

Module 10: Linear and Quadratic Function Families
Topic 2 Content: Finding Zeros and Intercepts of Quadratic Functions Notes

Introduction



Today's Lesson

- You will learn how to find the zeros and intercepts of a quadratic function.

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.

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Finding Zeros and Intercepts of Quadratic Functions

**FINDING ZEROS AND INTERCEPTS
OF QUADRATIC FUNCTIONS**

Click the Examples Below to Learn More

Example One

Example Two

Example Three

Example Four

Self-Check

Click the examples below to learn more.

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

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Example One

EXAMPLE 1

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

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

$$0 = x^2 - 2x - 8$$

$$0 = (x + 2)(x - 4)$$

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

True

False

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

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Example One (continued)

EXAMPLE 1

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 $(x + 2)(x - 4)$.

True

Next

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 $(x + 2)(x - 4)$.

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Example One (continued)

EXAMPLE 1

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

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

$$0 = x^2 - 2x - 8$$

$$0 = (x + 2)(x - 4)$$

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

$\{-4, -2\}$

$\{-2, 4\}$

$\{2, 4\}$

$\{-4, 2\}$

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

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

$$0 = x^2 - 2x - 8$$

$$0 = (x + 2)(x - 4)$$

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) $\{-4, 2\}$

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Example One (continued)

EXAMPLE 1

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 .

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

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

$\{-2, 4\}$

Next

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 .

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

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

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Example One (continued)

EXAMPLE 1

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

The solutions, or roots are

$$\{-2, 4\}$$

Therefore, the zeros of the function are

$$\{-2, 4\}$$

Menu

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 .

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Example Two

EXAMPLE 2

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

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

The **zeros** are -2 and 4 .

The **x-intercepts** are $(-2, 0)$ and $(4, 0)$.

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

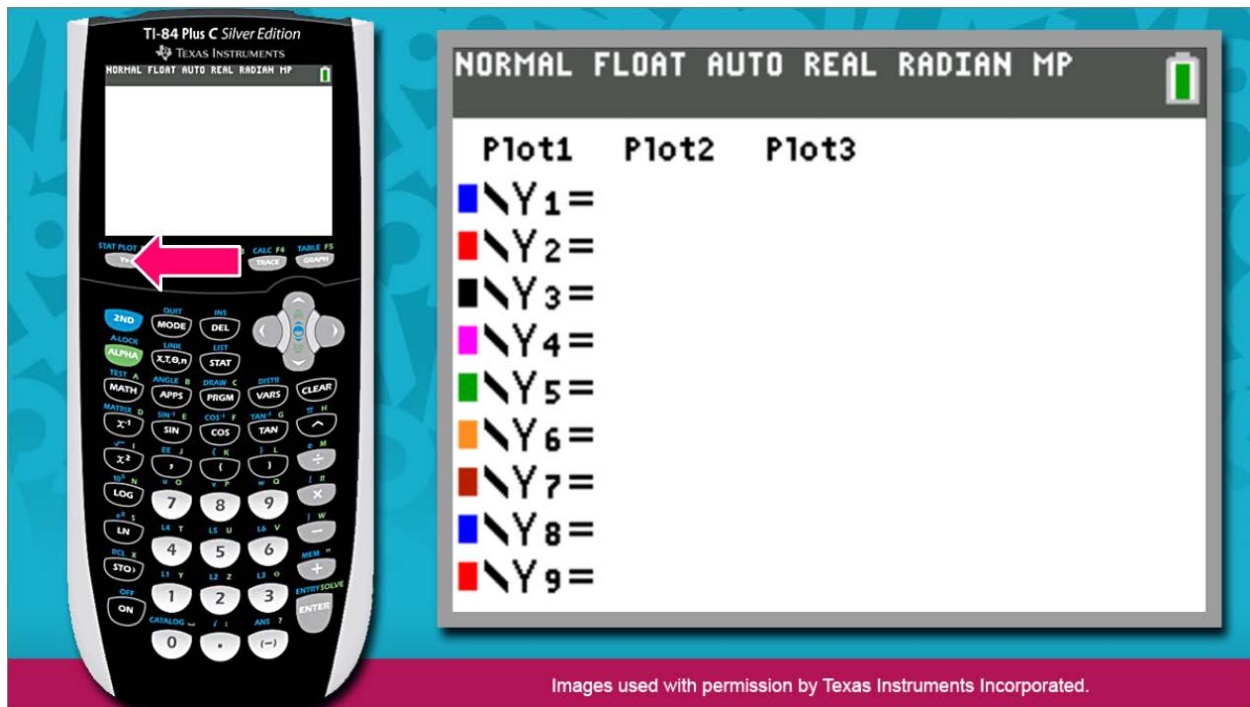
In the first example, you found the zeros of the given quadratic function algebraically.

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

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

Example Two (continued)

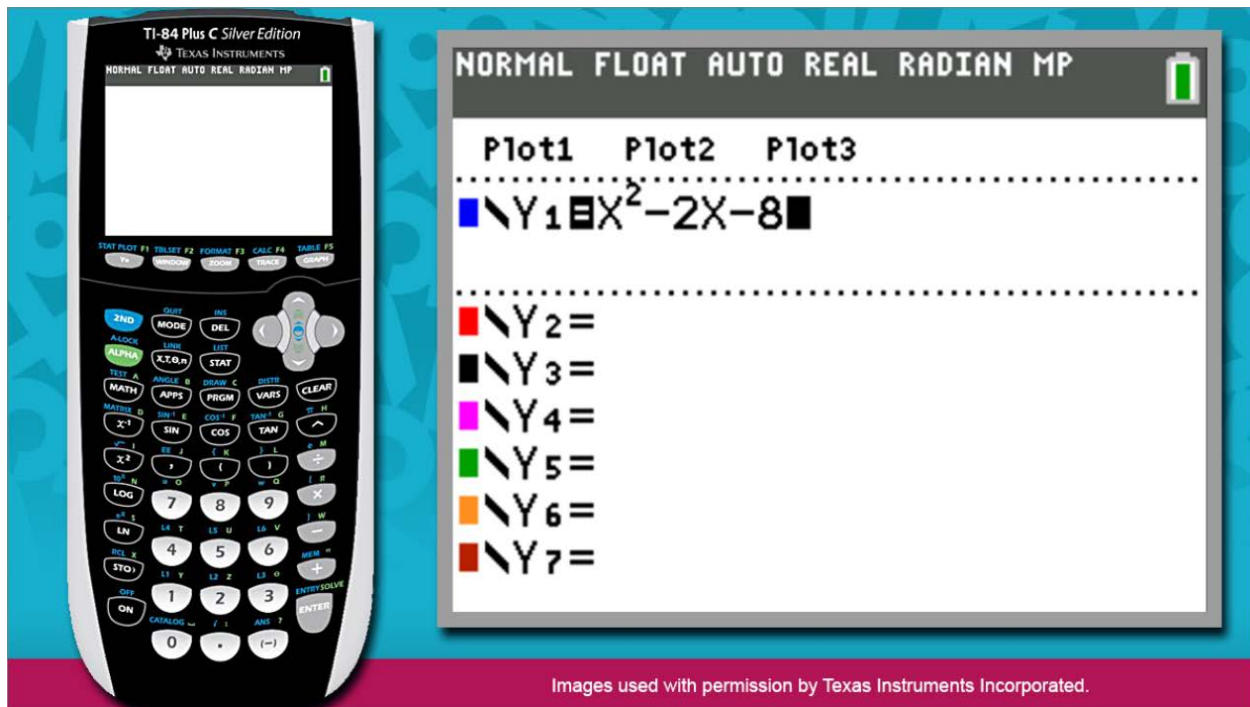


Press the Y= key.

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Example Two (continued)

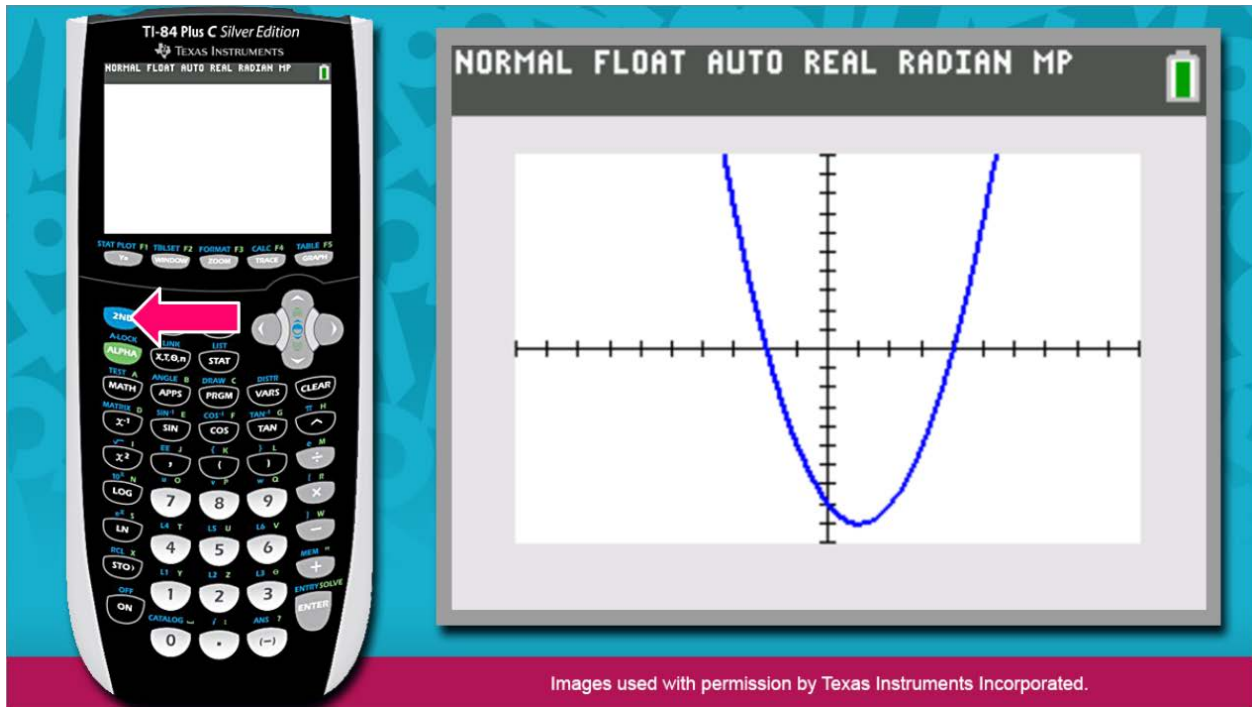


Now, enter the polynomial expression $x^2 - 2x - 8$ to the right of Y1.

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Example Two (continued)



Now, press GRAPH.

