Module 4: Radical Expressions
Topic 2 Content: Multiplying Radical Expressions

Introduction

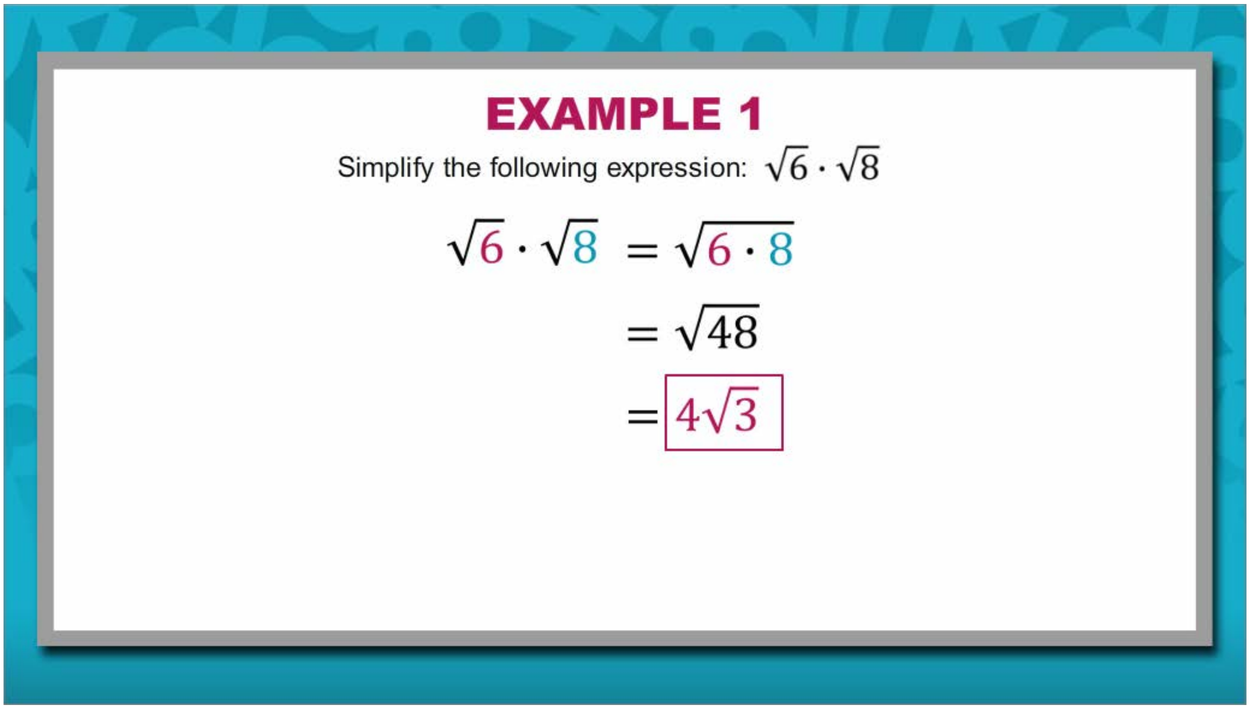
I'm so glad you could join me for this lesson in Algebra I. In this lesson, you will learn how to multiply radical expressions. Your skills simplifying radical expressions will prove useful during this lesson.

Multiplying Radical Expressions

Click the examples below to learn more.

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

Example 1



Simplify the following expression: $\sqrt{6} \cdot \sqrt{8}$

To find the product of two radical expressions, begin by applying the Product Property of Radicals. The Product Property of Radicals states that the square root of a product is equal to the product of the square roots of the factors. This means that $\sqrt{6} \cdot \sqrt{8}$ can be represented as $\sqrt{6 \cdot 8}$.

$$\sqrt{6} \cdot \sqrt{8} = \sqrt{6 \cdot 8}$$

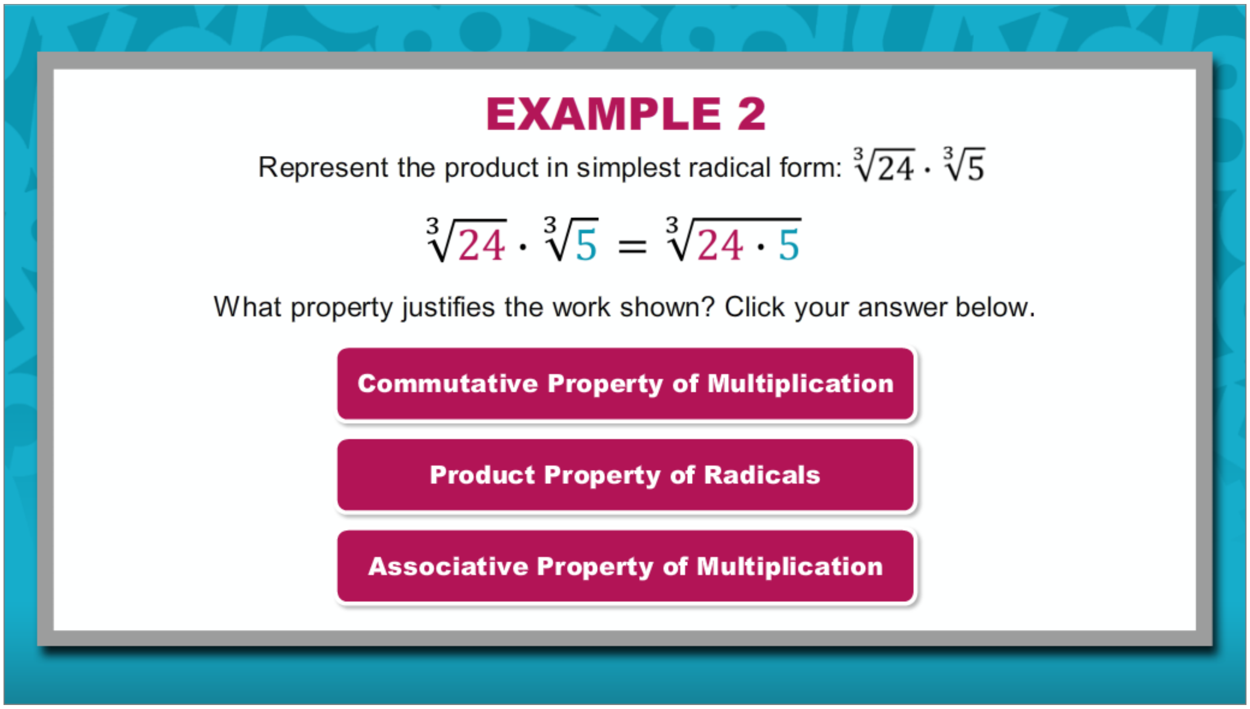
The next step is to simplify the radicand by finding the product of 6 and 8: $6 \cdot 8 = 48$.

$$= \sqrt{48}$$

The last step is to represent $\sqrt{48}$ in simplest radical form. The simplest radical form of $\sqrt{48}$ is $4\sqrt{3}$.

$$= 4\sqrt{3}$$

Example 2



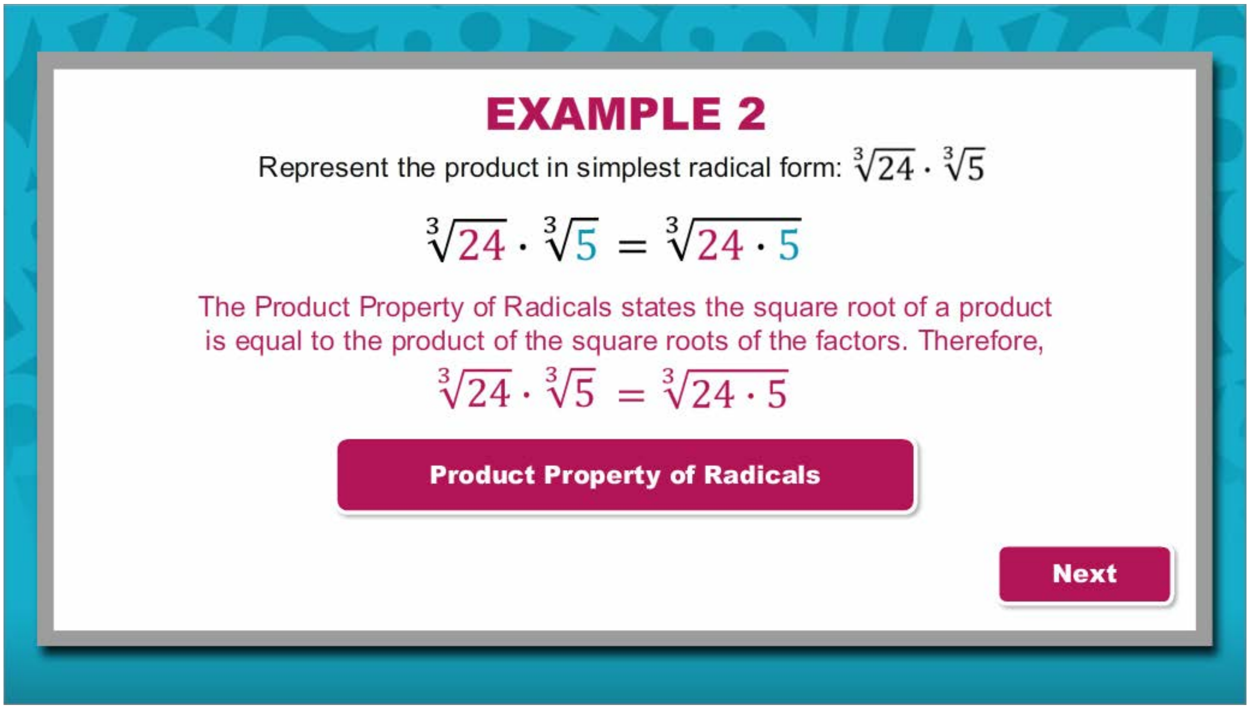
Represent the product in simplest radical form: $\sqrt[3]{24} \cdot \sqrt[3]{5}$

$$\sqrt[3]{24} \cdot \sqrt[3]{5} = \sqrt[3]{24 \cdot 5}$$

What property justifies the work shown? Click your answer below.

