

Module 1: Expressions

Topic 3: Evaluating Cube Roots

Introduction



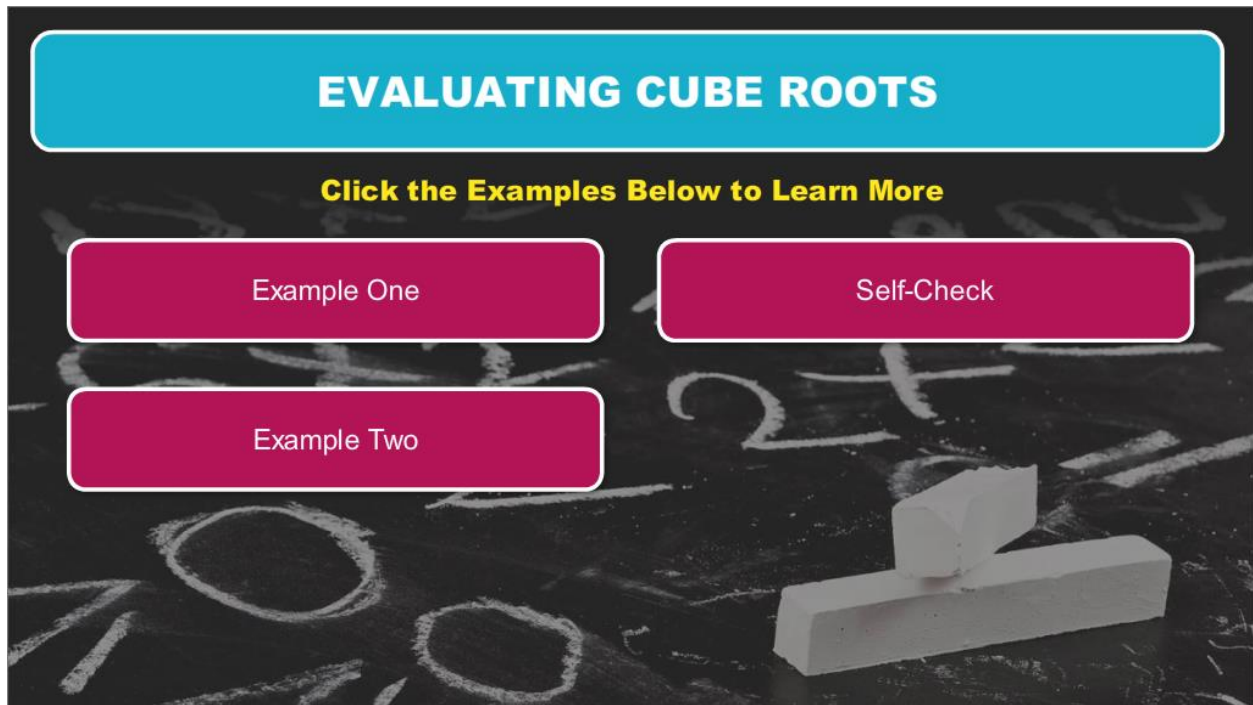
Today's Lesson

- You will examine expressions that include cube roots.
- You will learn how to evaluate these expressions for given replacement values.

Hello and welcome! I'm glad to have you here for this lesson in Algebra I, where you will apply your knowledge of the order of operations and cube roots to evaluate algebraic expressions for given replacement values.

Module 1: Expressions
Topic 3: Evaluating Cube Roots

Evaluating Cube Roots



The image shows a digital interface for learning about cube roots. At the top, a blue rounded rectangle contains the title "EVALUATING CUBE ROOTS" in white, bold, uppercase letters. Below this, a yellow text prompt reads "Click the Examples Below to Learn More". There are three pink rounded rectangular buttons: "Example One" and "Self-Check" are positioned side-by-side in the top row, and "Example Two" is centered below them. The background is a dark chalkboard with faint white chalk markings of numbers and symbols. In the bottom right corner, there is a photograph of a white rectangular prism with a smaller white cube-shaped object resting on top of it.

Click the examples below to learn more.

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Example 1

EXAMPLE 1

What is the value of $\sqrt[3]{xyz}$ when $x = 4$, $y = 2$, and $z = -1$?

$$\sqrt[3]{x y z}$$

What is the value of $\sqrt[3]{xyz}$, when $x = 4$, $y = 2$, and $z = -1$?

To answer this question, you must begin by substituting the replacement values into the expression. Place 4 in the place of x , 2 in the place of y , and -1 in the place of z . According to the order of operations, you must begin by simplifying the expression under the cube root symbol.

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Example 1 (continued)

EXAMPLE 1

What is the value of $\sqrt[3]{xyz}$ when $x = 4$, $y = 2$, and $z = -1$?

$$\sqrt[3]{(4)(2)(-1)}$$

To answer this question, you must begin by substituting the replacement values into the expression. Place 4 in the place of x , 2 in the place of y , and -1 in the place of z . According to the order of operations, you must begin by simplifying the expression under the cube root symbol.

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Example 1 (continued)

EXAMPLE 1

What is the value of $\sqrt[3]{xyz}$ when $x = 4$, $y = 2$, and $z = -1$?

$$\sqrt[3]{-8}$$

$(4)(2)(-1)$ is -8 . Now that you have performed the necessary multiplication, you are ready to take the cube root.

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Example 1 (continued)

EXAMPLE 1

What is the value of $\sqrt[3]{xyz}$ when $x = 4$, $y = 2$, and $z = -1$?