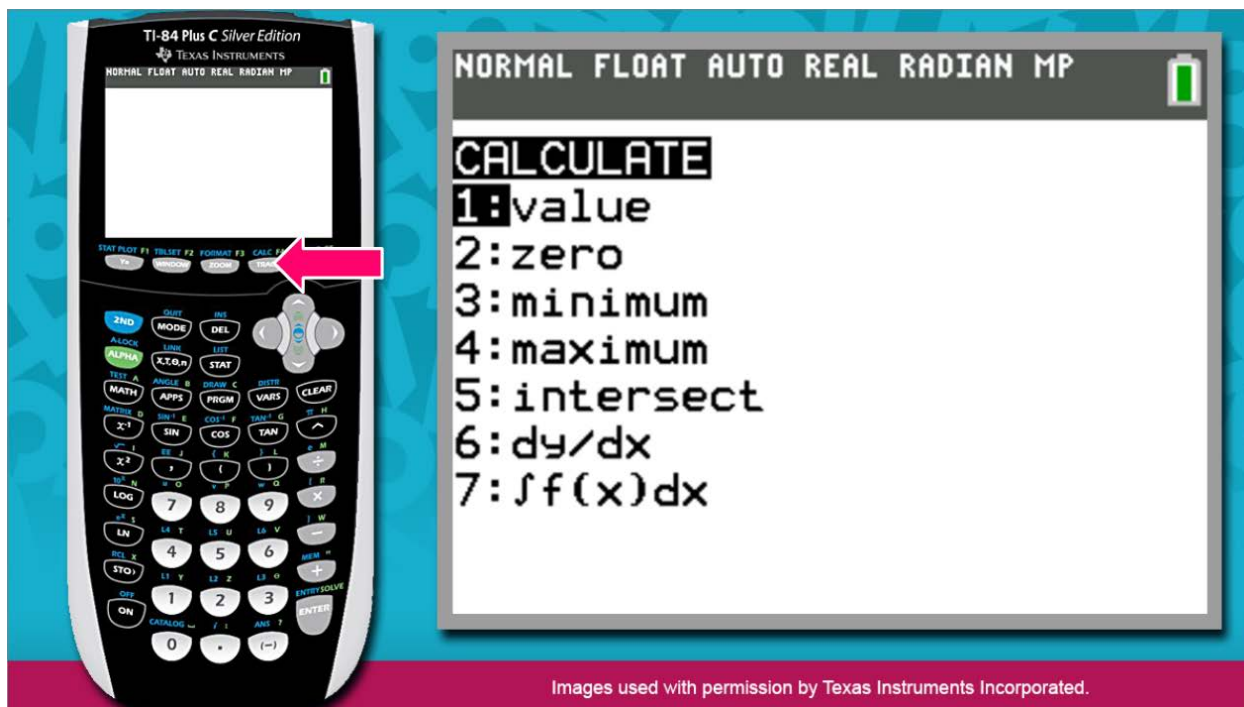
You can now move on to identify the x -intercepts.

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

Module 10: Linear and Quadratic Function Families

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

Example Two (continued)

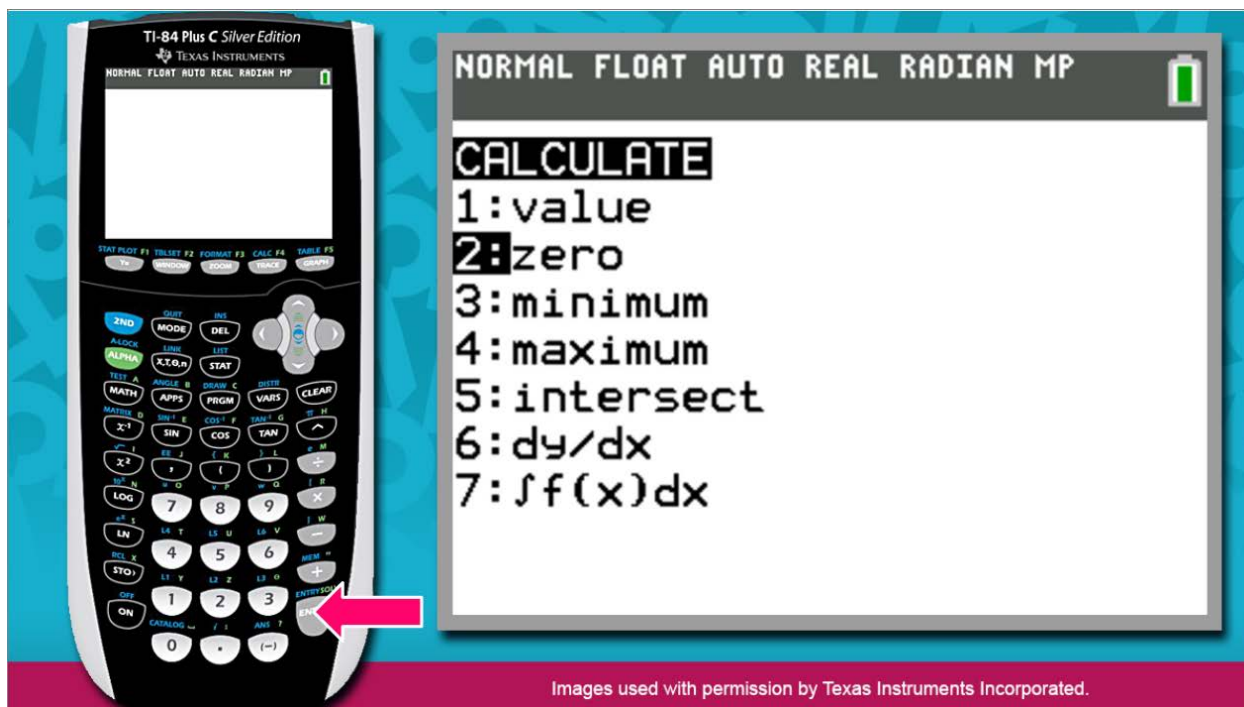


Next, press TRACE, to access the CALCULATE menu. You'll notice a list of options appear on the screen.

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Example Two (continued)

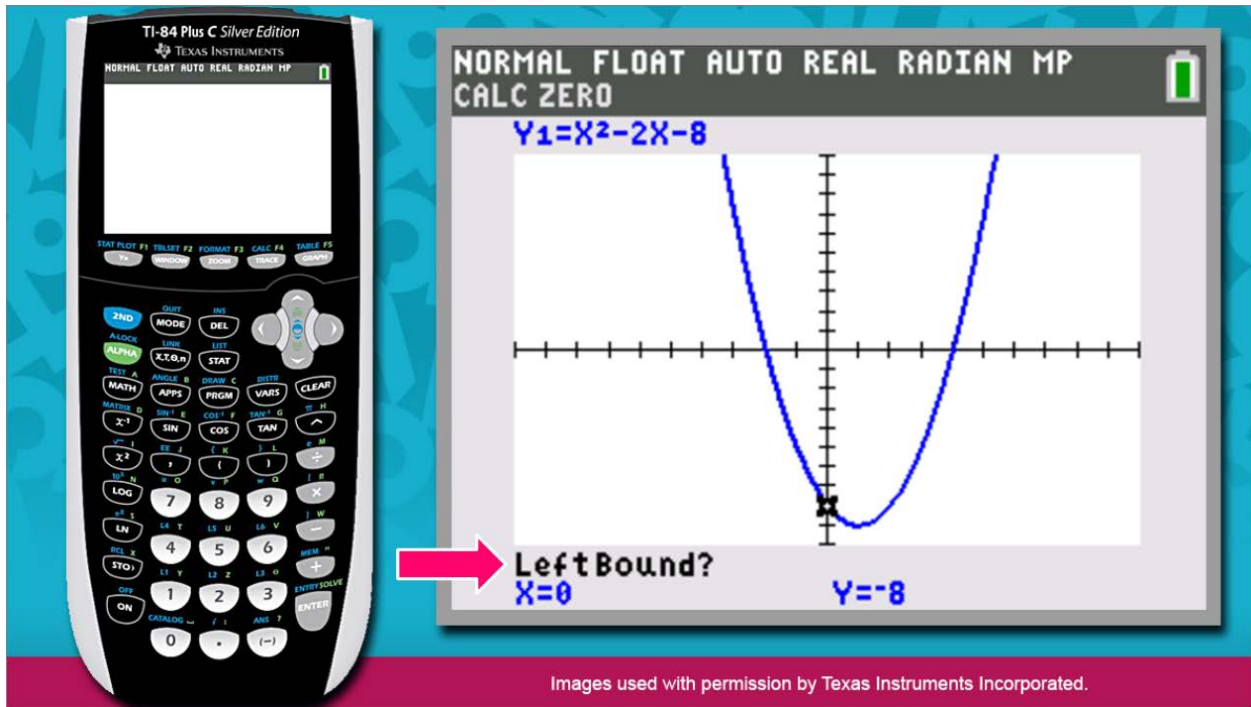


Press the down arrow so that the cursor moves to the second option in the list, the zero option.

Now, press ENTER.

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

Example Two (continued)

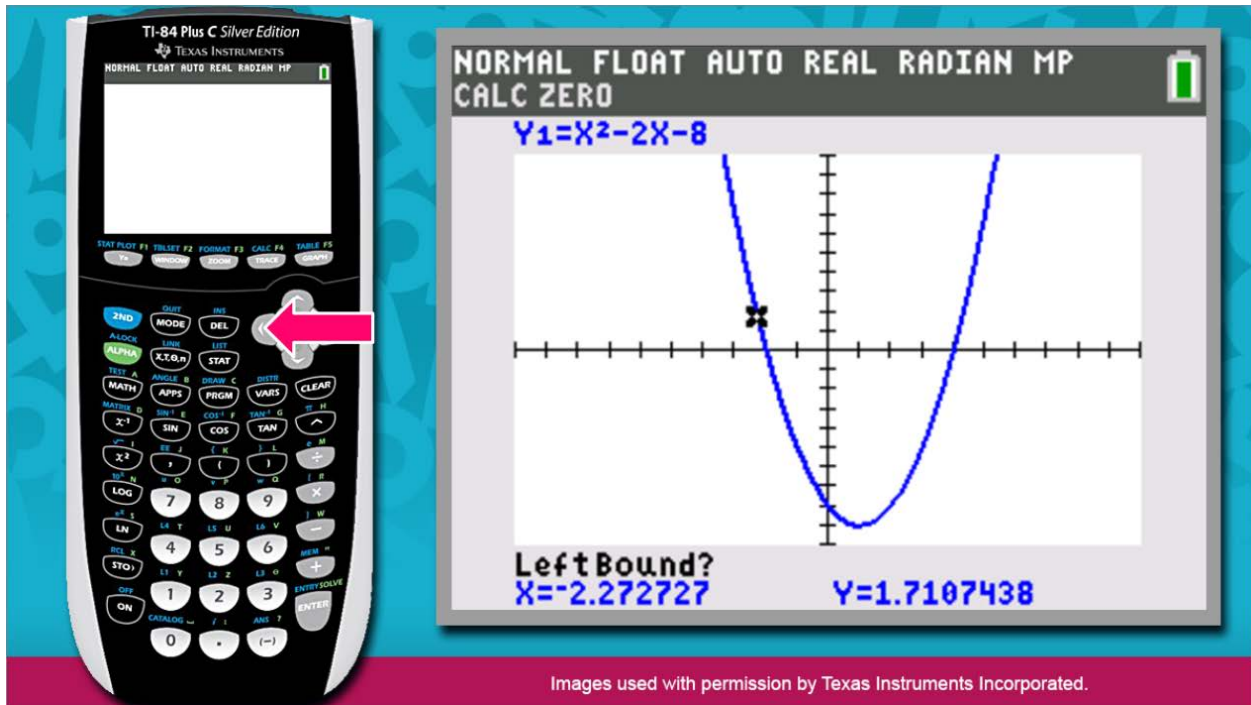


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The calculator is now prepared to identify an x -intercept. You'll notice a question appear in the bottom left corner of the window. The calculator is prompting you to set a left boundary for the region in which you would like for it to search for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

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Example Two (continued)