A) Commutative Property of Multiplication
B) Product Property of Radicals
C) Associative Property of Multiplication

Example 2 (continued)

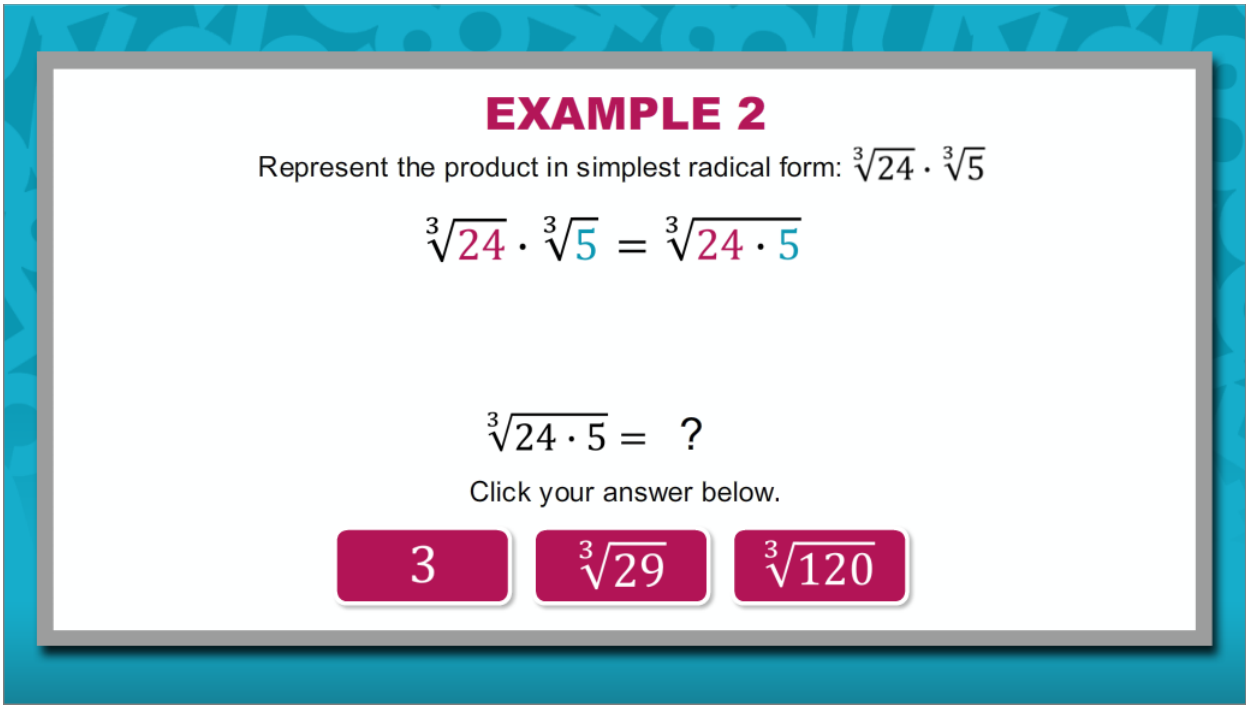


$$\sqrt[3]{24} \cdot \sqrt[3]{5} = \sqrt[3]{24 \cdot 5}$$

The Product Property of Radicals states that the square root of a product is equal to the product of the square roots of the factors. Therefore,

$$\sqrt[3]{24} \cdot \sqrt[3]{5} = \sqrt[3]{24 \cdot 5}.$$

Example 2 (continued)



$$\sqrt[3]{24} \cdot \sqrt[3]{5} = \sqrt[3]{24 \cdot 5}$$

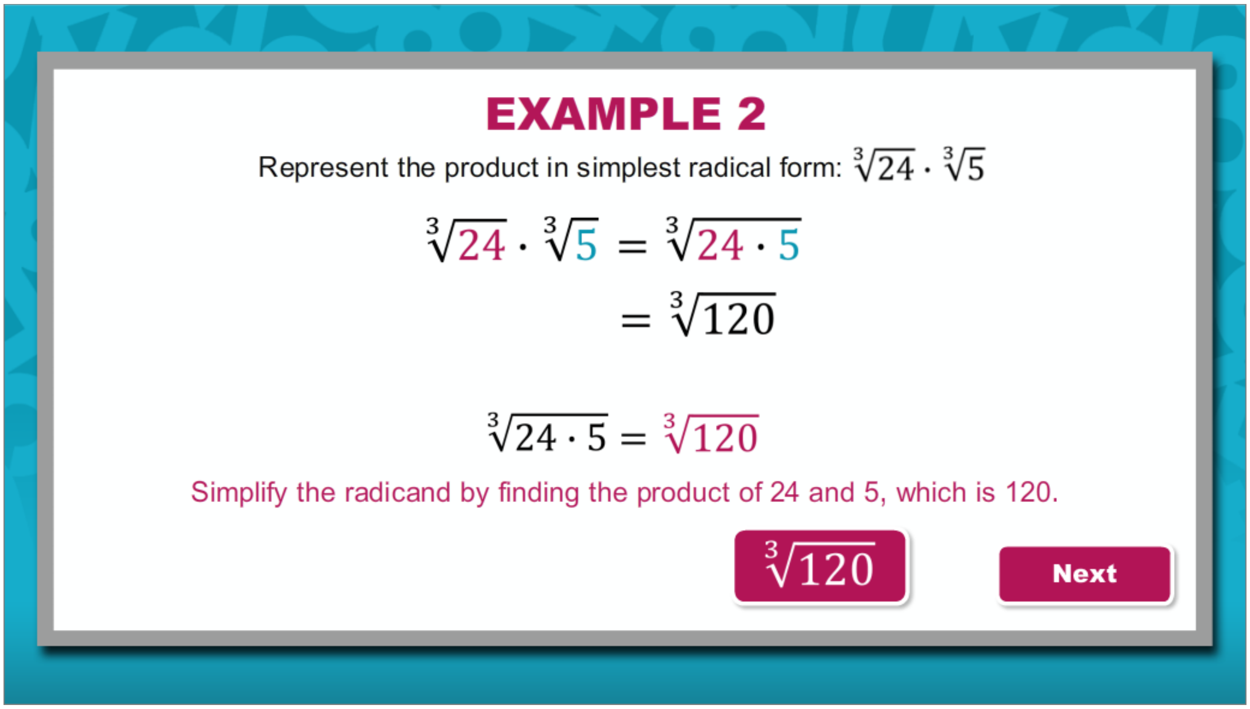
The next step is to find the product of the factors of the radicand.

$$\sqrt[3]{24 \cdot 5} = ?$$

Click your answer below.

A) 3
B) $\sqrt[3]{29}$
C) $\sqrt[3]{120}$

Example 2 (continued)

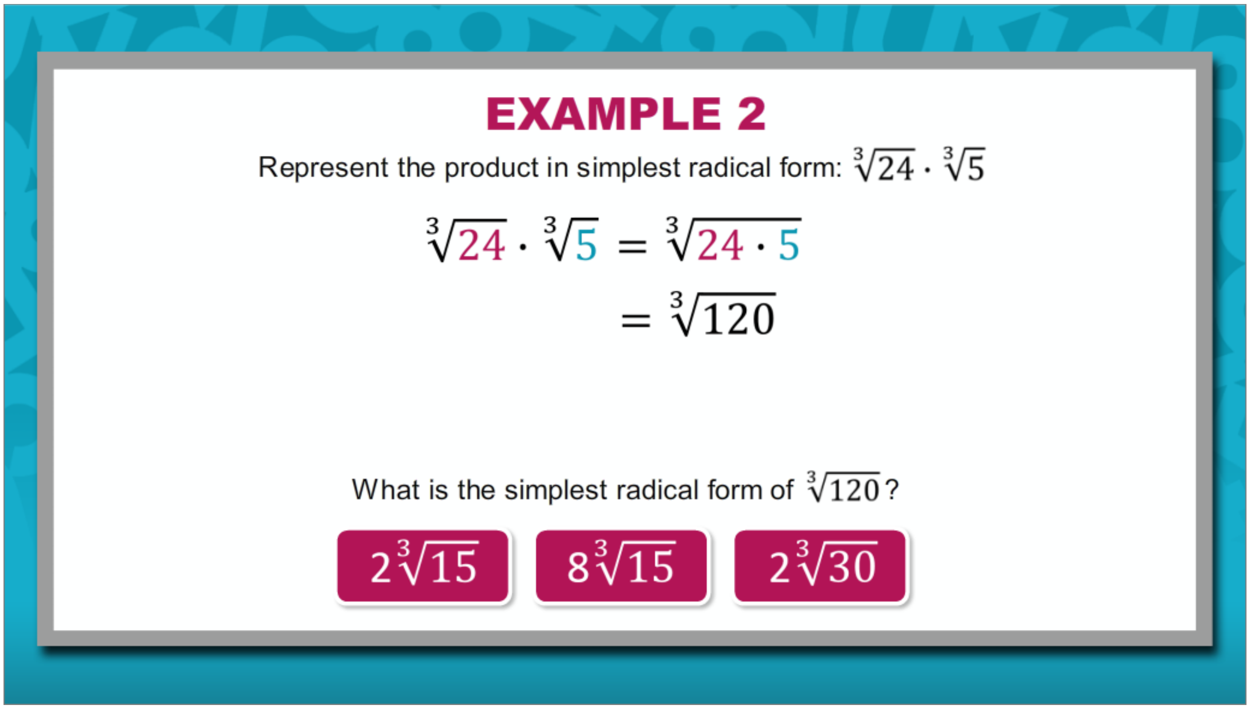


$$\begin{aligned}\sqrt[3]{24} \cdot \sqrt[3]{5} &= \sqrt[3]{24 \cdot 5} \\ &= \sqrt[3]{120}\end{aligned}$$

$\sqrt[3]{24 \cdot 5} = \sqrt[3]{120}$

Simplify the radicand by finding the product of 24 and 5, which is 120.