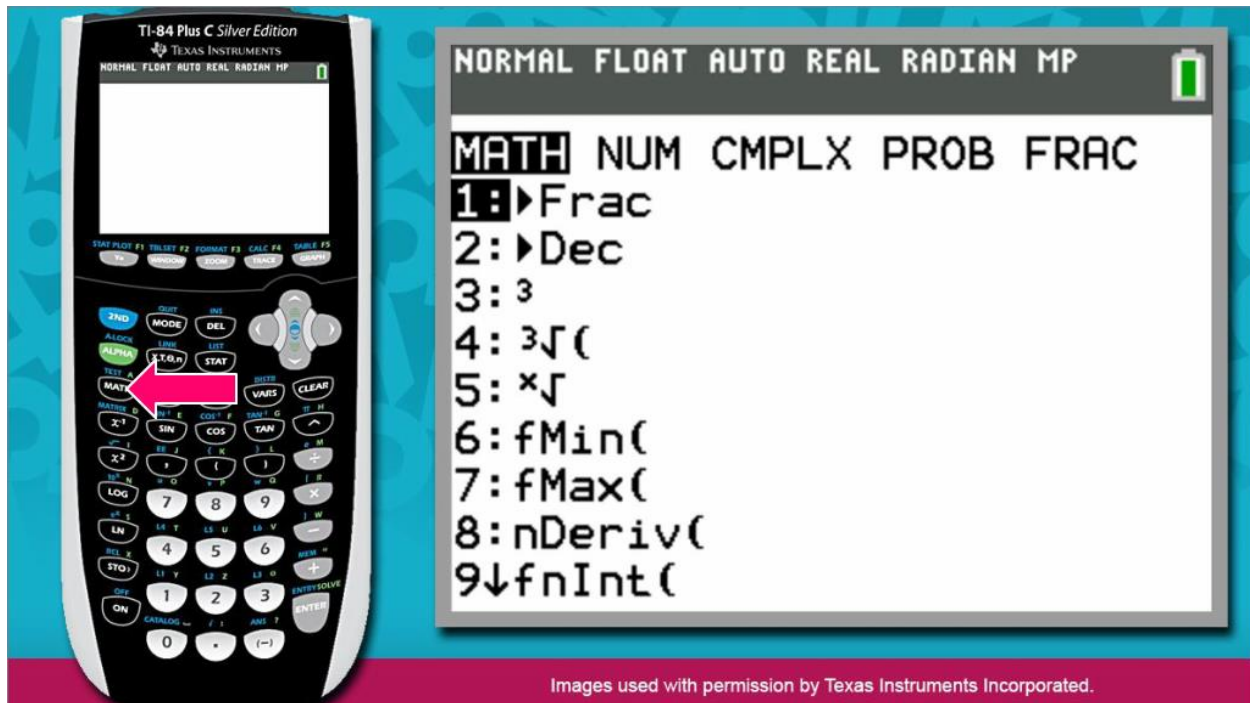
$$\sqrt[3]{-8} = ?$$

What is the cube root of -8 ? Or in other words, what number raised to the third power equals -8 ?

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Example 1 (continued)



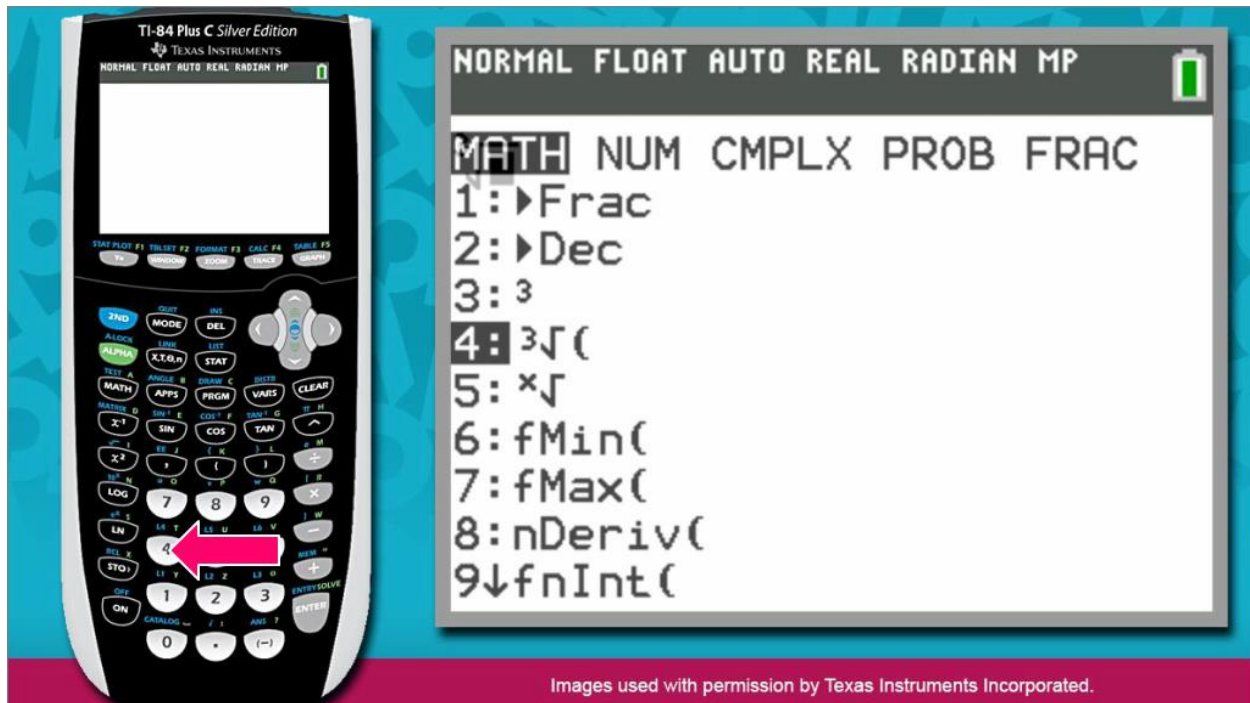
You may use paper and pencil to determine this answer, or you may want to use the cube root function in the calculator.

Press the MATH key, located directly below the green ALPHA key. This button will allow you to view some additional functions that the calculator is able to perform.