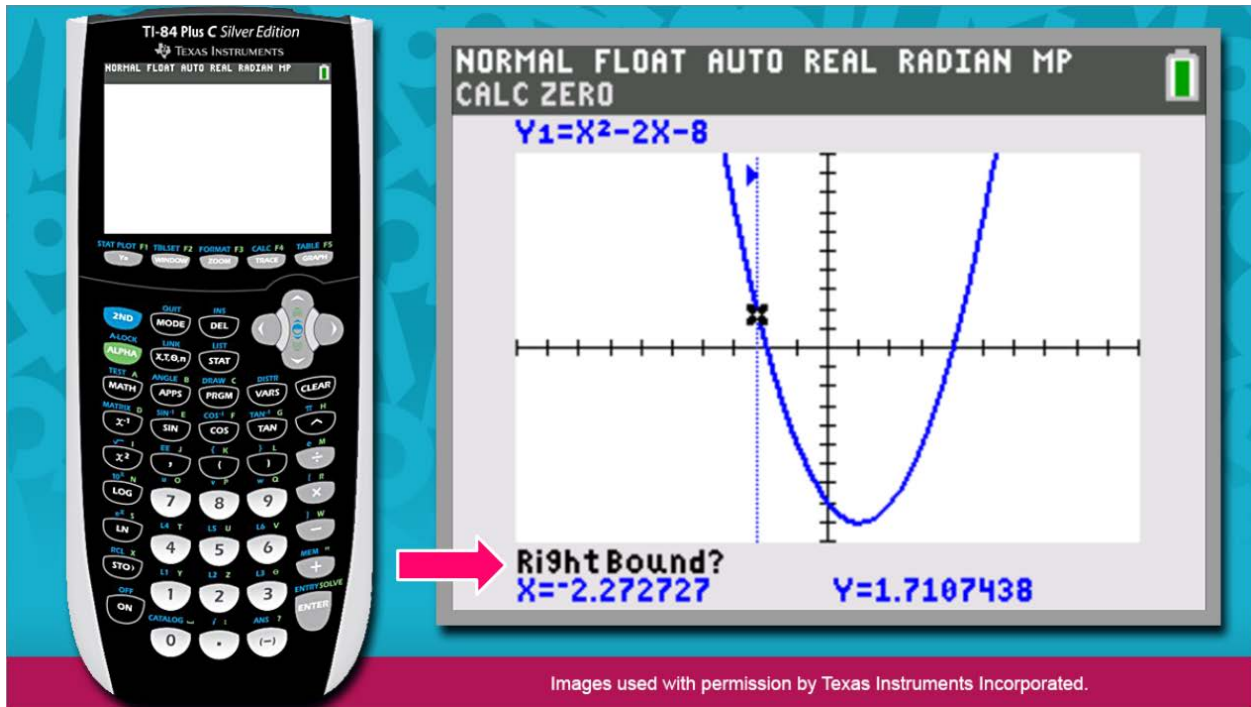


Start by calculating the x -intercept on the left side of the graph.

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

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Example Two (continued)

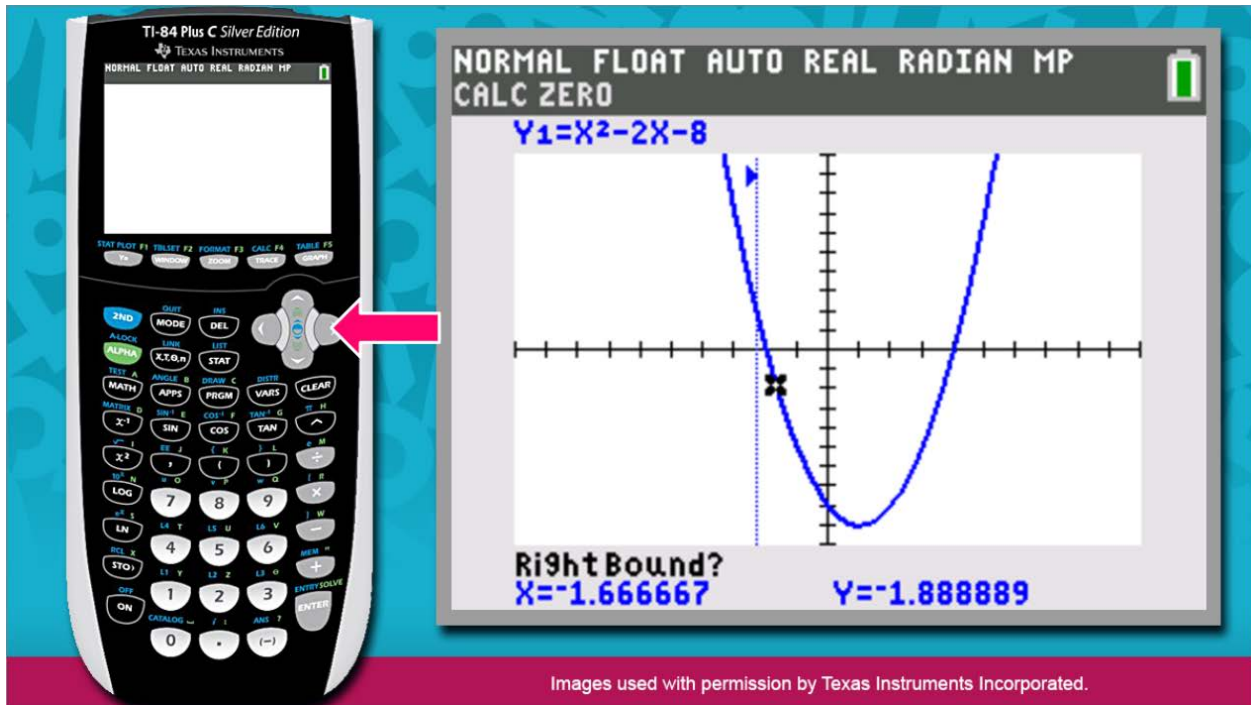


Then, press ENTER.

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.

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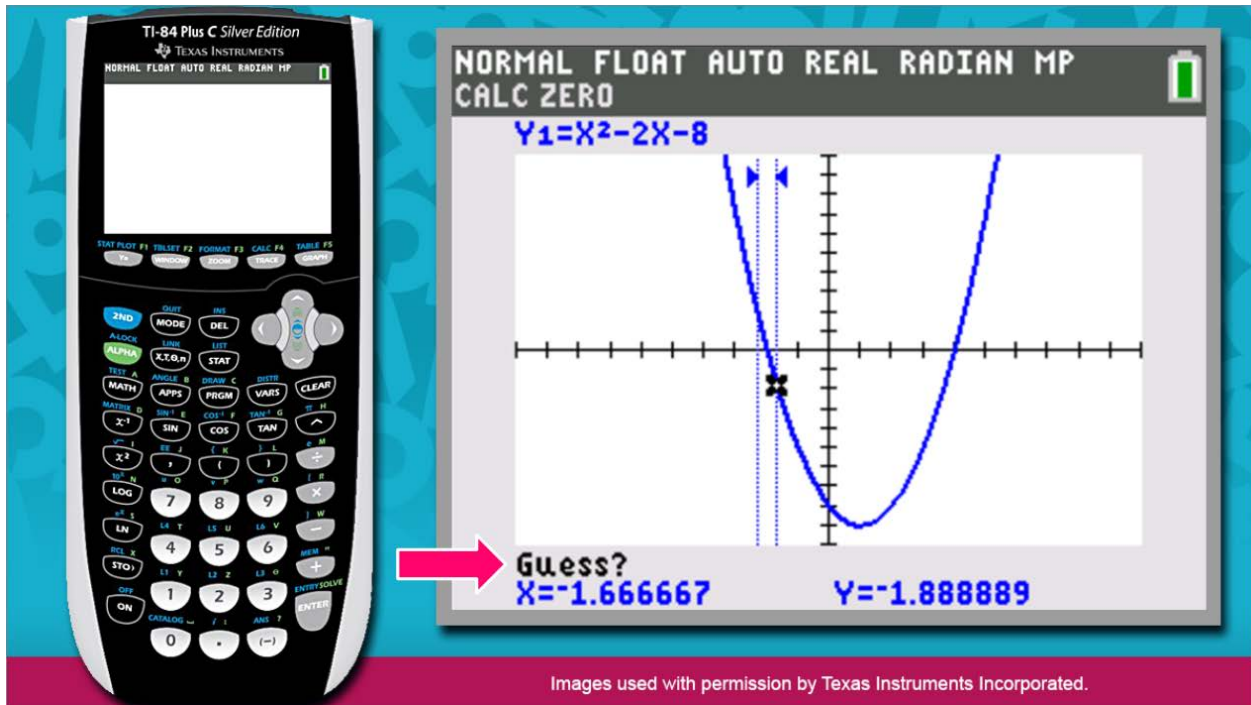
Example Two (continued)



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

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Example Two (continued)



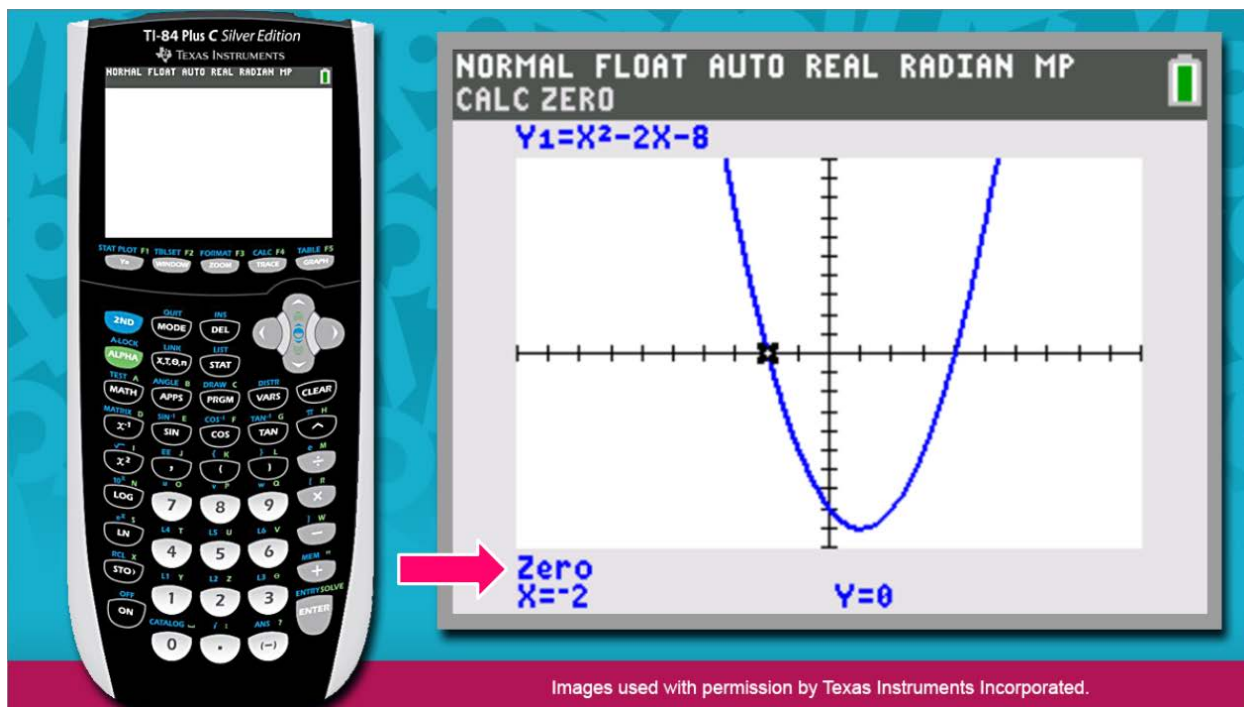
Now, press ENTER.

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.

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Example Two (continued)



Press ENTER.