Example 2 (continued)



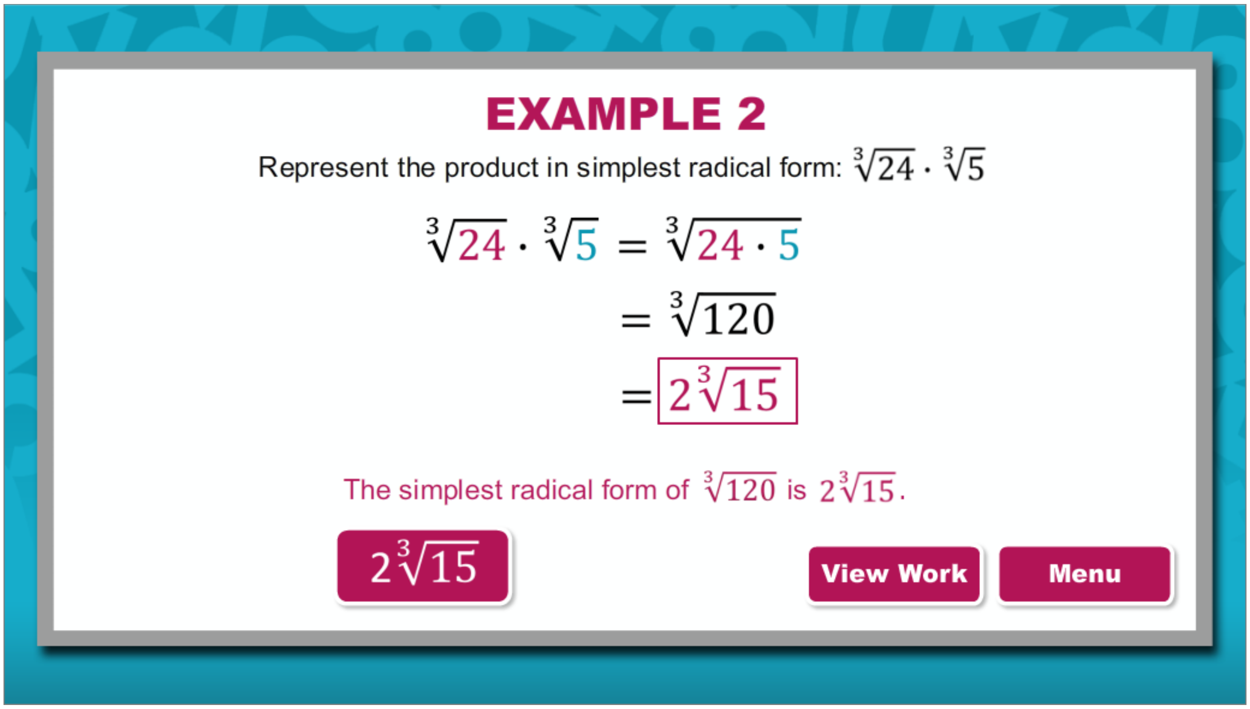
$$\begin{aligned} \sqrt[3]{24} \cdot \sqrt[3]{5} &= \sqrt[3]{24 \cdot 5} \\ &= \sqrt[3]{120} \end{aligned}$$

The last step is to represent $\sqrt[3]{120}$ in simplest radical form.

What is the simplest radical form of $\sqrt[3]{120}$?

A) $2\sqrt[3]{15}$
B) $8\sqrt[3]{15}$
C) $2\sqrt[3]{30}$

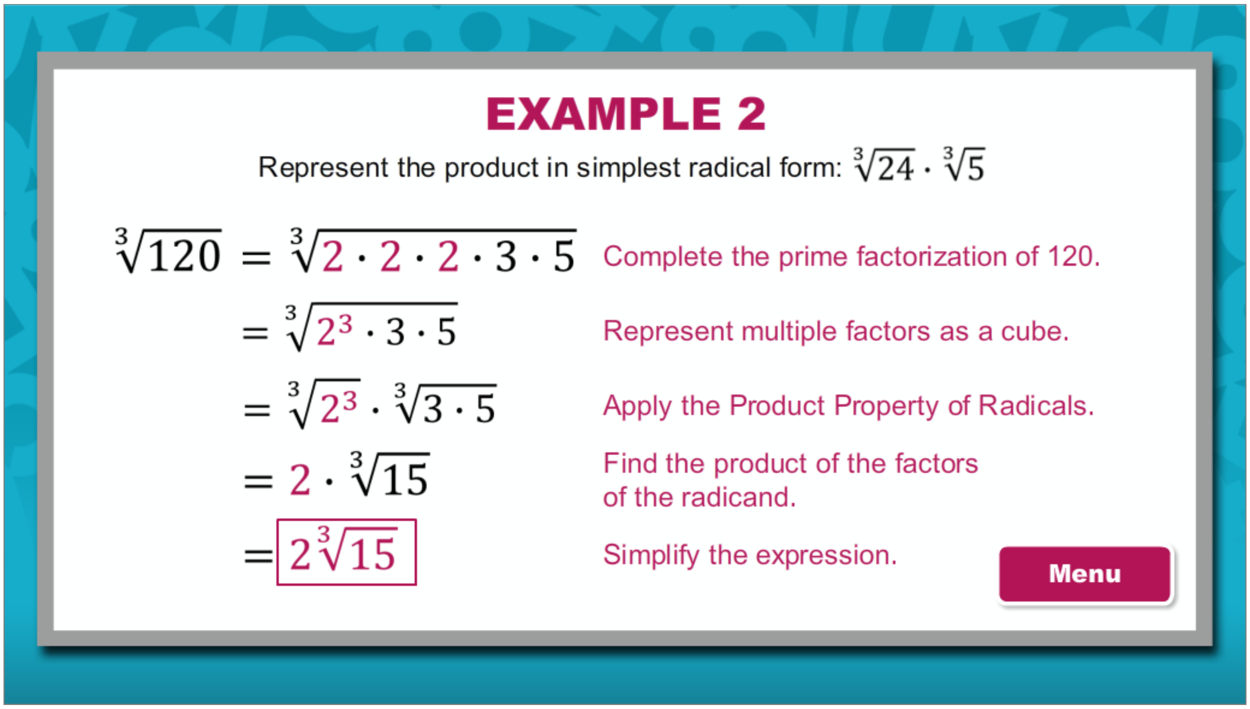
Example 2 (continued)



$$
\begin{aligned}
\sqrt[3]{24} \cdot \sqrt[3]{5} &= \sqrt[3]{24 \cdot 5} \\
&= \sqrt[3]{120} \\
&= 2\sqrt[3]{15}
\end{aligned}
$$

The simplest radical form of $\sqrt[3]{120}$ is $2\sqrt{15}$.

Example 2 (continued)



$\sqrt[3]{120} = \sqrt[3]{2 \cdot 2 \cdot 2 \cdot 3 \cdot 5}$	Complete the prime factorization of 120.
$= \sqrt[3]{2^3 \cdot 3 \cdot 5}$	Represent multiple factors as cubes.
$= \sqrt[3]{2^3} \cdot \sqrt[3]{3 \cdot 5}$	Apply the Product Property of Radicals.
$= 2 \cdot \sqrt[3]{15}$	Find the product of the factors of the radicand.
$= 2\sqrt[3]{15}$	Simplify the expression.

Example 3

Simplify the following expression: $-4\sqrt{5} \cdot 3\sqrt{8}$

The Commutative Property of Multiplication allows you to change the order of multiplication. Apply the property in this example by multiplying -4 and 3 first. Then, multiply $\sqrt{5}$ and $\sqrt{8}$.

$-4 \cdot 3 = -12$

To find the product of $\sqrt{5}$ and $\sqrt{8}$, apply the Product Property of Radicals. The Product Property of Radicals states that the square root of a product is equal to the product of the square roots of the factors.

Therefore, $\sqrt{5} \cdot \sqrt{8}$ can be represented as $\sqrt{5 \cdot 8}$.

The next step is to find the product of the factors of the radicand: $5 \cdot 8 = 40$.