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Example 1 (continued)

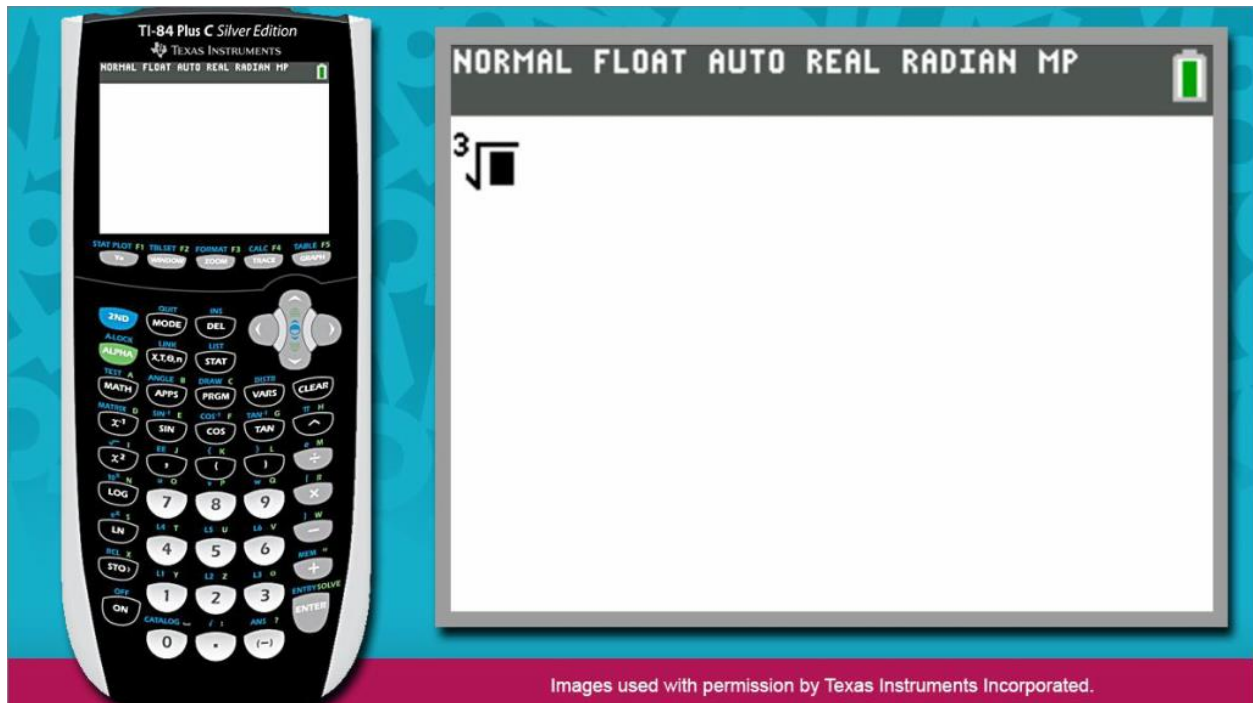


The cube root function is the fourth option in the list. Press 4 to select it.

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Example 1 (continued)

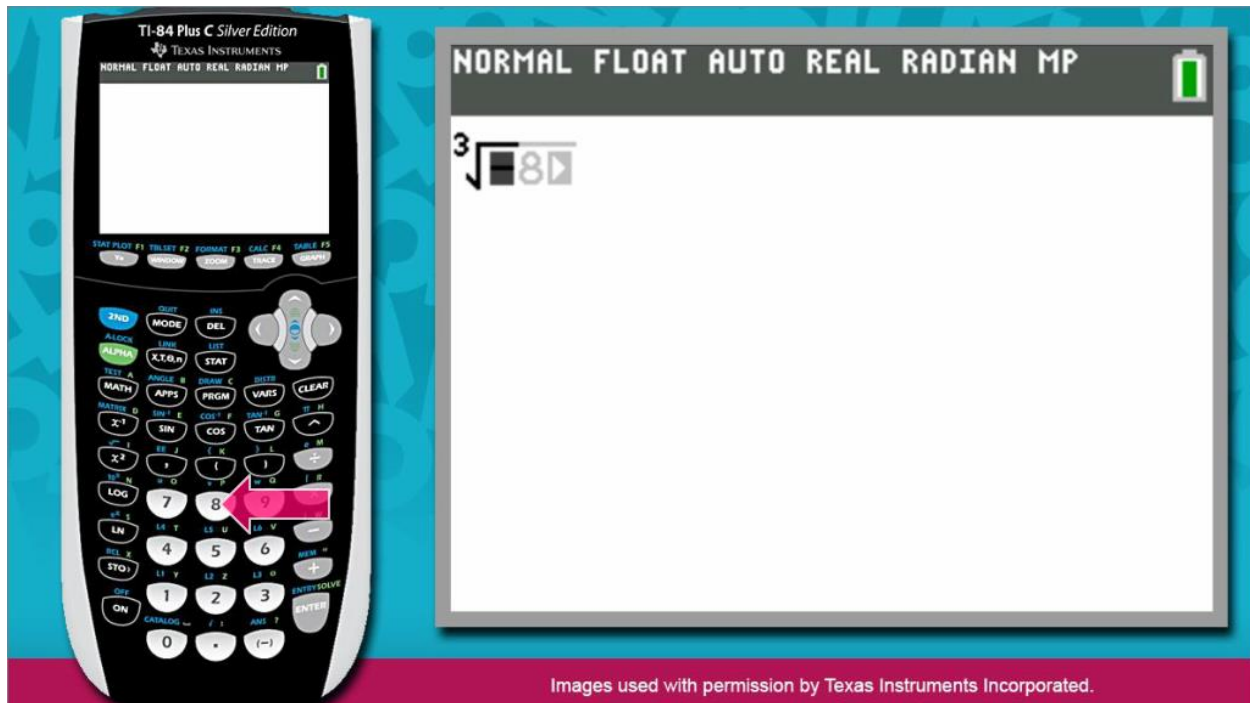


Notice that the calculator has returned to the home screen, ready to take the cube root of the value you enter next.

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Example 1 (continued)