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

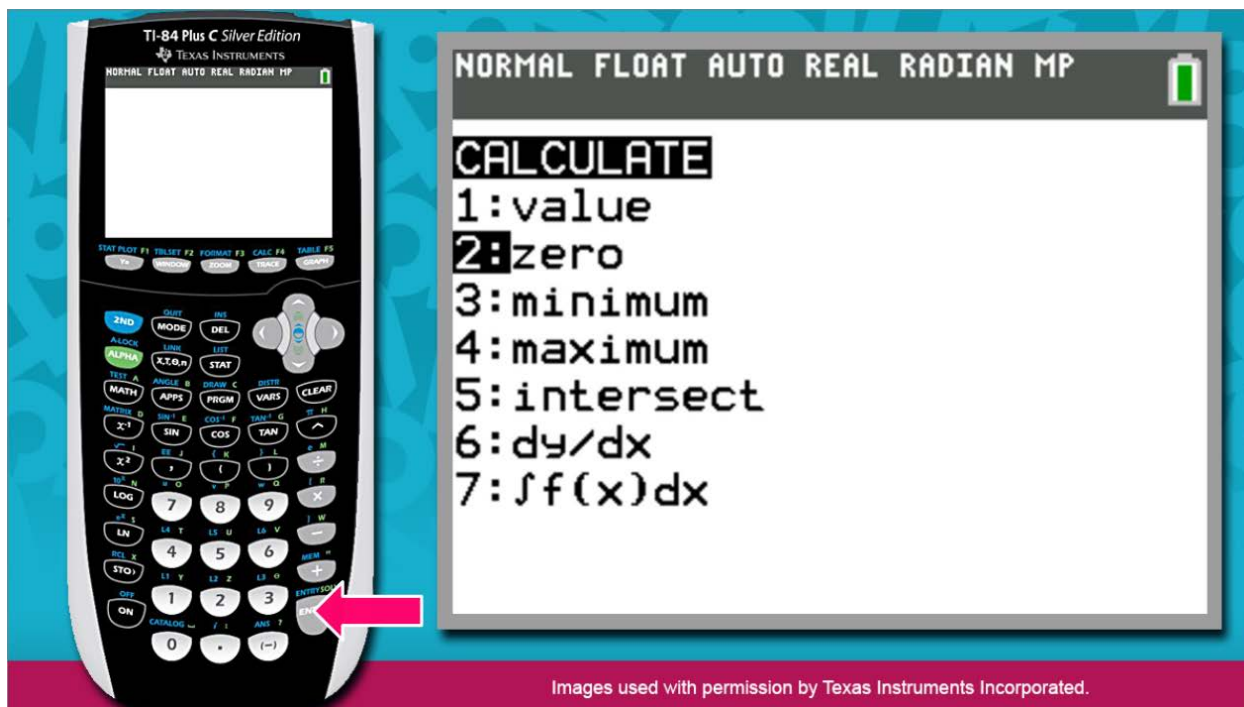
Notice that at the bottom of the window, the calculator informs you that a zero of the function is -2 .

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

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Example Two (continued)



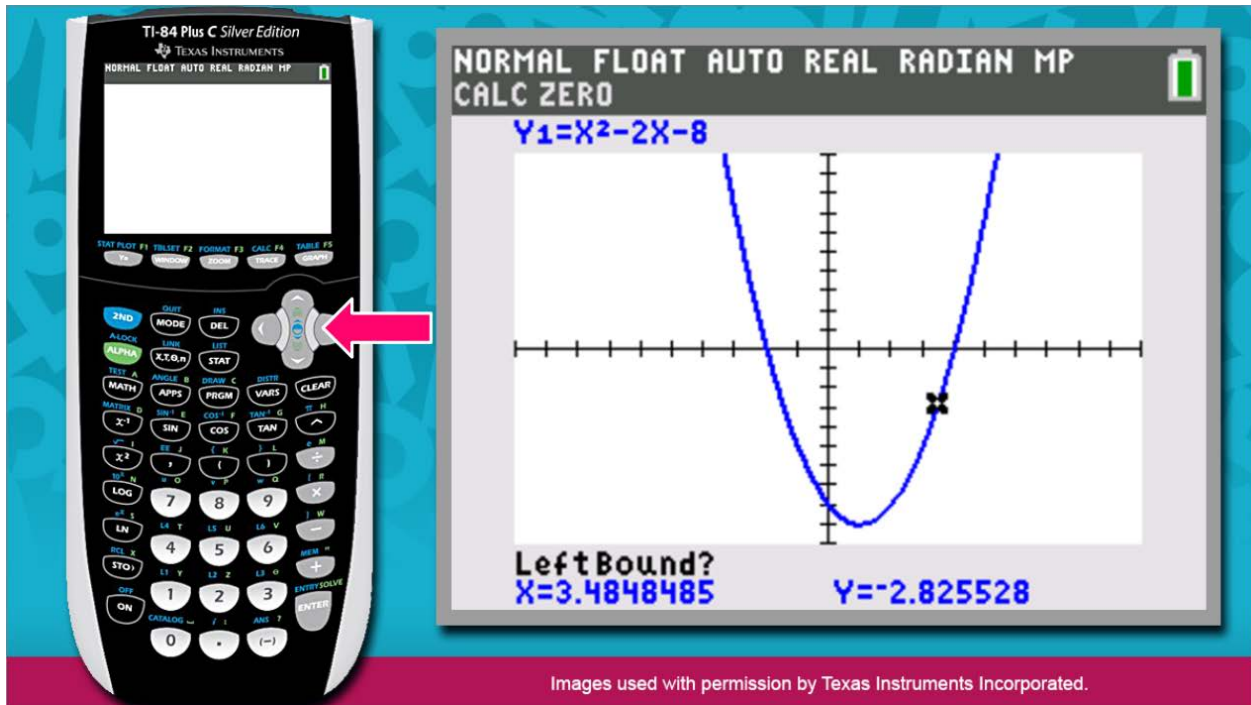
Press 2nd and then press trace, to access the CALCULATE menu.

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

Press ENTER.

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Example Two (continued)



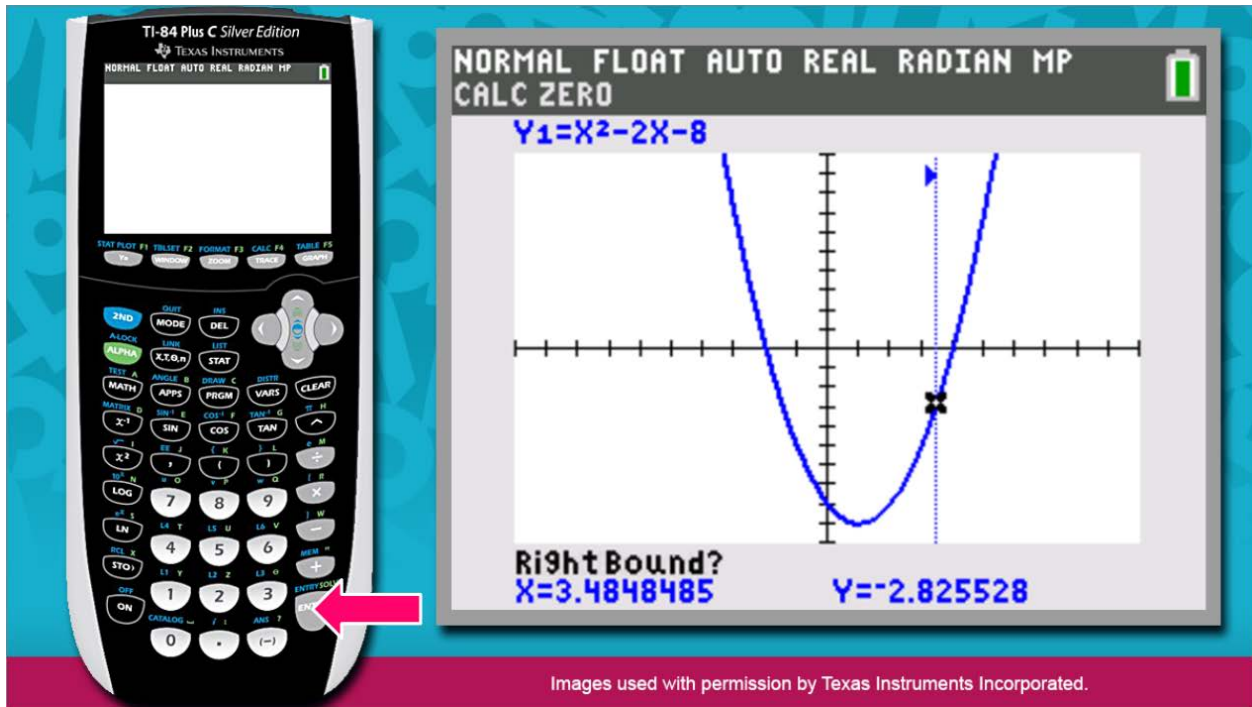
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Press the right arrow key until the cursor is slightly to the left of the x -intercept on the opposite side of the graph.

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Example Two (continued)



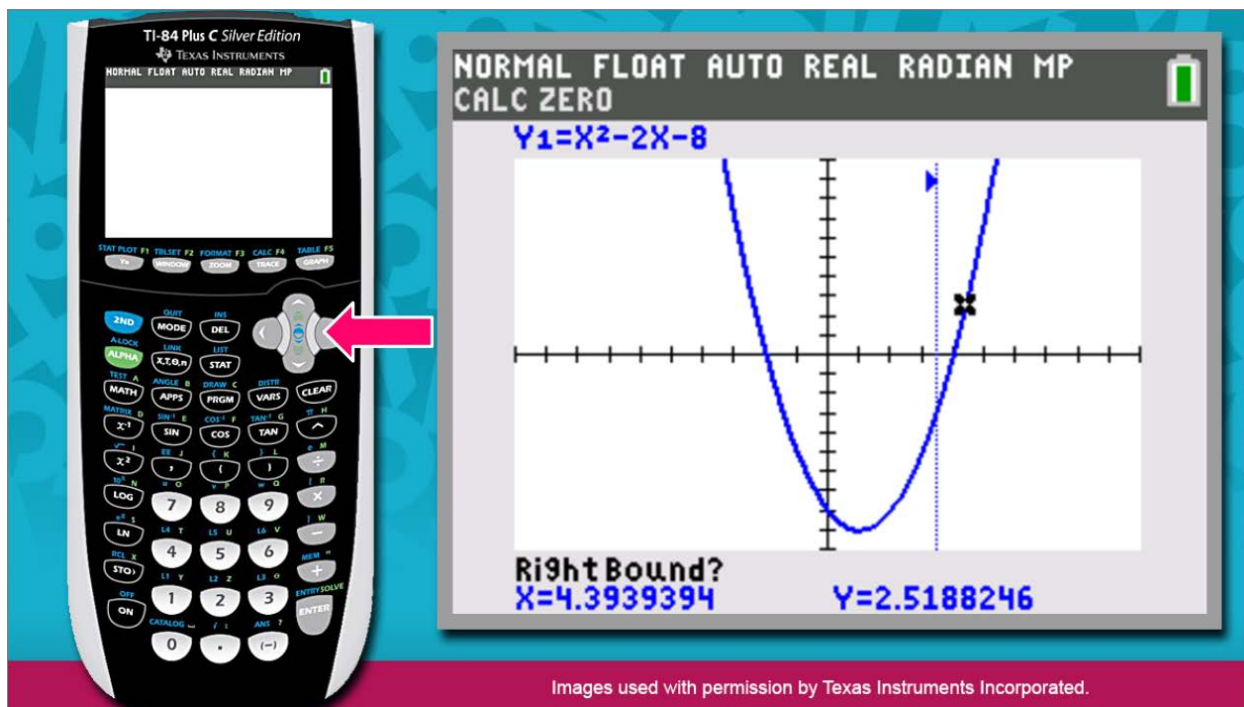
Then, press ENTER.

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.