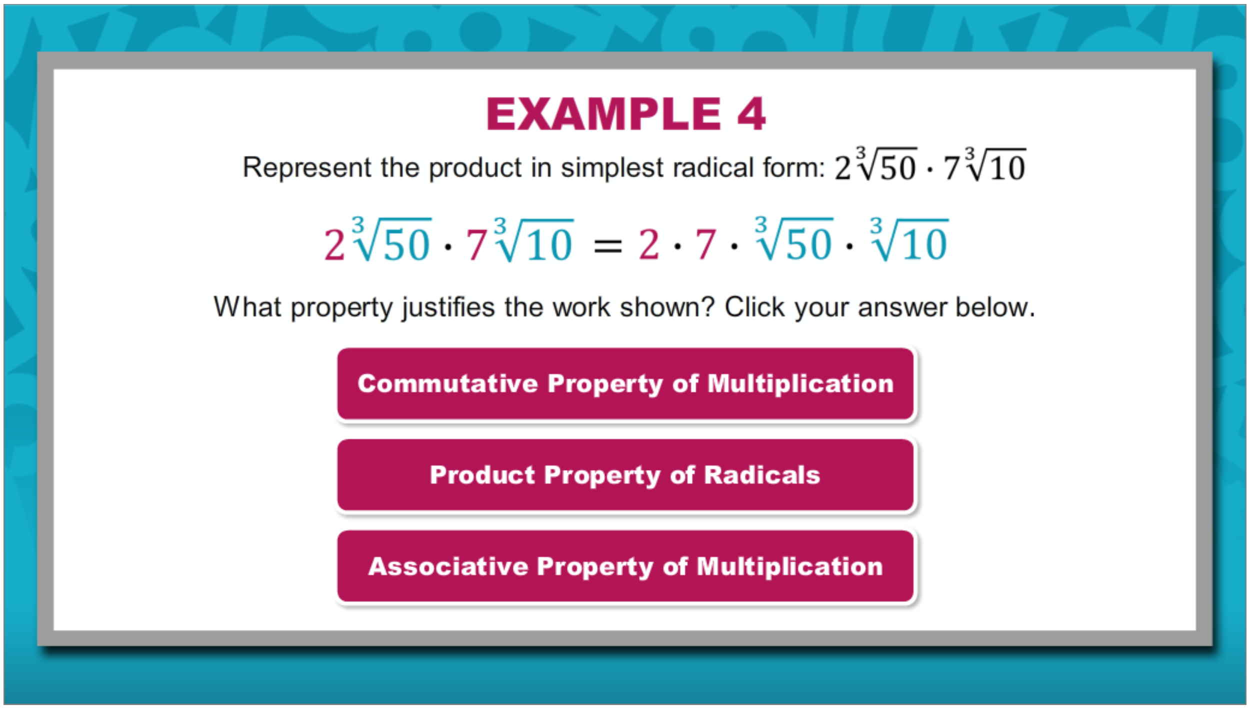
Now, represent $\sqrt{40}$ in simplest radical form. The simplest radical form of $\sqrt{40}$ is $2\sqrt{10}$.

The last step is to simplify the product: $-12 \cdot 2 = -24$. The final answer is $-24\sqrt{10}$.

Steps to solve this problem:

$$\begin{aligned} -4\sqrt{5} \cdot 3\sqrt{8} &= -4 \cdot 3 \cdot \sqrt{5} \cdot \sqrt{8} \\ &= -12 \cdot \sqrt{5 \cdot 8} \\ &= -12 \cdot \sqrt{40} \\ &= -12 \cdot 2\sqrt{10} \\ &= -24\sqrt{10} \end{aligned}$$

Example 4



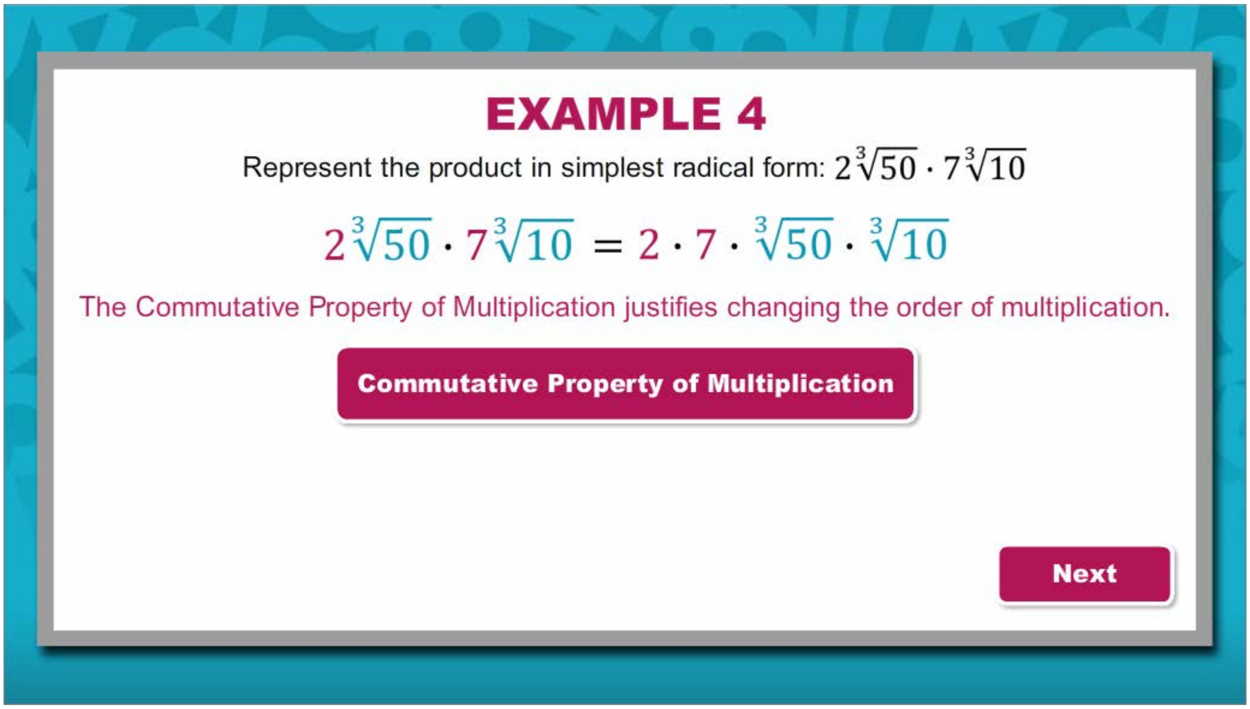
Represent the product in simplest radical form: $2\sqrt[3]{50} \cdot 7\sqrt[3]{10}$

$$2\sqrt[3]{50} \cdot 7\sqrt[3]{10} = 2 \cdot 7 \cdot \sqrt[3]{50} \cdot \sqrt[3]{10}$$

What property justifies the work shown? Click your answer below.

A) Commutative Property of Multiplication
B) Product Property of Radicals
C) Associative Property of Multiplication

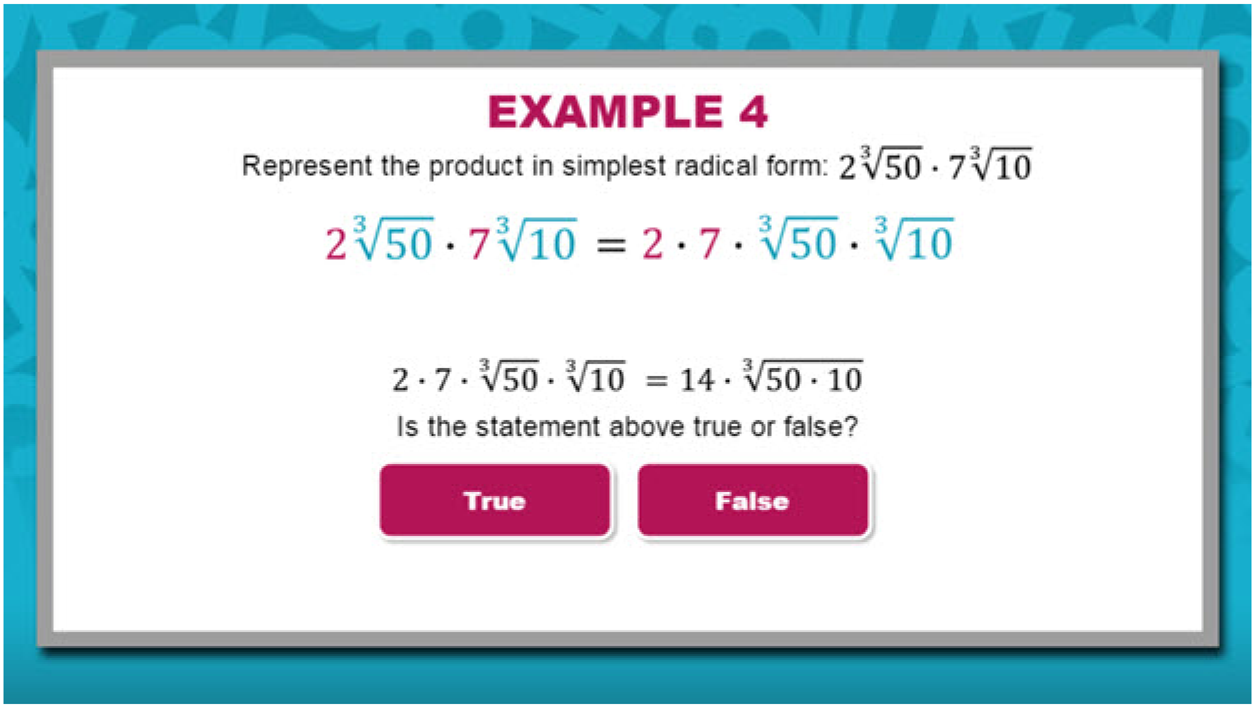
Example 4 (continued)



$$2\sqrt[3]{50} \cdot 7\sqrt[3]{10} = 2 \cdot 7 \cdot \sqrt[3]{50} \cdot \sqrt[3]{10}$$

The Commutative Property of Multiplication justifies changing the order of multiplication.