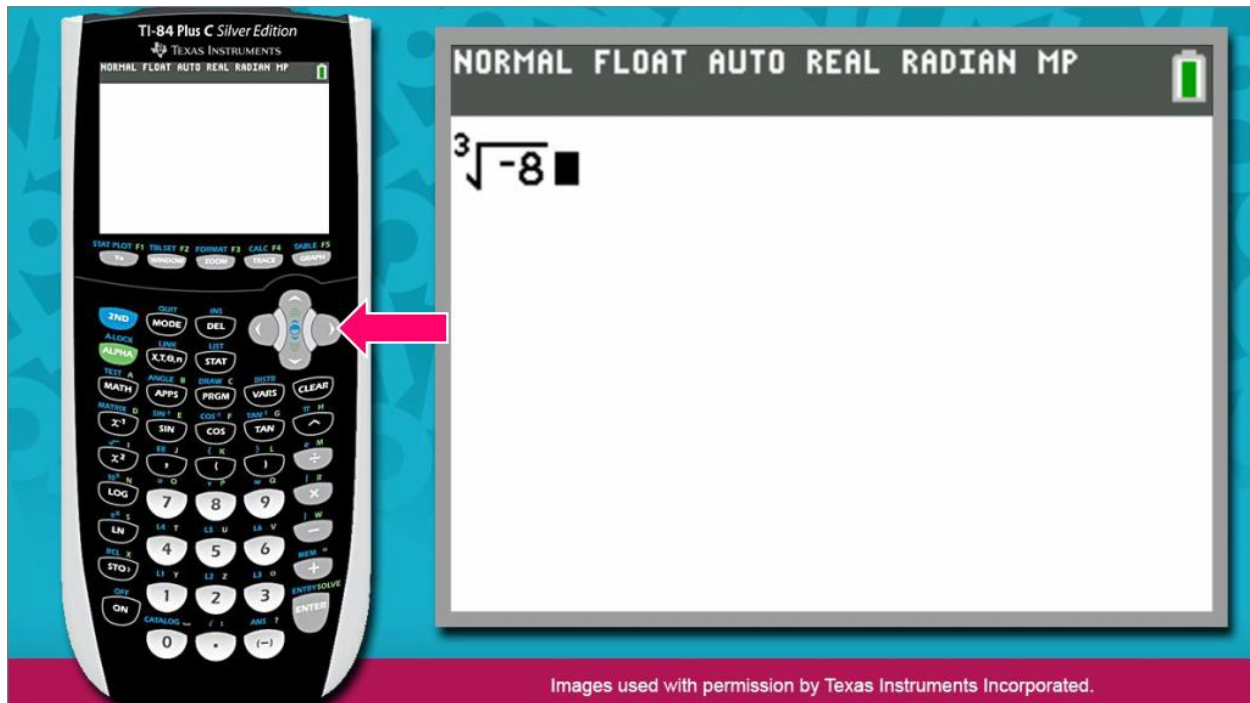


Press the negative key, located underneath the 3 key, then press 8. You will notice the cursor change to a right arrow. This is the calculator's way of alerting you to press the right arrow key if you have finished entering in the value within the cube root symbol.

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Example 1 (continued)

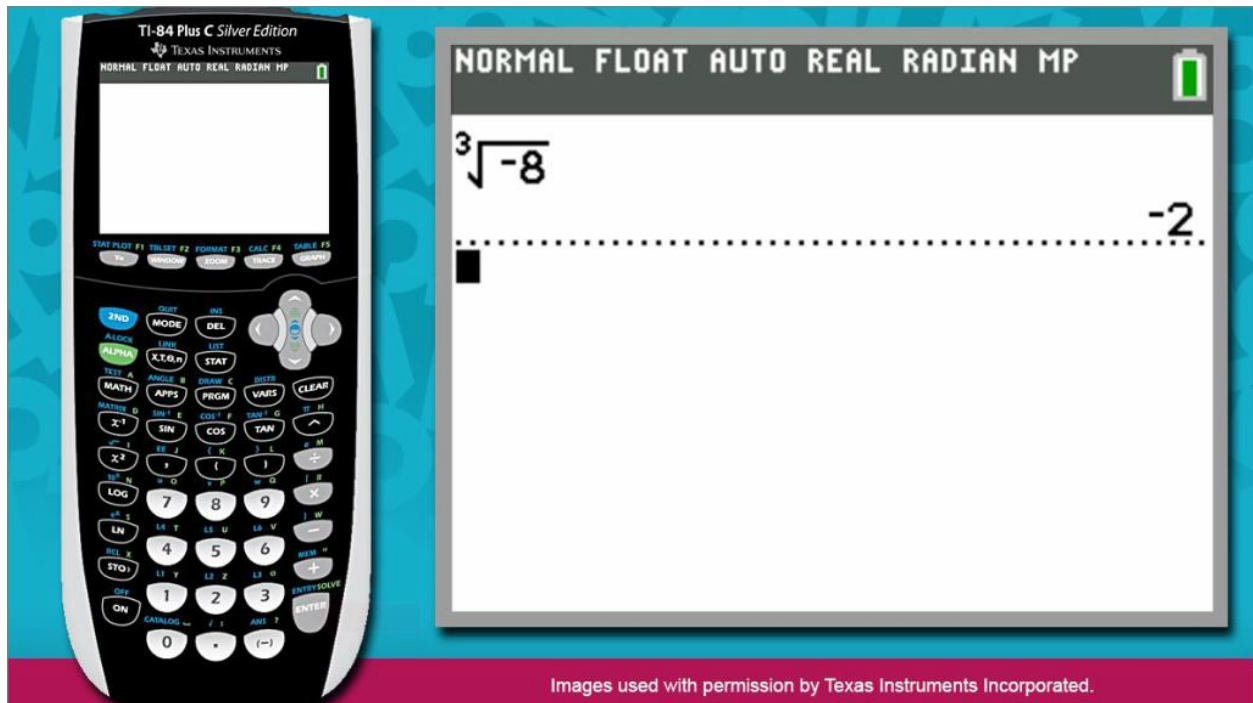


Because you have finished entering in this value, press the right arrow key. You will notice the cursor move to the right of the expression.

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Example 1 (continued)



Now press enter. The cube root of -8 is -2 .

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Example 1 (continued)

EXAMPLE 1

What is the value of $\sqrt[3]{xyz}$ when $x = 4$, $y = 2$, and $z = -1$?

$$\sqrt[3]{-8} = \boxed{-2}$$

When $x = 4$, $y = 2$, and $z = -1$, $\sqrt[3]{xyz}$ has a value of -2 .

Your work is complete.

When $x = 4$, $y = 2$, and $z = -1$, $\sqrt[3]{xyz}$ has a value of -2 .

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Example 2

EXAMPLE 2

Find the value of $\frac{\sqrt[3]{5a}}{2b}$ when $a = 25$ and $b = 5$.

Give your answer as a fraction in simplest form.

$$\frac{\sqrt[3]{5(\square)}}{2(\square)}$$

Enter the given values into the appropriate places and click submit.

Submit

Begin by substituting the replacement values.

Enter the given values into the appropriate places and click submit.