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Example Two (continued)

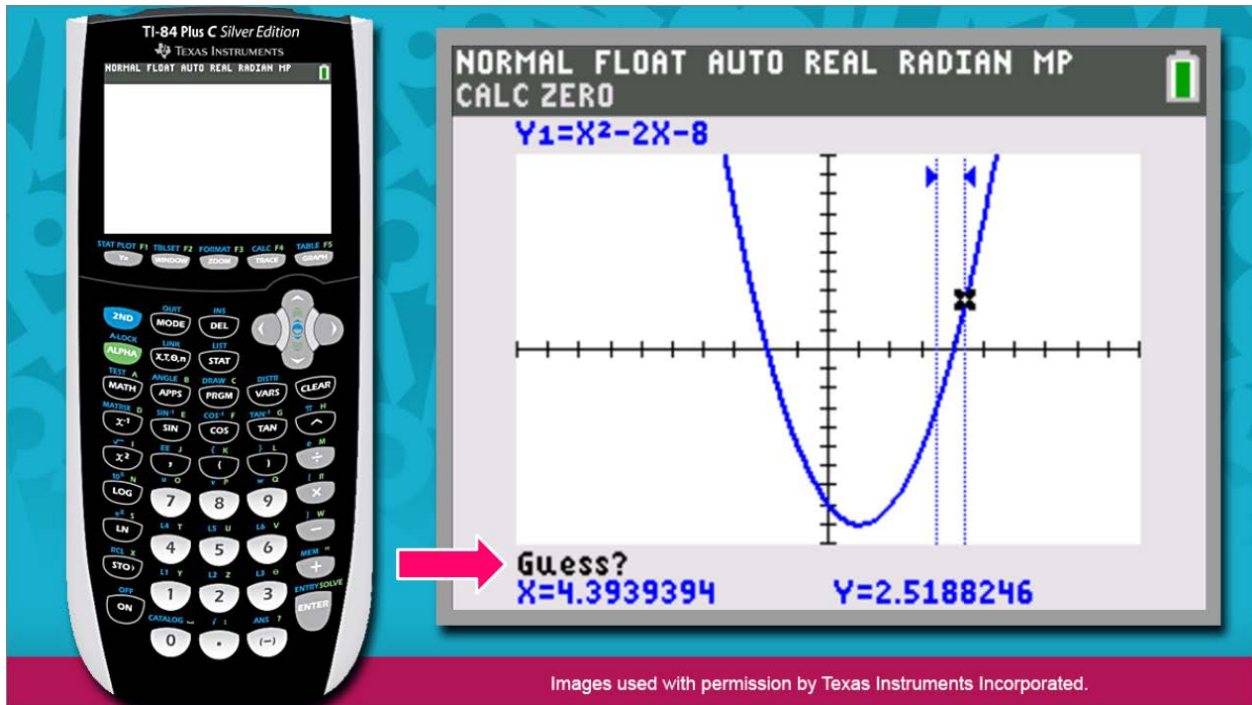


Press the right arrow key until the cursor is slightly to the right of the x -intercept.

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Example Two (continued)



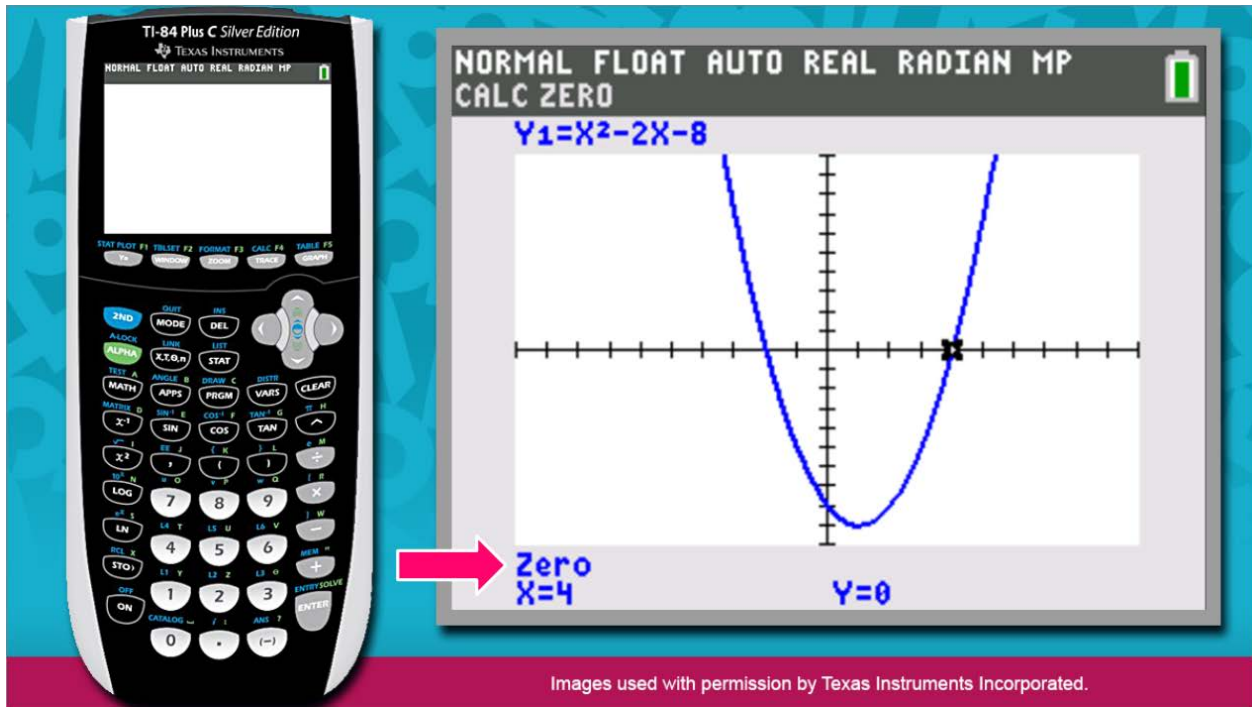
Now, press ENTER.

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.

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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 $x = 4$.

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Example Three

EXAMPLE 3

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

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

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

$$= 0 - 0 - 8$$

$$= -8$$

$$f(0) = -8$$

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

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 .

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Example Four

EXAMPLE 4

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

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

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

$$= 0 - 0 - 8$$

$$= -8$$

$$f(0) = -8$$

The y -intercept of the function is -8 .

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

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

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

$$= 0 - 0 - 8$$

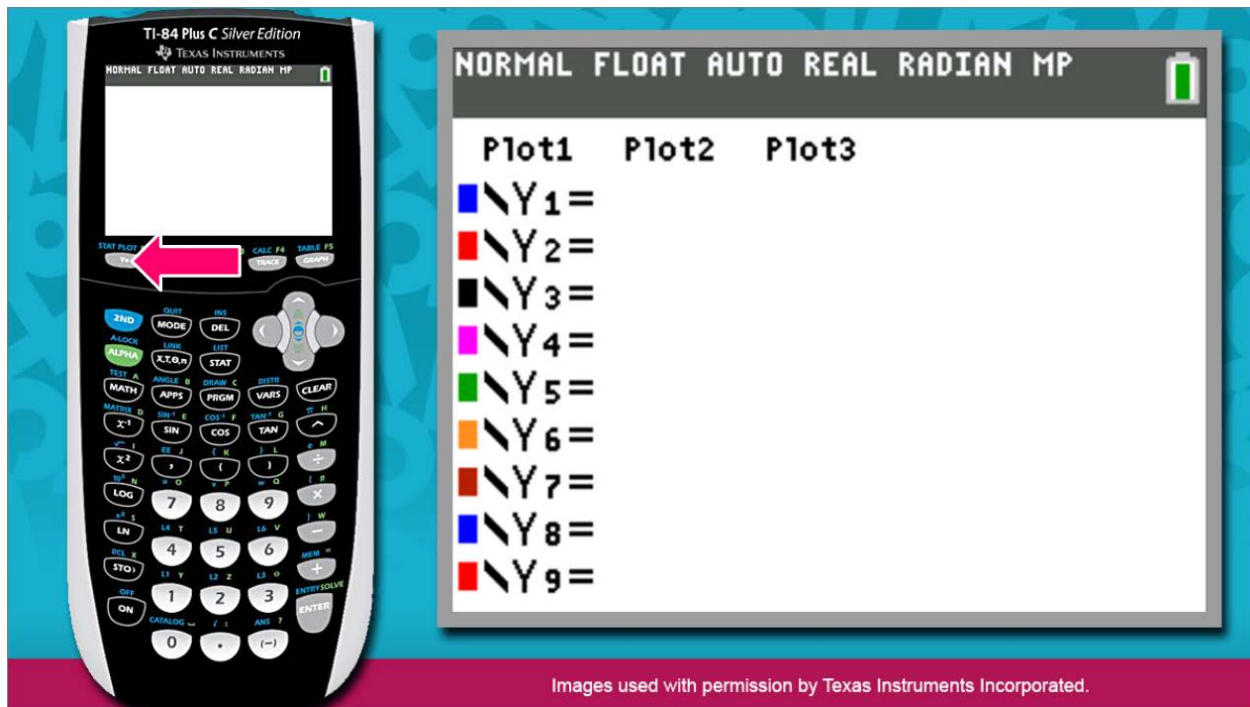
$$= -8$$

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.

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Example Four (continued)

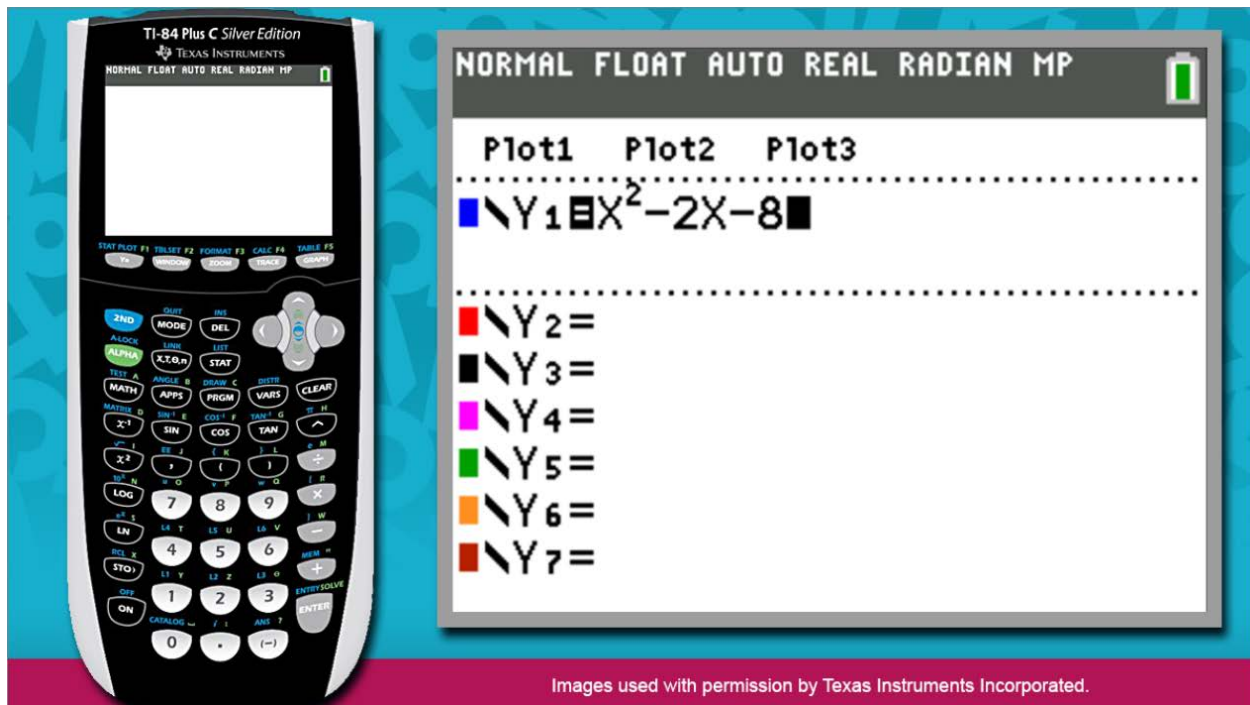


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Press the Y= key.