Example 4 (continued)



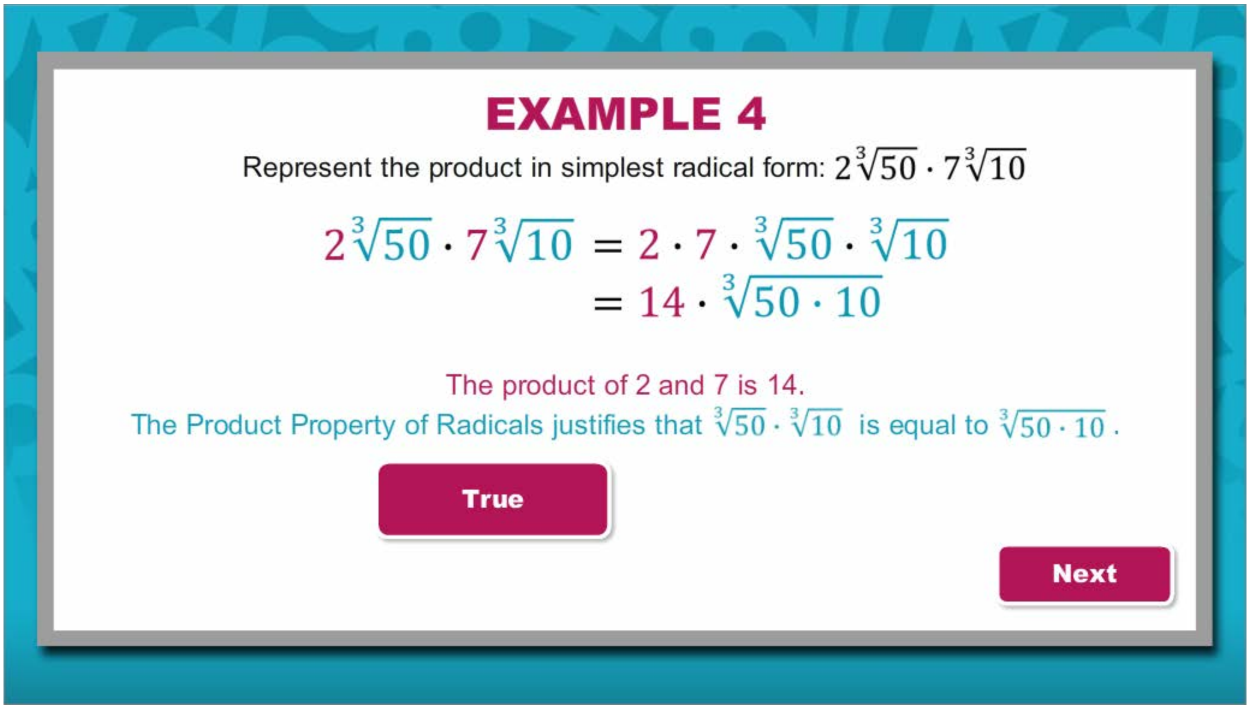
$$2\sqrt[3]{50} \cdot 7\sqrt[3]{10} = 2 \cdot 7 \cdot \sqrt[3]{50} \cdot \sqrt[3]{10}$$

$$2 \cdot 7 \cdot \sqrt[3]{50} \cdot \sqrt[3]{10} = 14 \cdot \sqrt[3]{50 \cdot 10}$$

Is the statement above true or false?

A) True
B) False

Example 4 (continued)

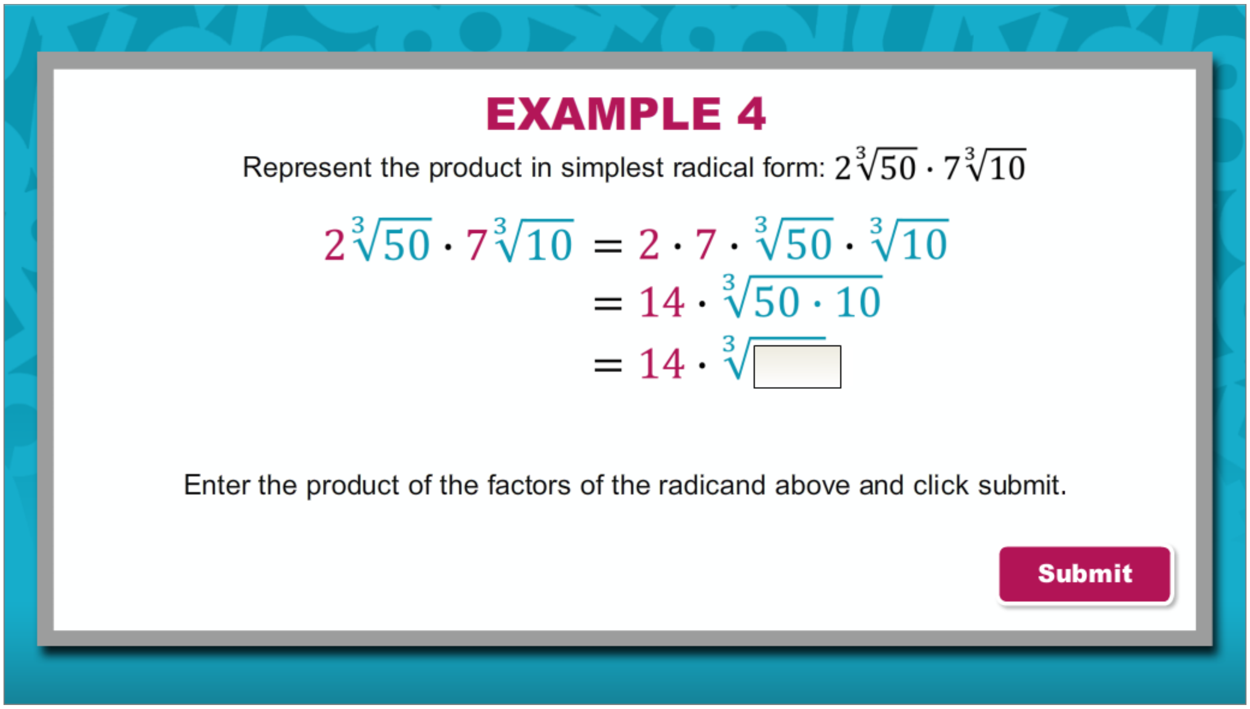


$$\begin{aligned} 2\sqrt[3]{50} \cdot 7\sqrt[3]{10} &= 2 \cdot 7 \cdot \sqrt[3]{50} \cdot \sqrt[3]{10} \\ &= 14 \cdot \sqrt[3]{50 \cdot 10} \end{aligned}$$

The product of 2 and 7 is 14.

The Product Property of Radicals justifies that $\sqrt[3]{50} \cdot \sqrt[3]{10}$ is equal to $\sqrt[3]{50 \cdot 10}$.

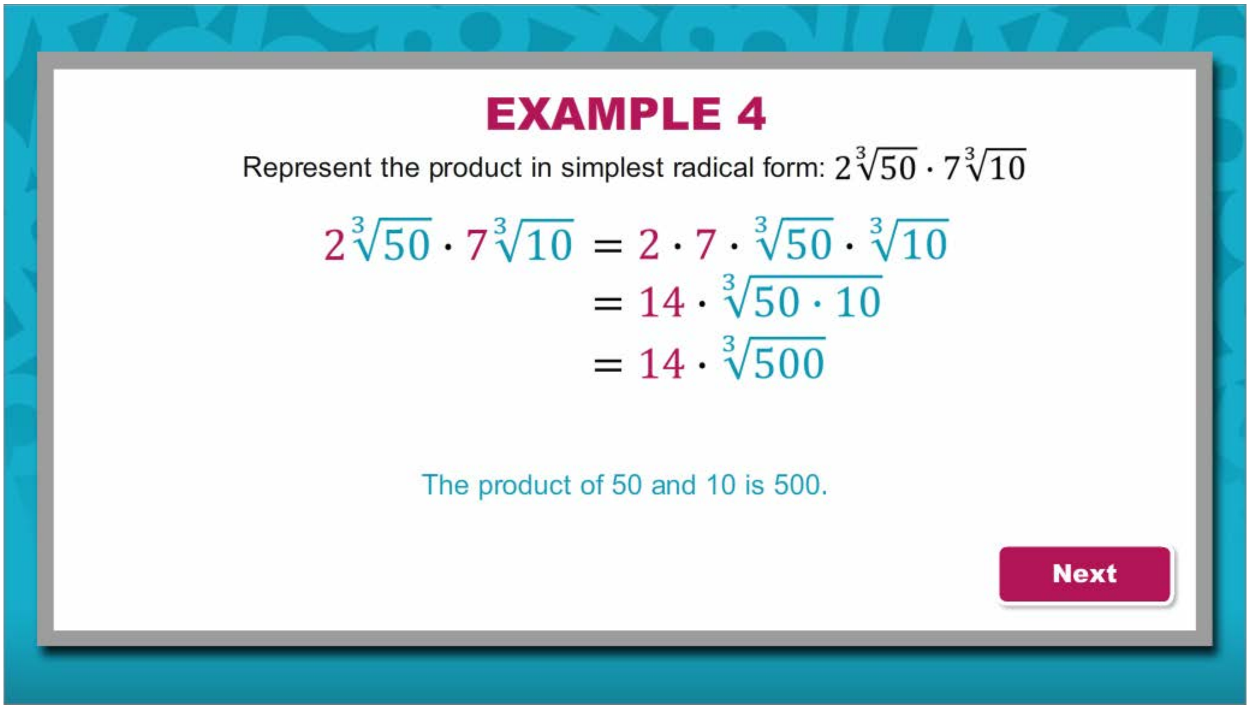
Example 4 (continued)