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Example 2 (continued)

EXAMPLE 2

Find the value of $\frac{\sqrt[3]{5a}}{2b}$ when $a = 25$ and $b = 5$.

Give your answer as a fraction in simplest form.

$$\frac{\sqrt[3]{5(25)}}{2(5)}$$

For this example, you need to substitute 25 for a and 5 for b .

Next

Feedback: For this example, you need to substitute 25 for a and 5 for b .

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Example 2 (continued)

EXAMPLE 2

Find the value of $\frac{\sqrt[3]{5a}}{2b}$ when $a = 25$ and $b = 5$.

Give your answer as a fraction in simplest form.

$$\frac{(\sqrt[3]{5(25)})}{(2(5))}$$

The numerator is
treated as a group

The denominator is
treated as a group

Now use the order of operations to simplify the expression. Remember that when simplifying an expression that includes a division bar, the expressions in the numerator and denominator are treated as groups. So according to the order of operations, you must simplify these expressions first.

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Example 2 (continued)

EXAMPLE 2

Find the value of $\frac{\sqrt[3]{5a}}{2b}$ when $a = 25$ and $b = 5$.

Give your answer as a fraction in simplest form.

$$\frac{\sqrt[3]{5(25)}}{2(5)}$$

In the numerator, you must simplify the product within the cube root symbol before you are able to take the cube root.

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Example 2 (continued)

EXAMPLE 2

Find the value of $\frac{\sqrt[3]{5a}}{2b}$ when $a = 25$ and $b = 5$.

Give your answer as a fraction in simplest form.

$$\frac{\sqrt[3]{5(25)}}{2(5)} = \frac{\sqrt[3]{\boxed{}}}{2(5)}$$

What is the product of 5 times 25?

Submit

You may choose to use paper and pencil or the calculator to determine the value of $5(25)$.
What is the product of 5 times 25?

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Example 2 (continued)

EXAMPLE 2

Find the value of $\frac{\sqrt[3]{5a}}{2b}$ when $a = 25$ and $b = 5$.

Give your answer as a fraction in simplest form.

$$\frac{\sqrt[3]{5(25)}}{2(5)} = \frac{\sqrt[3]{125}}{2(5)}$$

The product of 5 times 25 is 125.

Next

Feedback: The product of $5(25) = 125$.

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Example 2 (continued)

EXAMPLE 2

Find the value of $\frac{\sqrt[3]{5a}}{2b}$ when $a = 25$ and $b = 5$.

Give your answer as a fraction in simplest form.

$$\frac{\sqrt[3]{125}}{2(5)} = \frac{\boxed{}}{2(5)}$$

What is the cube root of 125?

Submit

In the expression, replace $5(25)$ with 125. In the numerator, you are now left with only one operation to perform. You must take the cube root. You may use paper and pencil to determine $\sqrt[3]{125}$, or you may want to use the cube root function in the calculator.

What is the cube root of 125?

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Example 2 (continued)

EXAMPLE 2

Find the value of $\frac{\sqrt[3]{5a}}{2b}$ when $a = 25$ and $b = 5$.

Give your answer as a fraction in simplest form.

$$\frac{\sqrt[3]{125}}{2(5)} = \frac{5}{2(5)}$$

The cube root of 125 is 5.

Next

Feedback: $\sqrt[3]{125} = 5$

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Example 2 (continued)

EXAMPLE 2

Find the value of $\frac{\sqrt[3]{5a}}{2b}$ when $a = 25$ and $b = 5$.

Give your answer as a fraction in simplest form.

$$\frac{5}{2(5)} = \frac{5}{\boxed{}}$$

What is the product of 2 and 5?

Submit

In the expression replace $\sqrt[3]{125}$ with 5. The numerator is now completely simplified. You can move on to simplify the product in the denominator.

What is the product of 2 and 5?

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Example 2 (continued)

EXAMPLE 2

Find the value of $\frac{\sqrt[3]{5a}}{2b}$ when $a = 25$ and $b = 5$.

Give your answer as a fraction in simplest form.

$$\frac{5}{2(5)} = \frac{5}{10}$$

The product of 2 and 5 is 10.

Next

Feedback: $2(5) = 10$.

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Example 2 (continued)

EXAMPLE 2

Find the value of $\frac{\sqrt[3]{5a}}{2b}$ when $a = 25$ and $b = 5$.

Give your answer as a fraction in simplest form.

$$\frac{5}{10}$$

In the expression, replace $2(5)$ with 10 . Now the expressions in both the numerator and denominator are simplified.

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Example 2 (continued)

Next

EXAMPLE 2

Find the value of $\frac{\sqrt[3]{5a}}{2b}$ when $a = 25$ and $b = 5$.

Give your answer as a fraction in simplest form.