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Example Four (continued)



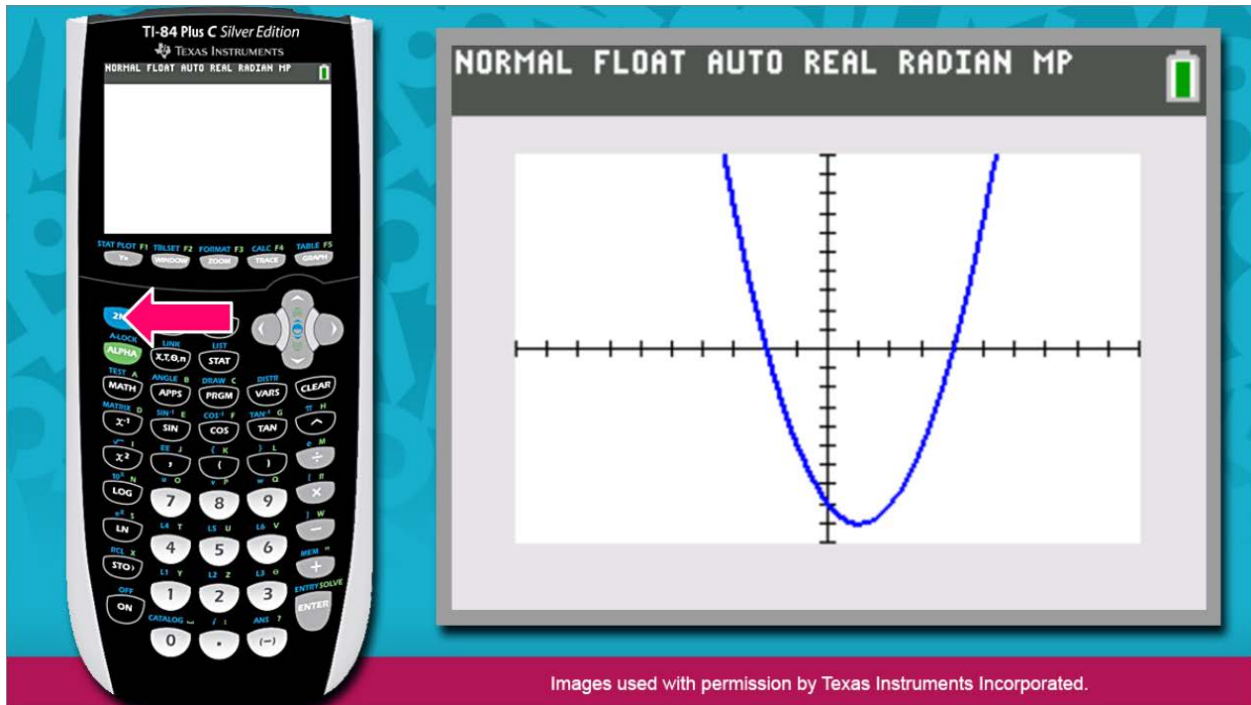
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Enter the expression $x^2 - x - 8$ to the right of Y1.

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Example Four (continued)



Now, press GRAPH.

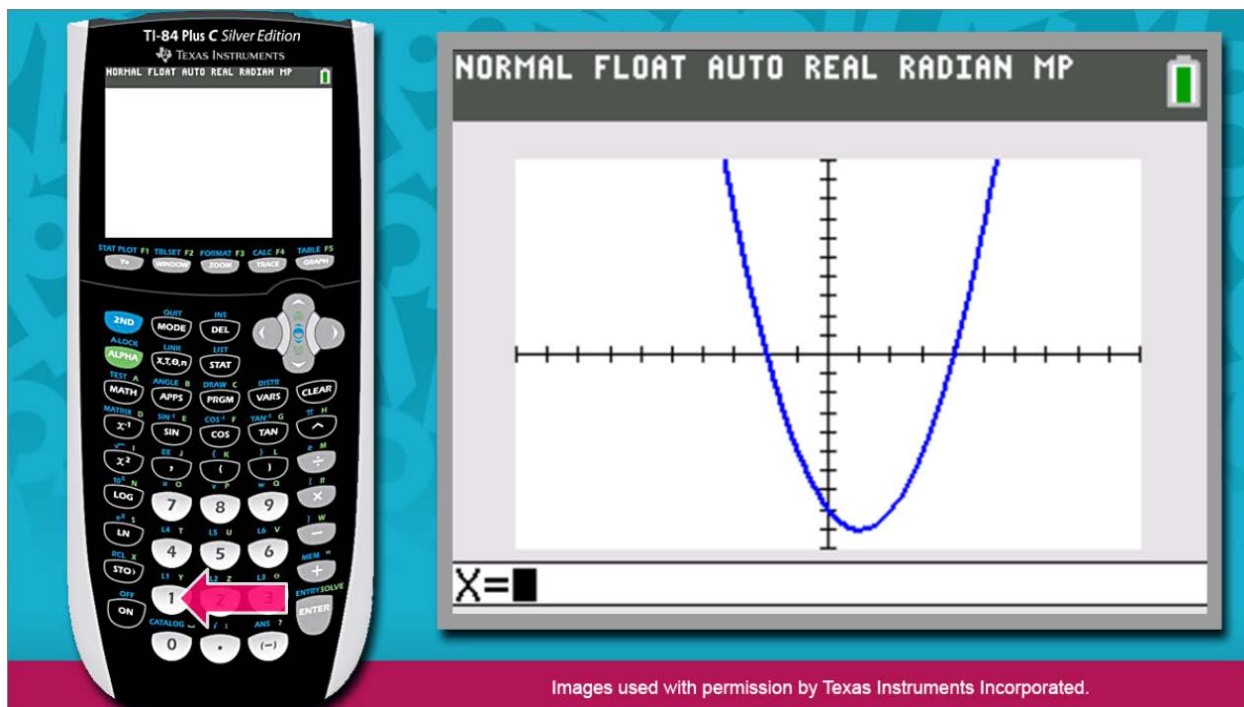
You can now move on to identify the y -intercept.

Press 2^{nd} .

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Example Four (continued)

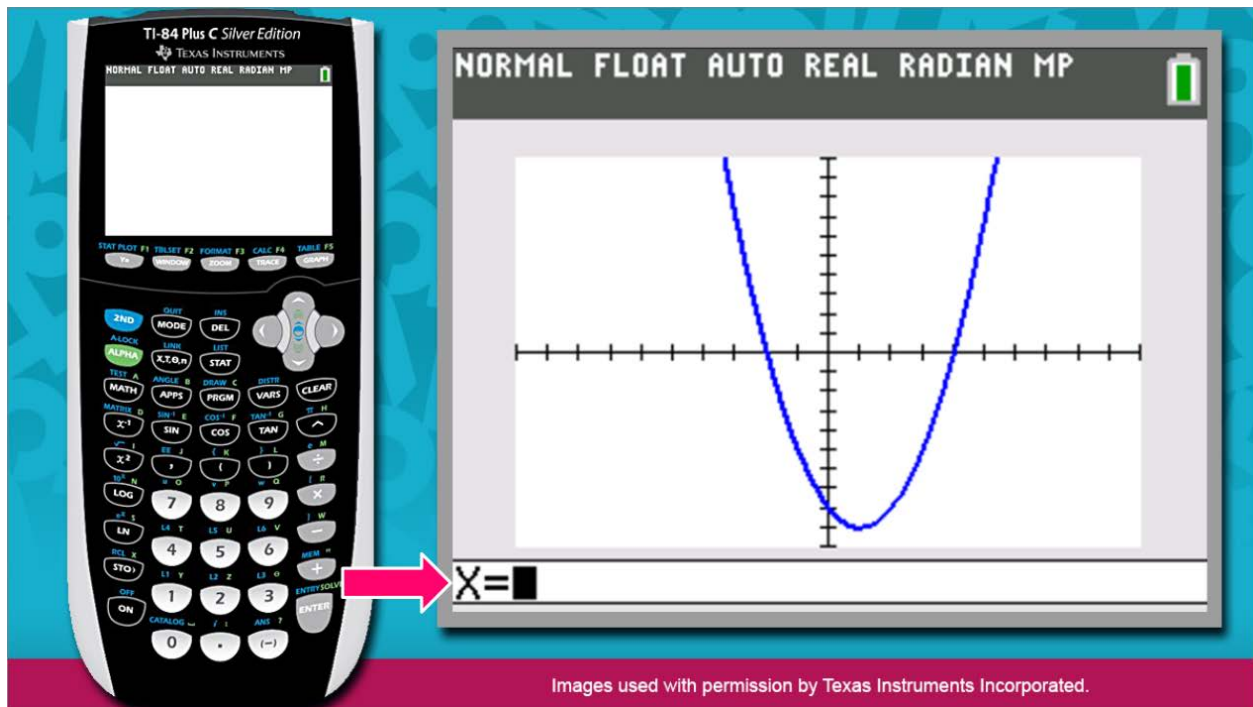


Next, press TRACE to access the CALCULATE menu. Press 1 to select the value option. This option allows you to enter an input value.

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Example Four (continued)

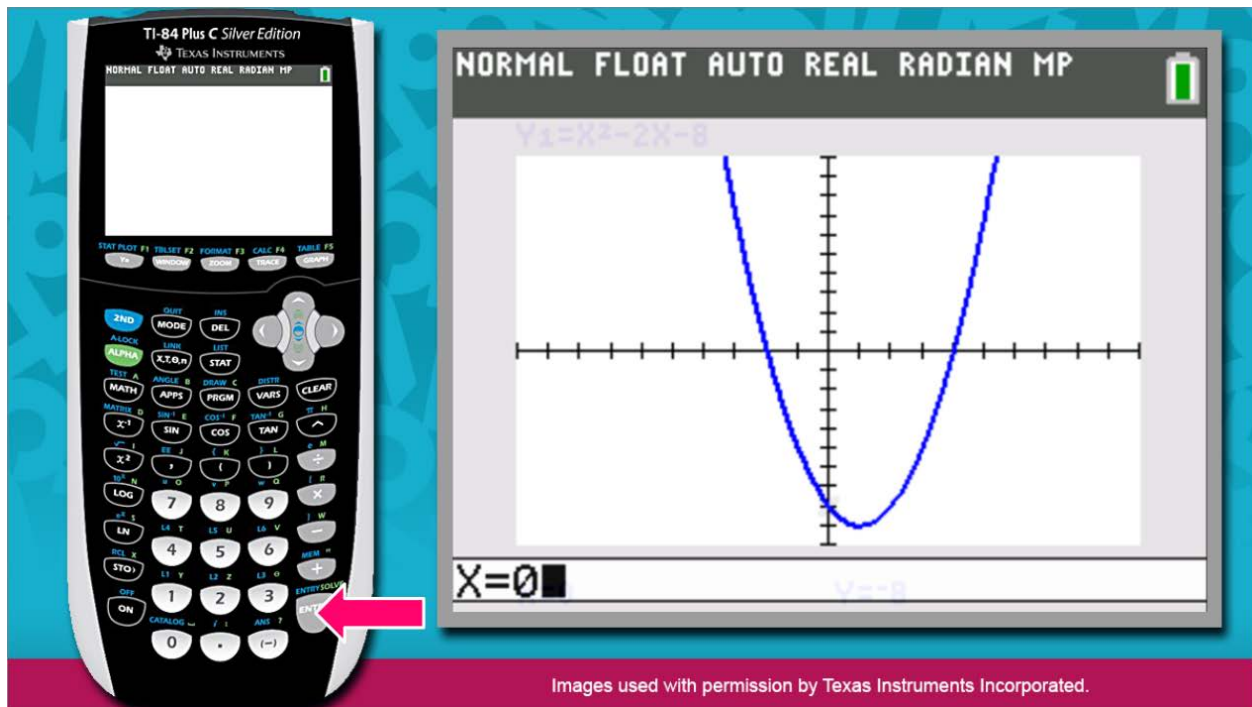


Notice in the bottom left corner of the window that the calculator is prompting you to enter a value for x .