$$
\begin{aligned}
2\sqrt[3]{50}\cdot 7\sqrt[3]{10} &= 2\cdot 7\cdot \sqrt[3]{50}\cdot \sqrt[3]{10}\\
&= 14\cdot \sqrt[3]{50\cdot 10}\\
&= 14\cdot \sqrt[3]{?}
\end{aligned}
$$

Enter the product of the factors of the radicand above and click submit.

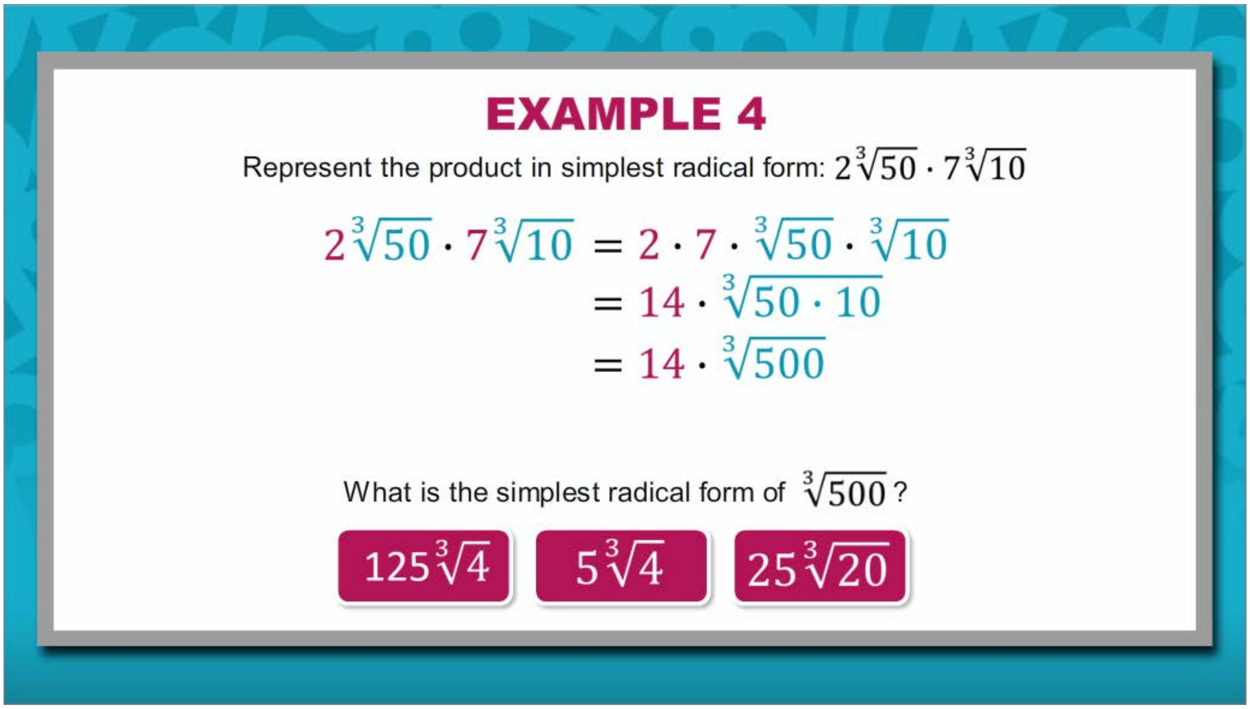
Example 4 (continued)



$$
\begin{aligned}
2\sqrt[3]{50}\cdot 7\sqrt[3]{10} &= 2\cdot 7\cdot \sqrt[3]{50}\cdot \sqrt[3]{10} \\
&= 14\cdot \sqrt[3]{50\cdot 10} \\
&= 14\cdot 500
\end{aligned}
$$

The product of 50 and 10 is 500.

Example 4 (continued)

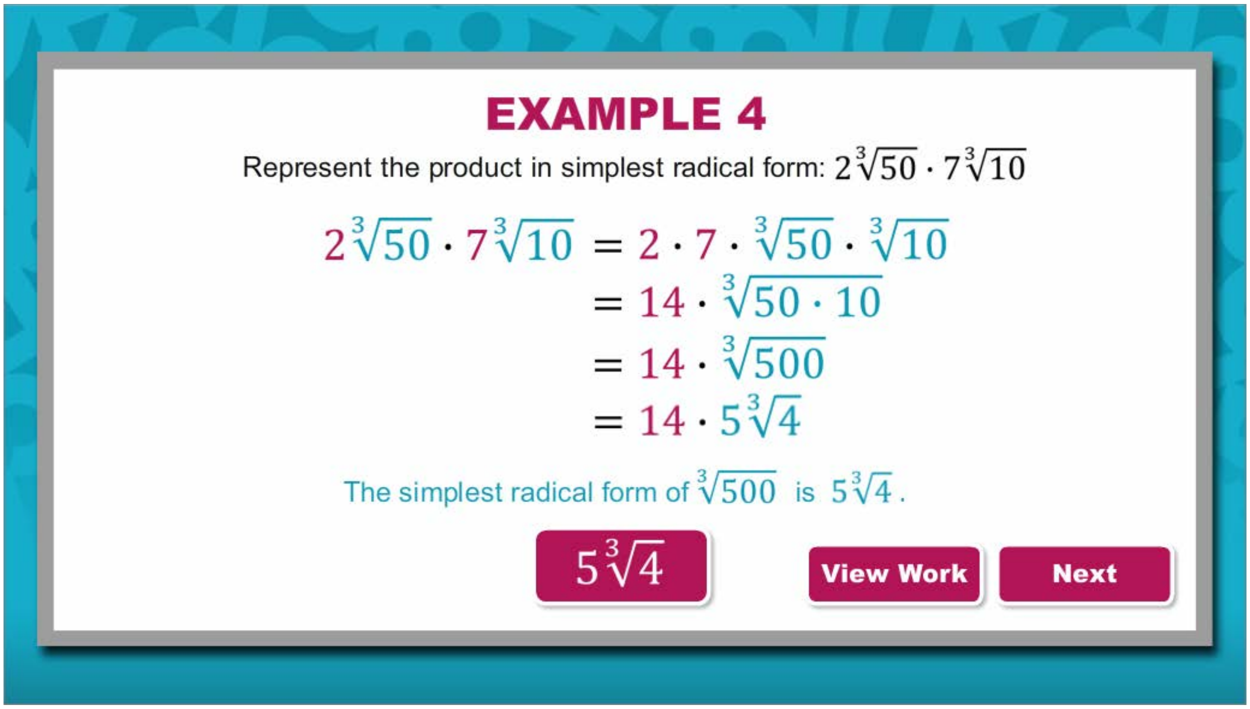


$$\begin{aligned} 2\sqrt[3]{50} \cdot 7\sqrt[3]{10} &= 2 \cdot 7 \cdot \sqrt[3]{50} \cdot \sqrt[3]{10} \\ &= 14 \cdot \sqrt[3]{50 \cdot 10} \\ &= 14 \cdot 500 \end{aligned}$$

What is the simplest radical form of $\sqrt[3]{500}$?