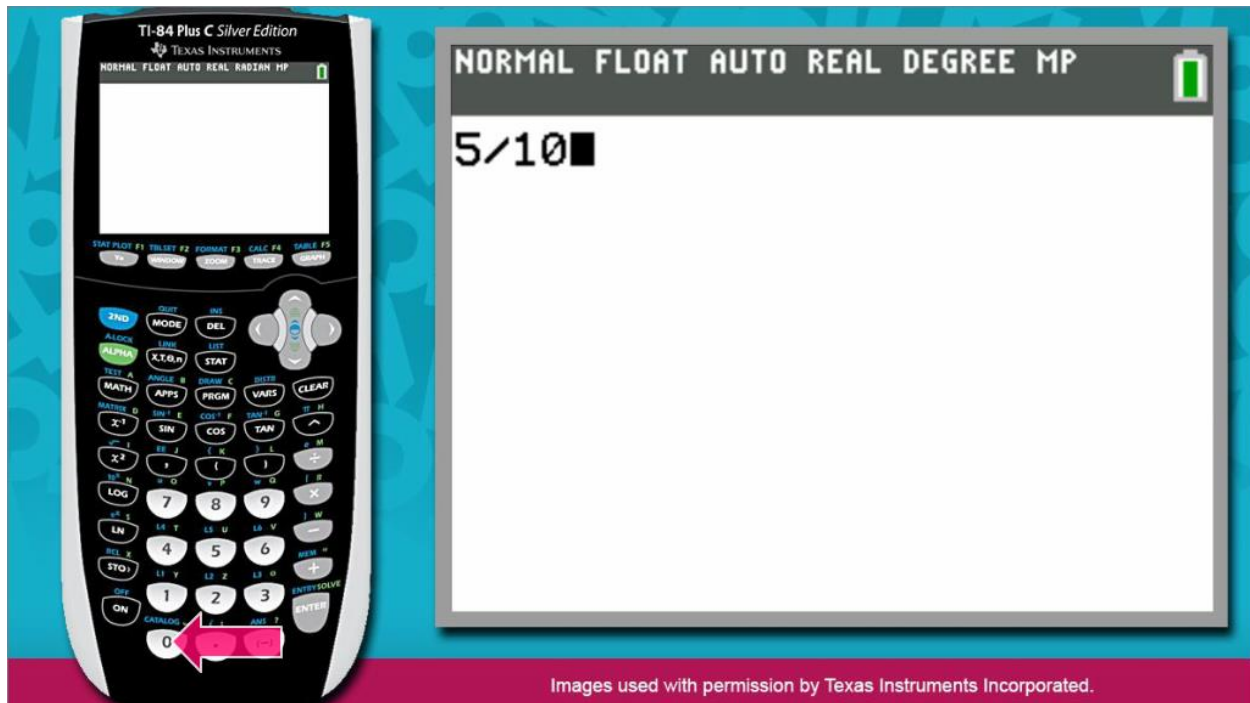
$$\frac{5}{10}$$

In this example you are asked to give your answer as a fraction in simplest form. You may choose to use mental math to simplify $\frac{5}{10}$, or you may want to use one of the functions in the calculator.

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Example 2 (continued)

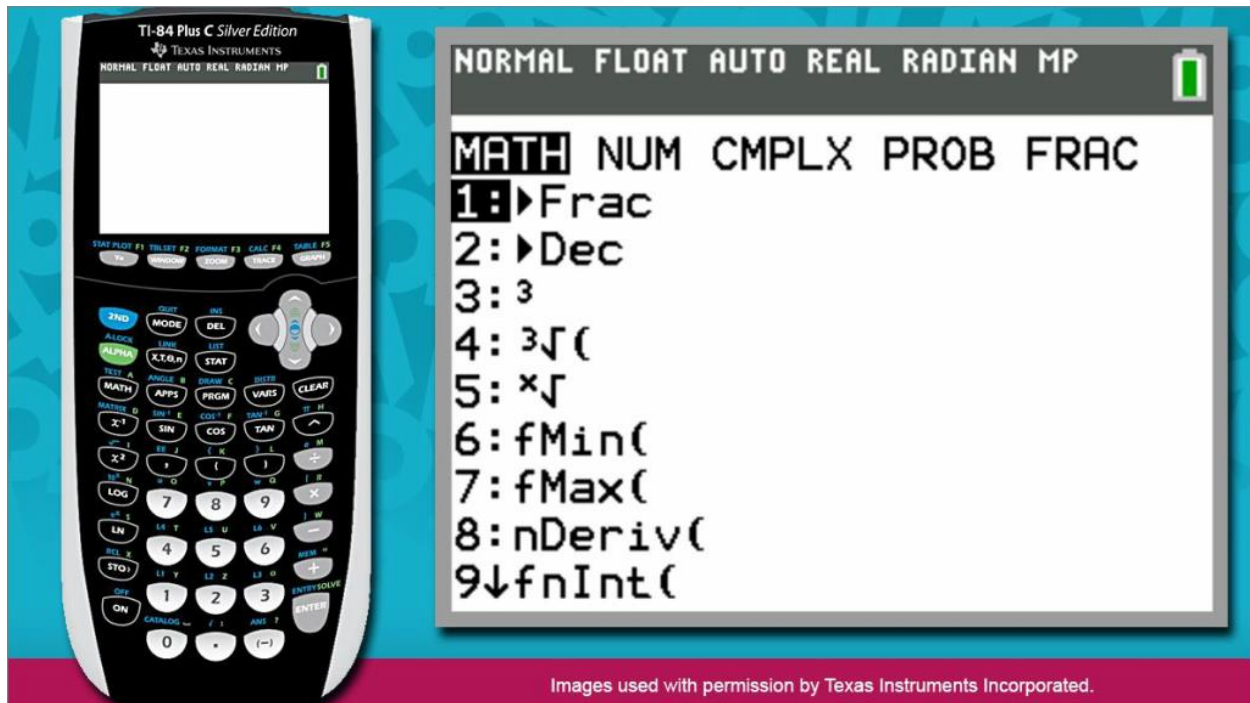


Remember that a fraction is essentially a division problem. So begin by pressing 5, then the division key, then 1, then 0.

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Example 2 (continued)

