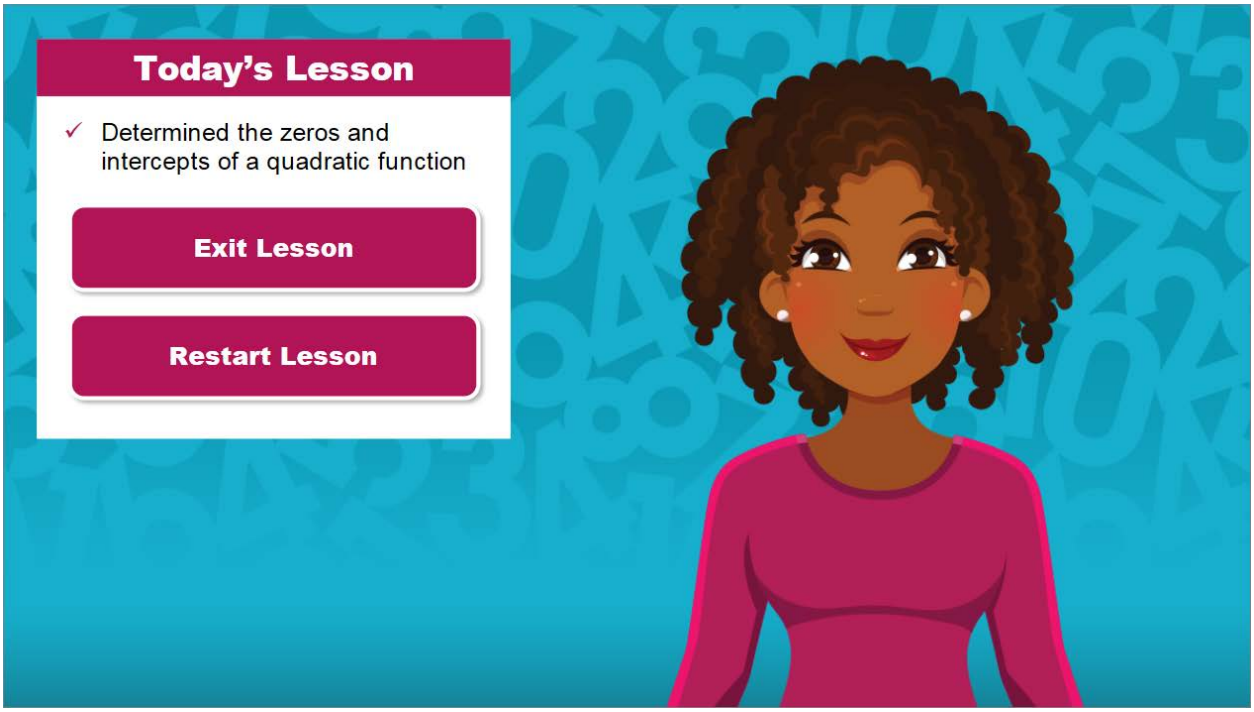
For your reference, the images above show the correct solution to the self-check problem.

Self-Check 4: Answer (continued)



For your reference, the image above shows the correct solution to the self-check problem.

Conclusion



You have reached the conclusion of this lesson where you learned how to find the zeros and intercepts of a quadratic function.