A) $125\sqrt[3]{4}$
B) $5\sqrt[3]{4}$
C) $25\sqrt[3]{20}$

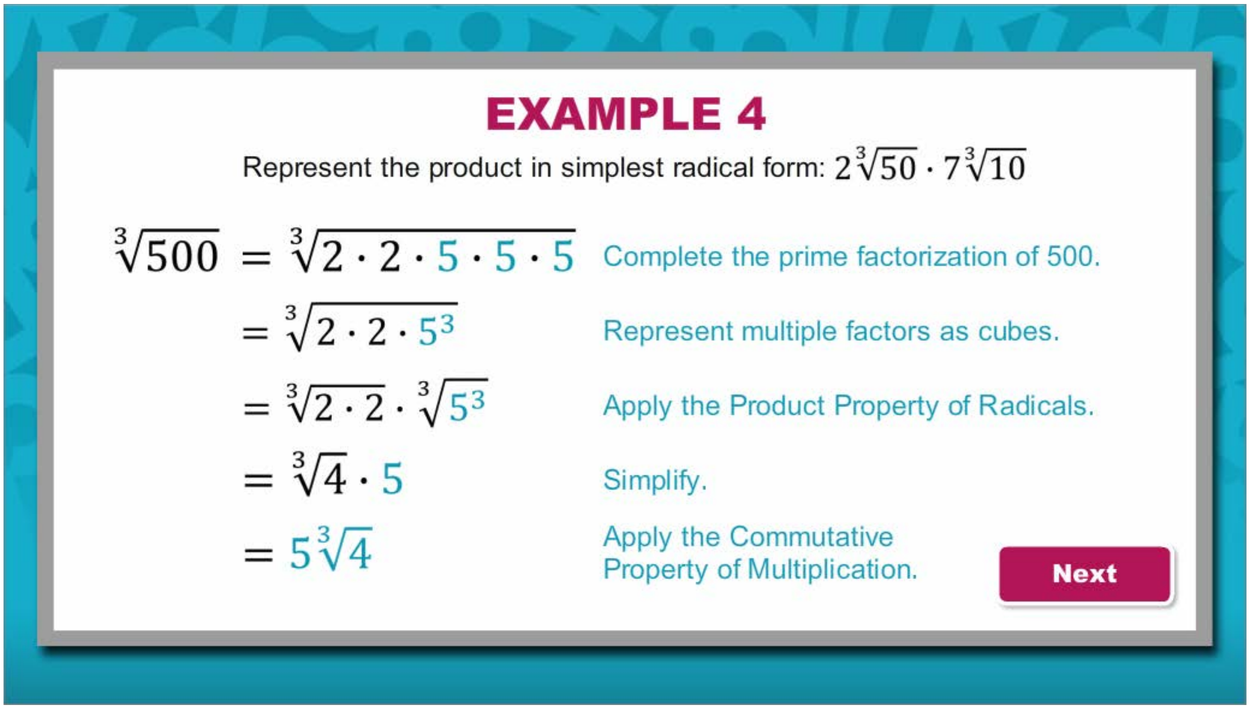
Example 4 (continued)



$$
\begin{aligned}
2\sqrt[3]{50} \cdot 7\sqrt[3]{10} &= 2 \cdot 7 \cdot \sqrt[3]{50} \cdot \sqrt[3]{10} \\
&= 14 \cdot \sqrt[3]{50 \cdot 10} \\
&= 14 \cdot 500 \\
&= 14 \cdot 5\sqrt[3]{4}
\end{aligned}
$$

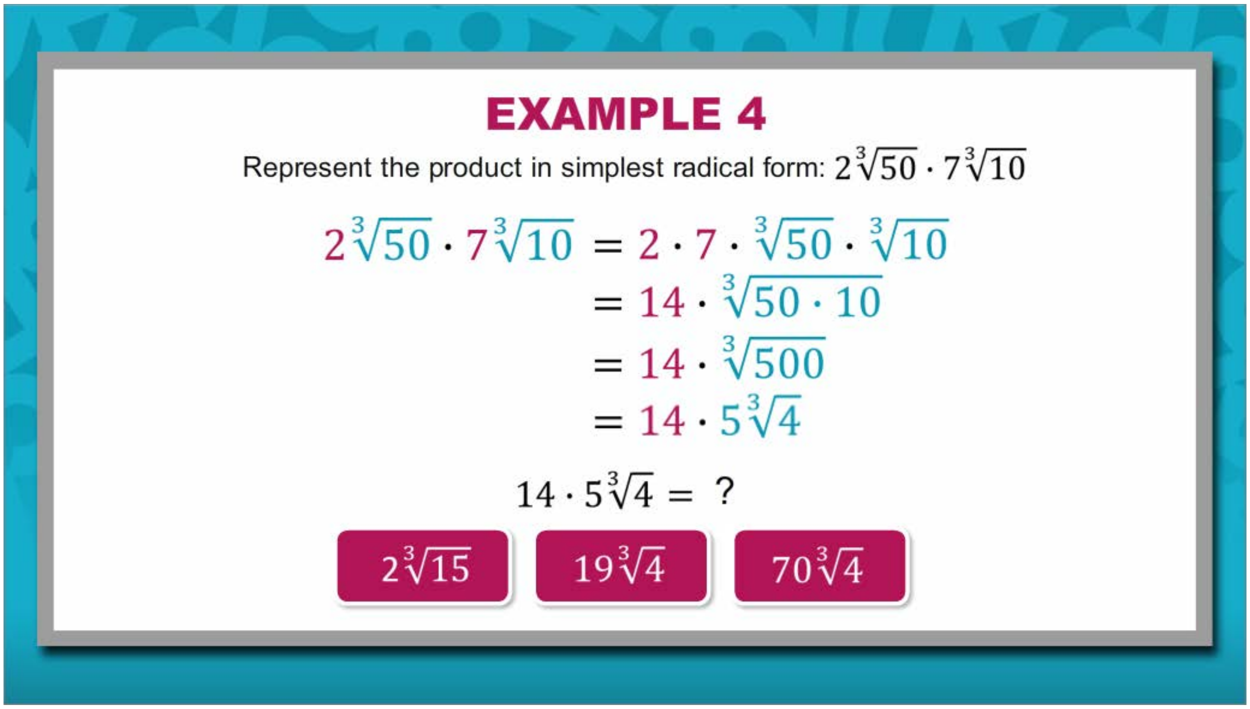
The simplest radical form of $\sqrt[3]{500}$ is $5\sqrt[3]{4}$.

Example 4 (continued)



$\sqrt[3]{500} = \sqrt[3]{2 \cdot 2 \cdot 5 \cdot 5 \cdot 5}$	Complete the prime factorization of 500.
$= \sqrt[3]{2 \cdot 2 \cdot 5^3}$	Represent multiple factors as cubes.
$= \sqrt[3]{2 \cdot 2} \cdot \sqrt[3]{5^3}$	Apply the Product Property of Radicals.
$= \sqrt[3]{4} \cdot 5$	Simplify.
$= 5\sqrt[3]{4}$	Apply the Commutative Property of Multiplication.

Example 4 (continued)



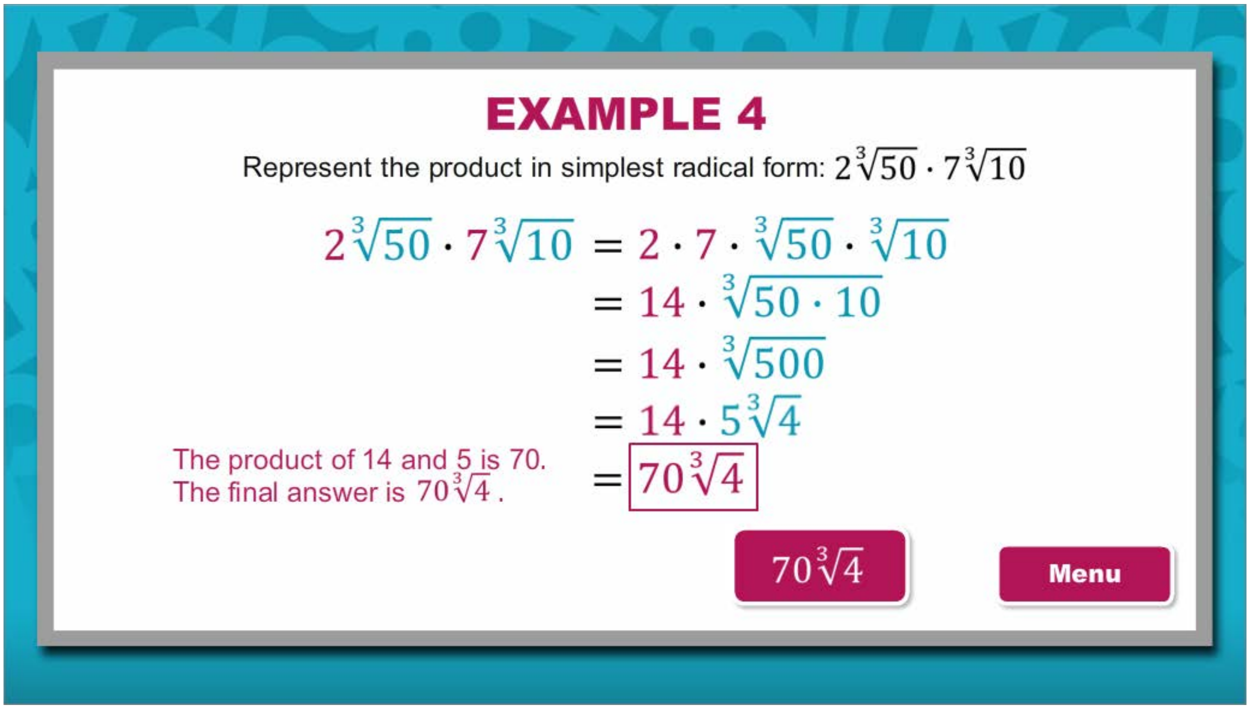
$$
\begin{aligned}
2\sqrt[3]{50} \cdot 7\sqrt[3]{10} &= 2 \cdot 7 \cdot \sqrt[3]{50} \cdot \sqrt[3]{10} \\
&= 14 \cdot \sqrt[3]{50 \cdot 10} \\
&= 14 \cdot 500 \\
&= 14 \cdot 5\sqrt[3]{4}
\end{aligned}
$$

Complete the final step.

$$14 \cdot 5\sqrt[3]{4} = ?$$

A) $2\sqrt[3]{15}$
B) $19\sqrt[3]{4}$
C) $70\sqrt[3]{4}$

Example 4 (continued)