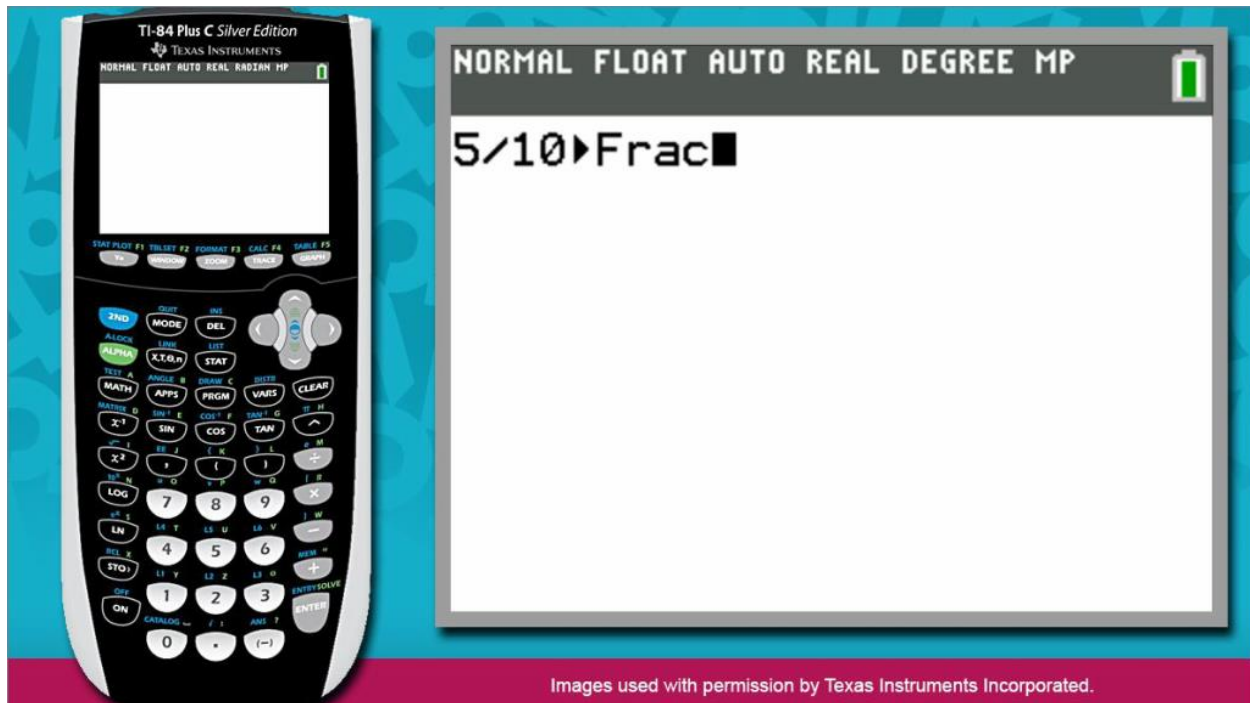


Now it's time to inform the calculator that you would like the quotient expressed as a fraction in simplest form. Press the MATH key. Press 1 to choose the first option.

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Example 2 (continued)



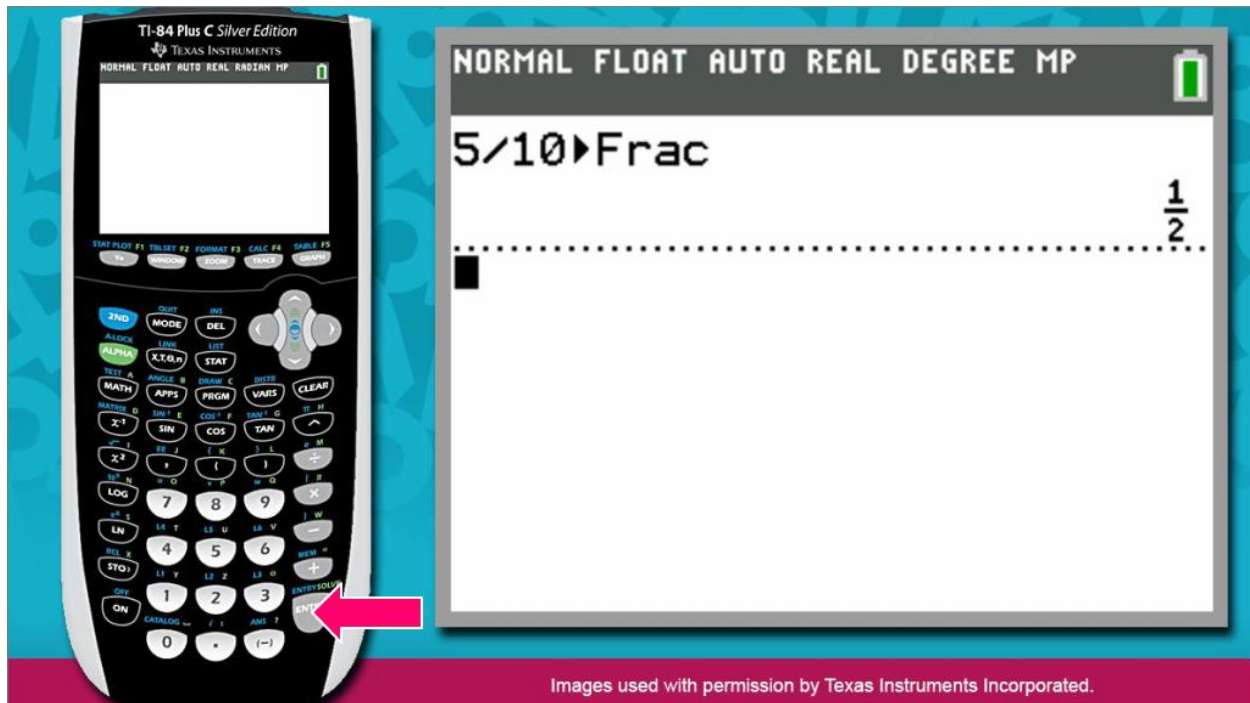
Images used with permission by Texas Instruments Incorporated.

You will notice the calculator return to the home screen. Immediately following your expression is a function that will alert your calculator to give an answer as a fraction in simplest form.

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Example 2 (continued)



Press enter. The quotient of 5 and 10, given as a fraction in simplest form, is $\frac{1}{2}$.

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Example 2 (continued)

EXAMPLE 2

Find the value of $\frac{\sqrt[3]{5a}}{2b}$ when $a = 25$ and $b = 5$.

Give your answer as a fraction in simplest form.