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Example Four (continued)



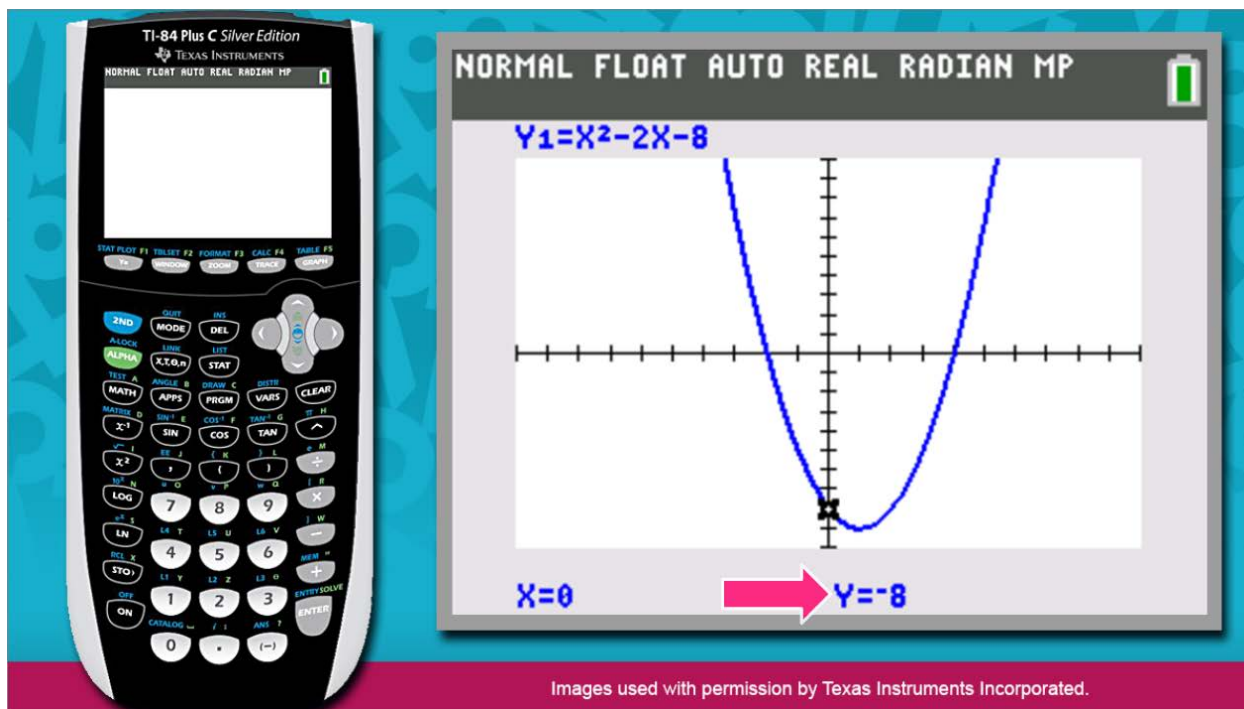
Recall that the y -intercept is the output value that results when the input value is 0.

Press 0. Then, press ENTER.

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Example Four (continued)

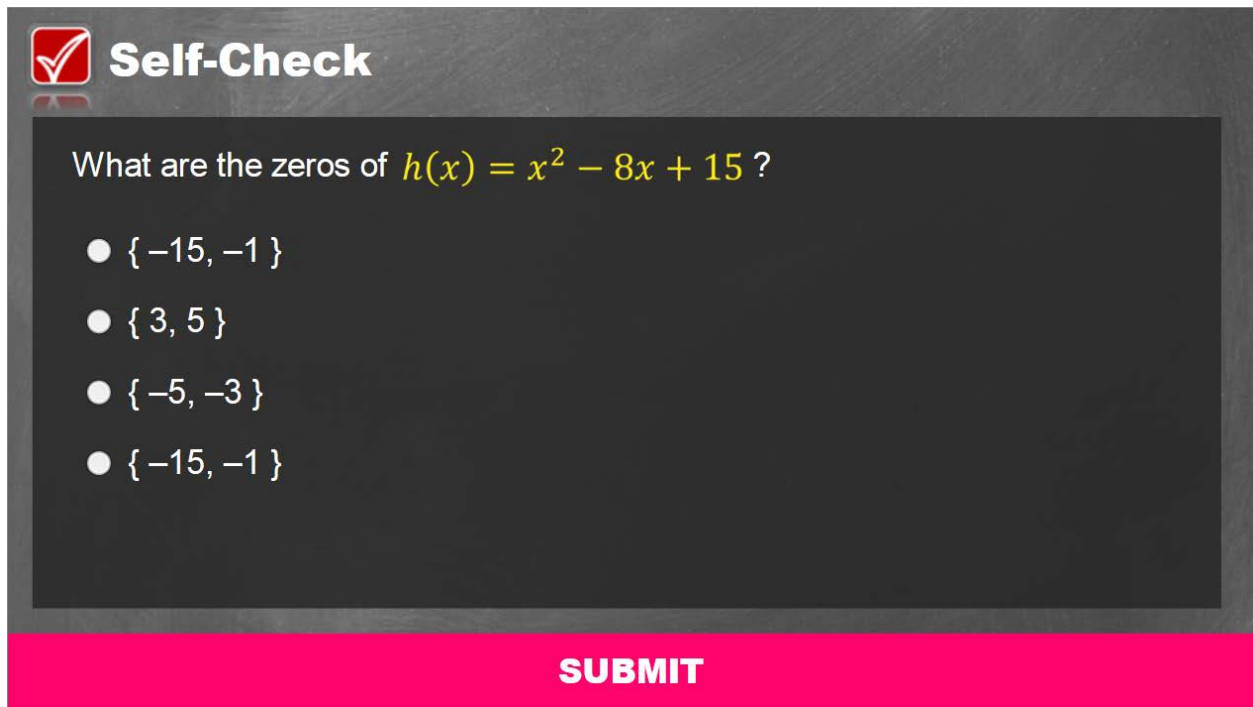


The cursor is blinking at the location of the y-intercept $(0, -8)$.

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

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Self-Check 1

A self-check interface with a dark grey background. At the top left is a red checkmark icon in a white square, followed by the text "Self-Check" in white. Below this is a dark grey rectangular area containing the question "What are the zeros of $h(x) = x^2 - 8x + 15$?" in white. Underneath the question are four radio button options, each with a white dot and a white set of numbers in curly braces: $\{-15, -1\}$, $\{3, 5\}$, $\{-5, -3\}$, and $\{-15, -1\}$. At the bottom of the interface is a bright pink rectangular button with the word "SUBMIT" in white capital letters.

Self-Check

What are the zeros of $h(x) = x^2 - 8x + 15$?

- $\{-15, -1\}$
- $\{3, 5\}$
- $\{-5, -3\}$
- $\{-15, -1\}$

SUBMIT

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

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Self-Check 1: Answer

Correct

That's correct! First, factor the polynomial completely.

$$h(x) = x^2 - 8x + 15$$
$$0 = x^2 - 8x + 15$$
$$0 = (x - 3)(x - 5)$$

Then, find the solutions by setting each factor equal to zero and solving for x .

$$\begin{array}{r} 0 = x - 3 \\ +3 \quad +3 \\ \hline 3 = x \end{array}$$
$$\begin{array}{r} 0 = x - 5 \\ +5 \quad +5 \\ \hline 5 = x \end{array}$$

The set $\{3,5\}$ represents the zeros of $h(x) = x^2 - 8x + 15$.

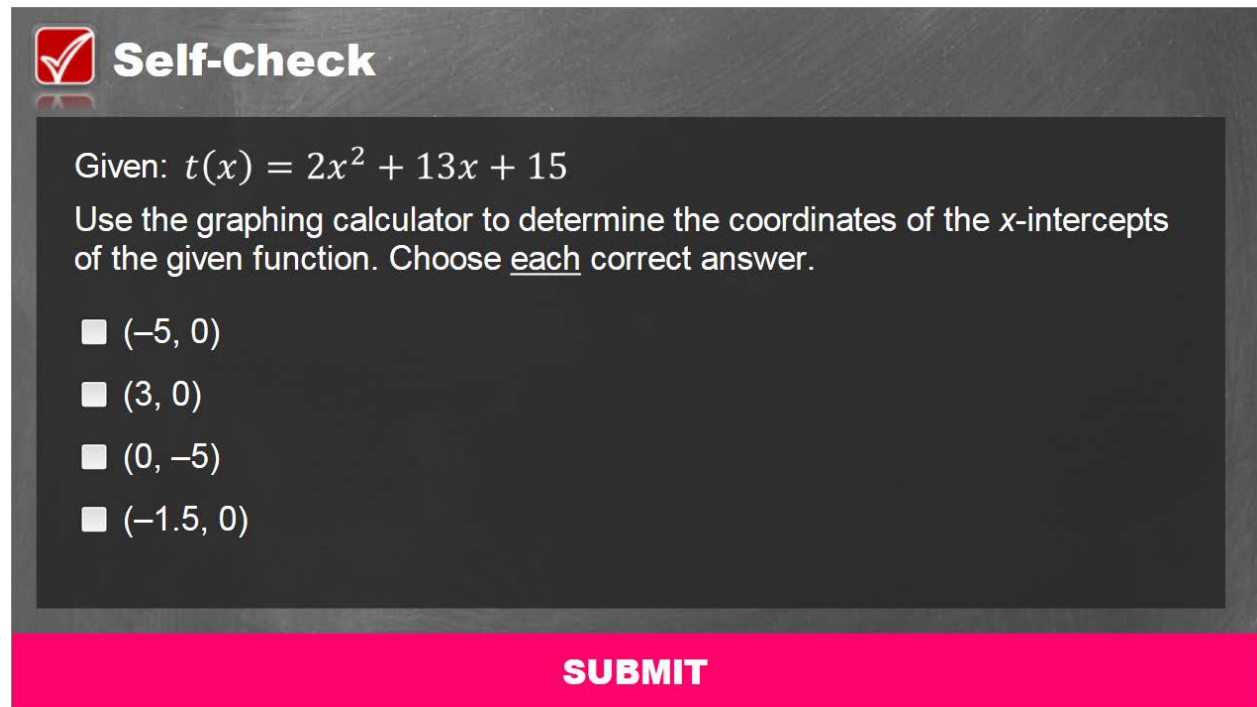
Continue

SUBMIT

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

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Self-Check 2

A self-check interface with a dark grey background. At the top left is a red checkmark icon in a white square, followed by the text "Self-Check" in white. Below this, the text "Given: $t(x) = 2x^2 + 13x + 15$ " is displayed. Underneath, it says "Use the graphing calculator to determine the coordinates of the x-intercepts of the given function. Choose each correct answer." There are four radio button options: (-5, 0), (3, 0), (0, -5), and (-1.5, 0). At the bottom, there is a bright pink rectangular button with the word "SUBMIT" in white capital letters.

Self-Check

Given: $t(x) = 2x^2 + 13x + 15$

Use the graphing calculator to determine the coordinates of the x-intercepts of the given function. Choose each correct answer.

- (-5, 0)
- (3, 0)
- (0, -5)
- (-1.5, 0)

SUBMIT

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

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Self-Check 2: Answer

Correct

That's correct!

```
NORMAL FLOAT AUTO REAL RADIAN MP
Plot1 Plot2 Plot3
Y1=2X^2+13X+15
Y2=
Y3=
Y4=
Y5=
Y6=
Y7=
```

Press the **Y=** key. Enter the polynomial expression to the right of Y1.