$$\frac{5}{10} = \frac{1}{2}$$

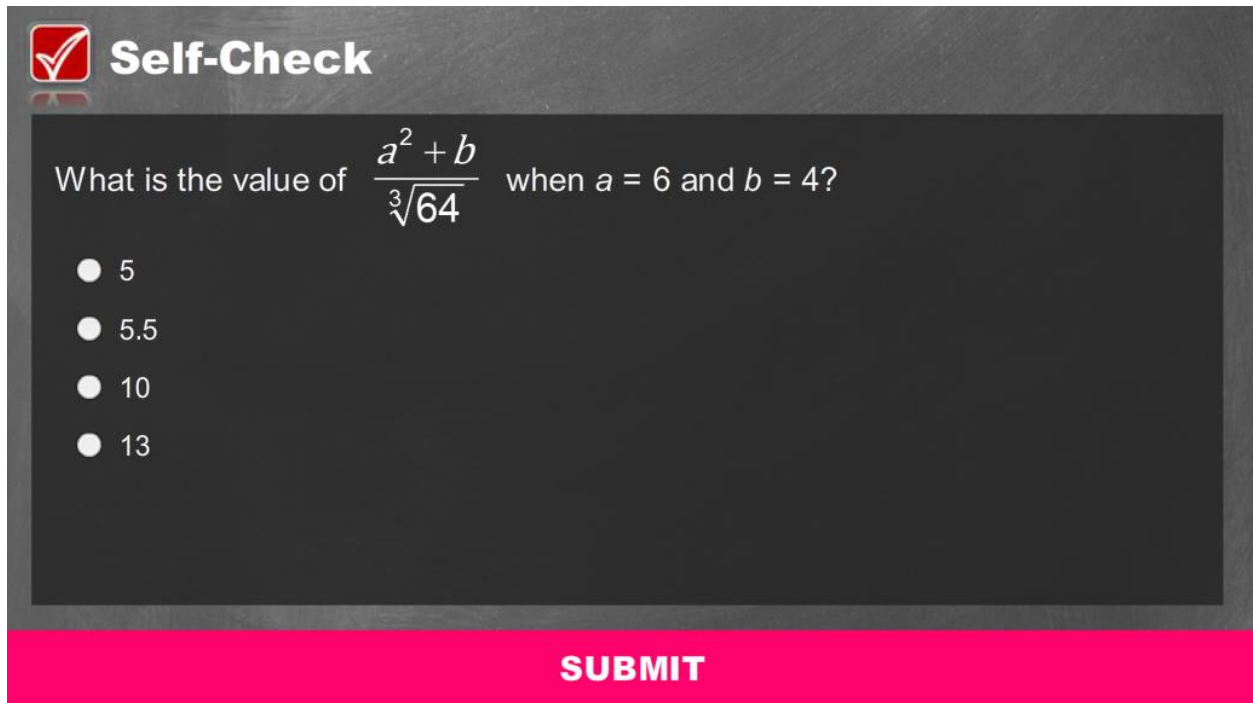
When $a = 25$ and $b = 5$, $\frac{\sqrt[3]{5a}}{2b}$ has a value of $\frac{1}{2}$.

Your work is complete.

When $a = 25$ and $b = 5$, $\frac{\sqrt[3]{5a}}{2b}$ has a value of $\frac{1}{2}$.

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Self-Check



Self-Check

What is the value of $\frac{a^2 + b}{\sqrt[3]{64}}$ when $a = 6$ and $b = 4$?

- 5
- 5.5
- 10
- 13

SUBMIT

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

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Self-Check: Answer

Correct

That's correct!

Evaluate the expression when $a = 6$ and $b = 4$.

$$\frac{a^2 + b}{\sqrt[3]{64}}$$

Substitute 6 for a and 4 for y .

$$\frac{(6)^2 + (4)}{\sqrt[3]{64}}$$

Evaluate the exponential expression in the numerator: $(6)^2 = 36$

$$\frac{36 + (4)}{\sqrt[3]{64}}$$

Simplify the sum in the numerator.

$$\frac{40}{\sqrt[3]{64}}$$

Evaluate the cube root in the denominator: $\sqrt[3]{64} = 4$

$$\frac{40}{4}$$

Divide: $\frac{40}{4} = 10$

Continue

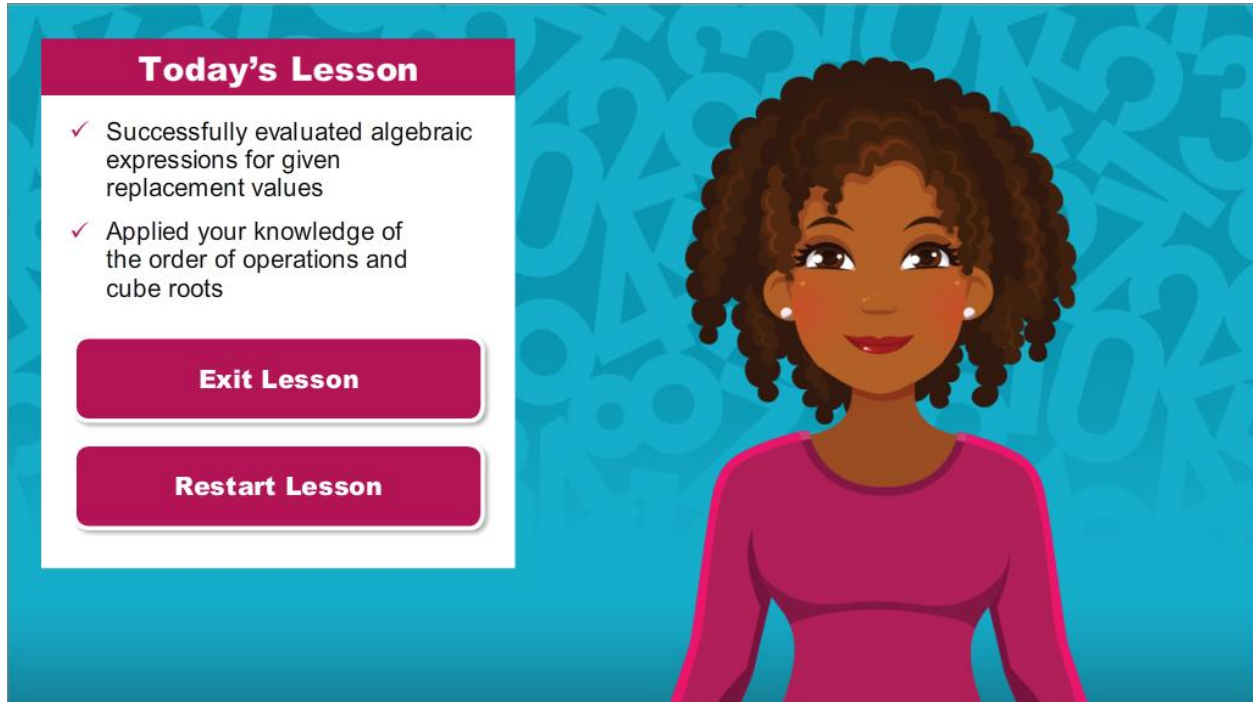
SUBMIT

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

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Conclusion



Today's Lesson

- ✓ Successfully evaluated algebraic expressions for given replacement values
- ✓ Applied your knowledge of the order of operations and cube roots

Exit Lesson

Restart Lesson

Congratulations! You have reached the conclusion of this lesson in Algebra I. You have applied your knowledge of the order of operations and cube roots to evaluate algebraic expressions for given replacement values.