Press **GRAPH**. Then, press **2nd** to begin identifying the x-intercepts.

Part One Part Two Part Three Part Four Continue

SUBMIT

Correct

```
NORMAL FLOAT AUTO REAL RADIAN MP
CALCULATE
1:value
2:zero
3:minimum
4:maximum
5:intersect
6:dy/dx
7:∫f(x)dx
```

Press **TRACE**, and select the zero option on the **CALCULATE** menu. Then, press **ENTER**.

Use the arrow keys to set the boundaries for the region in which you would like to search for the x-intercept on the left. When prompted to confirm, press **ENTER**.

Part One Part Two Part Three Part Four Continue

SUBMIT

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

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Self-Check 2: Answer (continued)

Self Check

Correct

NORMAL FLOAT AUTO REAL RADIAN MP
CALC ZERO
Y1=2X²+13X+15
Zero
X=-5 Y=0

The function has an x-intercept located at $(-5, 0)$.

NORMAL FLOAT AUTO REAL RADIAN MP
CALC ZERO
Y1=2X²+13X+15
Guess?
X=-1.212121 Y=2.1808999

Press **2nd** and then **TRACE** to access the **CALCULATE** menu. Choose the zero option and set the boundaries on the right side of the graph.

Part One Part Two **Part Three** Part Four Continue

SUBMIT

Self Check

Correct

Press **ENTER** when the calculator prompts you to confirm that you are ready for it to determine the location of the x-intercept.

The function has an x-intercept located at $(-1.5, 0)$.

The correct answers are $(-5, 0)$ and $(-1.5, 0)$.

NORMAL FLOAT AUTO REAL RADIAN MP
CALC ZERO
Y1=2X²+13X+15
Zero
X=-1.5 Y=0


Part One Part Two Part Three **Part Four** Continue

SUBMIT

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

Module 10: Linear and Quadratic Function Families
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Self-Check 3

 **Self-Check**

The y-intercept of $t(x) = x^2 - x - 20$ is 20.

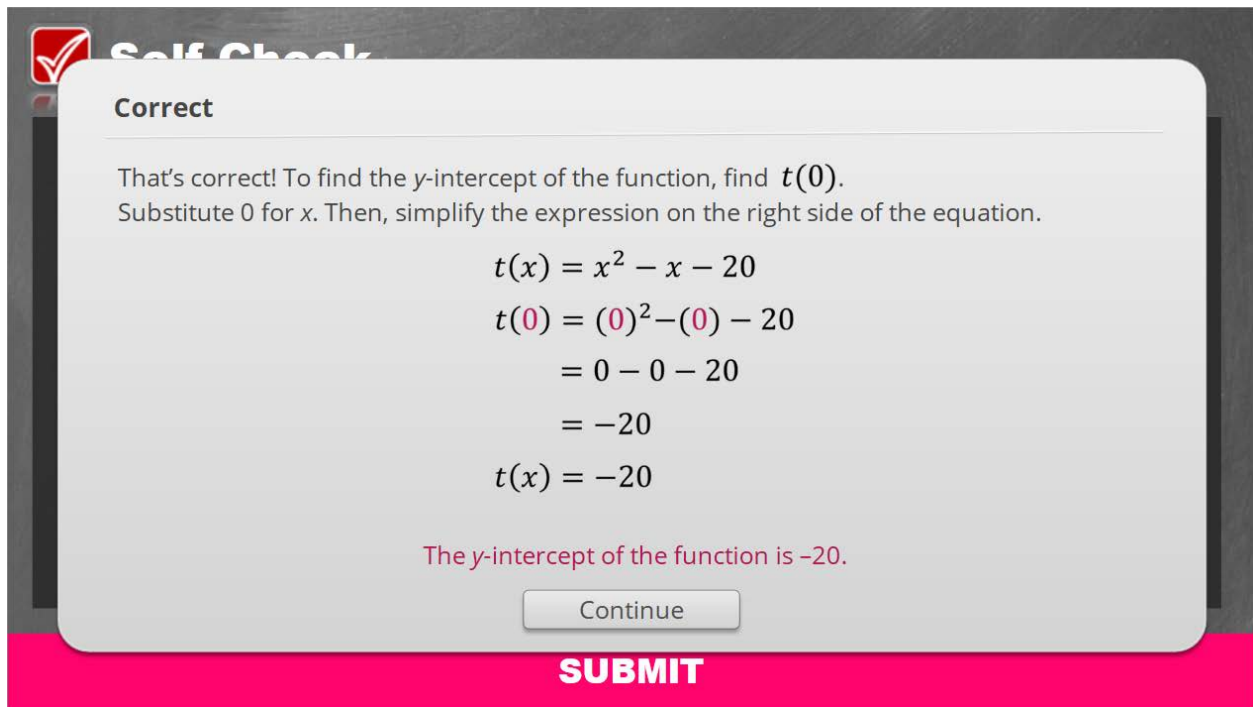
- True
- False

SUBMIT

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

Module 10: Linear and Quadratic Function Families
Topic 2 Content: Finding Zeros and Intercepts of Quadratic Functions Notes

Self-Check 3: Answer



Correct

That's correct! To find the y -intercept of the function, find $t(0)$.
Substitute 0 for x . Then, simplify the expression on the right side of the equation.

$$\begin{aligned}t(x) &= x^2 - x - 20 \\t(0) &= (0)^2 - (0) - 20 \\&= 0 - 0 - 20 \\&= -20 \\t(x) &= -20\end{aligned}$$

The y -intercept of the function is -20 .

Continue

SUBMIT

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

Module 10: Linear and Quadratic Function Families
Topic 2 Content: Finding Zeros and Intercepts of Quadratic Functions Notes

Self-Check 4



Self-Check

Use the graphing calculator to determine which of the following is the y-intercept of $w(x) = x^2 + 8x + 7$.

- (7, 0)
- (8, 7)
- (0, 8)
- (0, 7)

SUBMIT

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

Module 10: Linear and Quadratic Function Families

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

Self-Check 4: Answer

Correct

That's correct!

NORMAL FLOAT AUTO REAL RADIAN MP

Plot1 Plot2 Plot3

Y1 = X² + 8X + 7

Y2 =

Y3 =

Y4 =

Y5 =

Y6 =

Y7 =

Press the **Y=** key. Enter the expression $x^2 + 8x + 7$ to the right of Y1.

NORMAL FLOAT AUTO REAL RADIAN MP

Graph of $y = x^2 + 8x + 7$

Press **GRAPH**. Then, press **2nd** to begin identifying the y-intercept.

Part One Part Two Part Three Continue

SUBMIT

Correct

NORMAL FLOAT AUTO REAL RADIAN MP

TRACE

1:value

2:zero

3:minimum

4:maximum

5:intersect

6:dy/dx

7:∫f(x)dx

Press the **TRACE** key, and then press **1** to access the value option.

NORMAL FLOAT AUTO REAL RADIAN MP

Graph of $y = x^2 + 8x + 7$

X=0

Press **0**. Then Press **ENTER**.


Part One Part Two Part Three Continue

SUBMIT

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

Module 10: Linear and Quadratic Function Families
Topic 2 Content: Finding Zeros and Intercepts of Quadratic Functions Notes

Self-Check 4: Answer (continued)

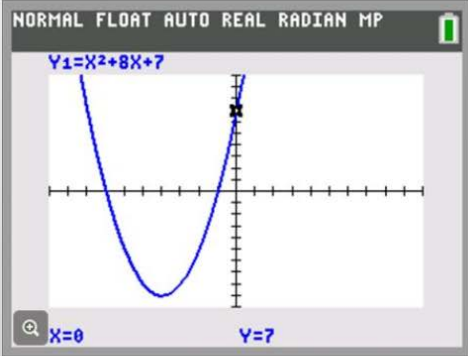
 **Self Check**

Correct

Notice the cursor is blinking at the location of the y -intercept $(0, 7)$.

At the bottom of the window, you'll also notice that the calculator informs you that when $x = 0$, $y = 7$.

The coordinates of the y -intercept are $(0, 7)$.



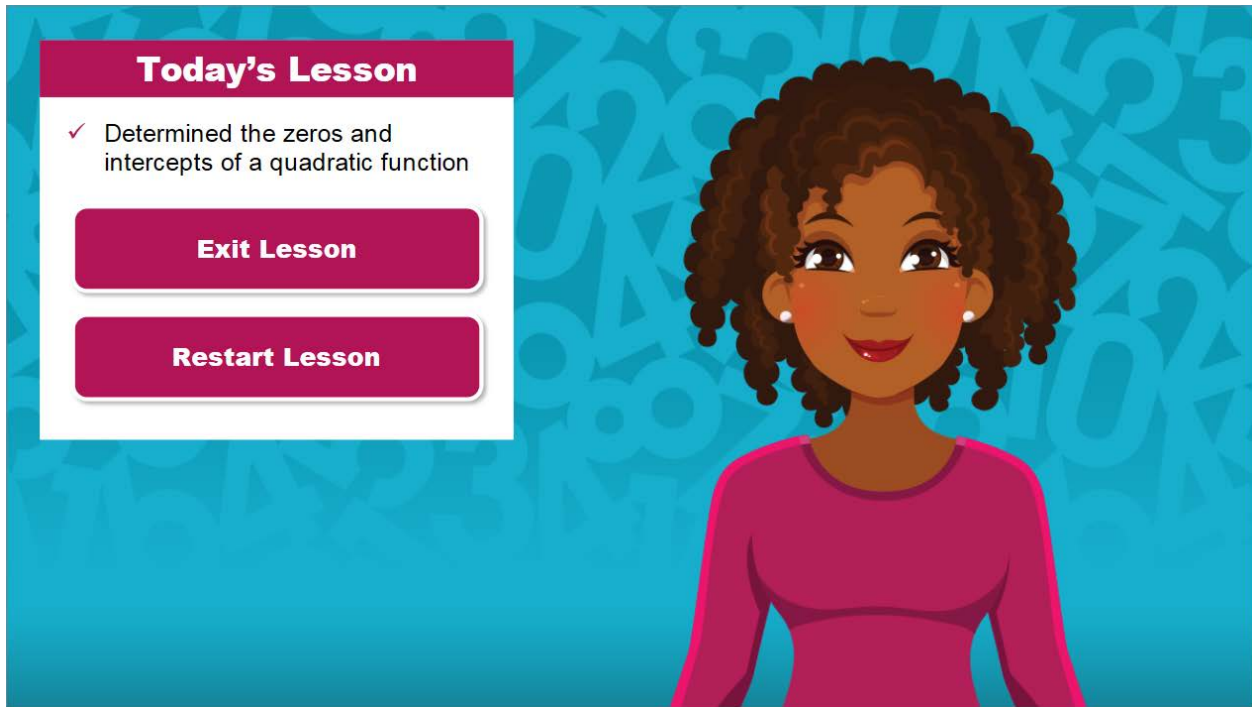
Part One Part Two **Part Three** Continue

SUBMIT

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

Module 10: Linear and Quadratic Function Families
Topic 2 Content: Finding Zeros and Intercepts of Quadratic Functions Notes

Conclusion



The image shows a digital interface for a lesson conclusion. On the left, a white sidebar with a pink header titled "Today's Lesson" contains a checkmark and the text "Determined the zeros and intercepts of a quadratic function". Below this are two pink buttons: "Exit Lesson" and "Restart Lesson". On the right, a cartoon illustration of a woman with curly brown hair and a pink top is set against a blue background with a pattern of mathematical symbols like pi, infinity, and numbers.

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