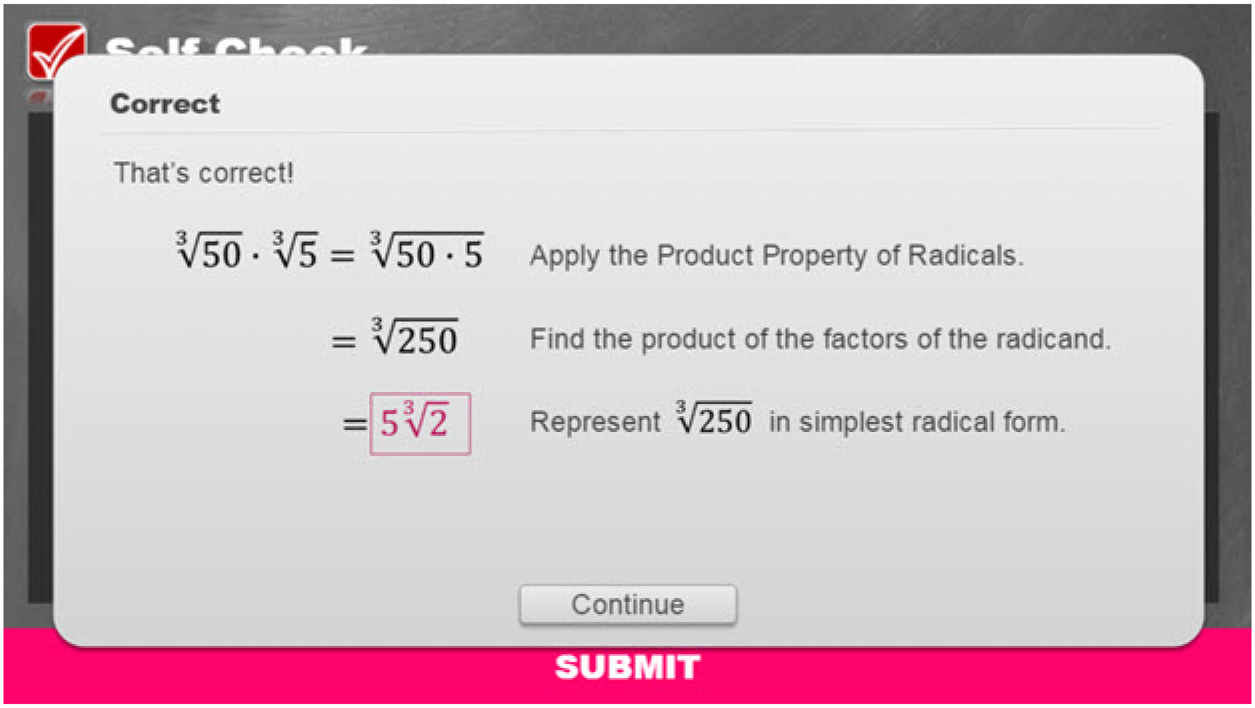
$$
\begin{aligned}
2\sqrt[3]{50} \cdot 7\sqrt[3]{10} &= 2 \cdot 7 \cdot \sqrt[3]{50} \cdot \sqrt[3]{10} \\
&= 14 \cdot \sqrt[3]{50 \cdot 10} \\
&= 14 \cdot 500 \\
&= 14 \cdot 5\sqrt[3]{4} \\
&= 70\sqrt[3]{4}
\end{aligned}
$$

The product of 14 and 5 is 70.

Self-Check 1

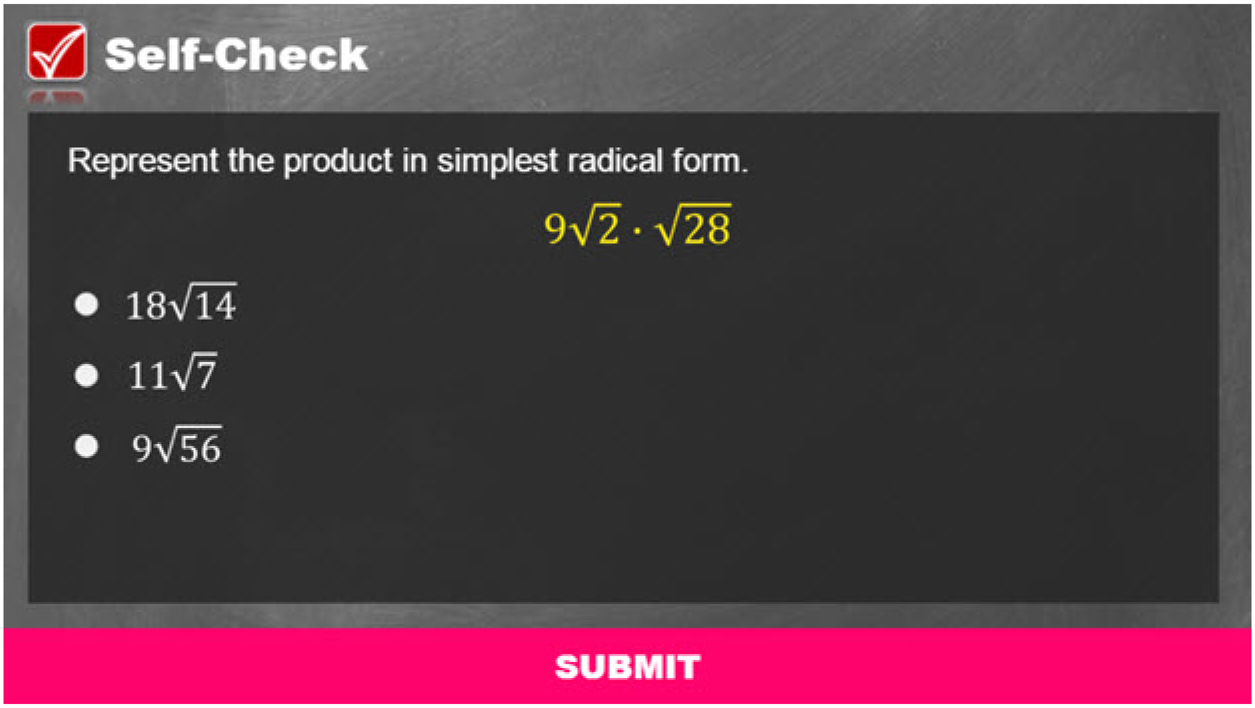
Solve the problem in the image above to check your understanding of the content.

Self-Check 1: Answer



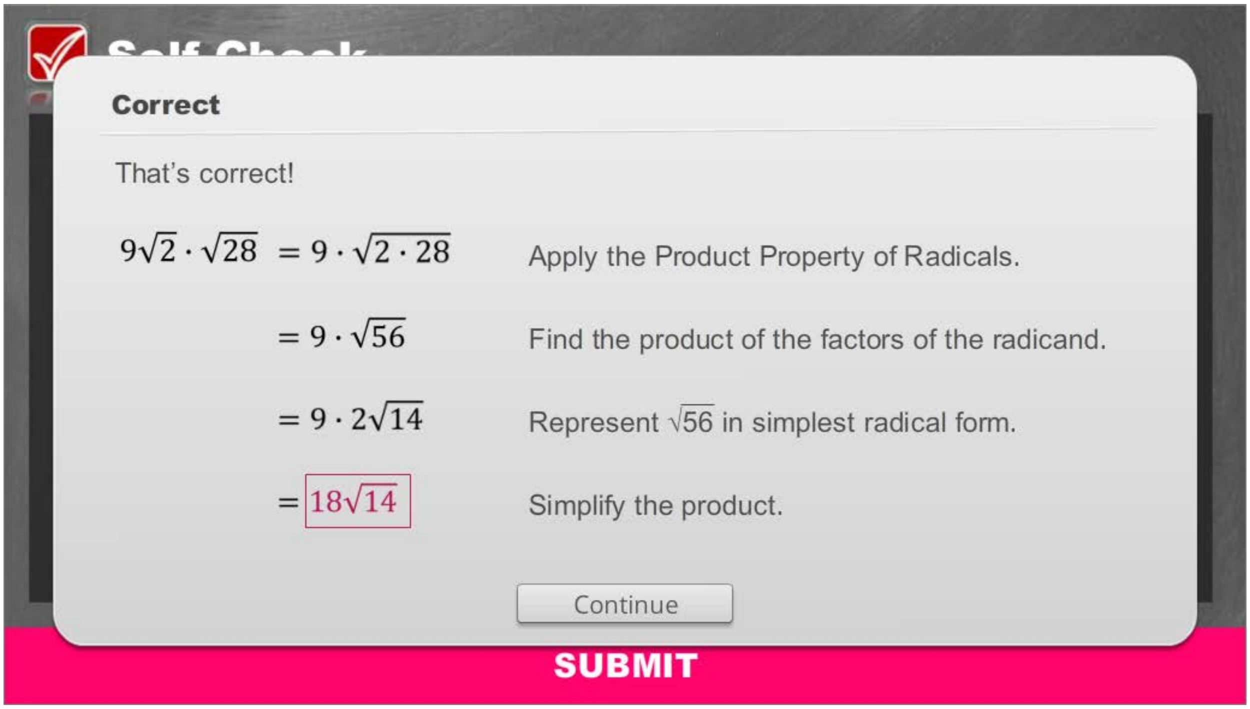
For your reference, the image above shows the correct solution to the self-check problem.

Self-Check 2



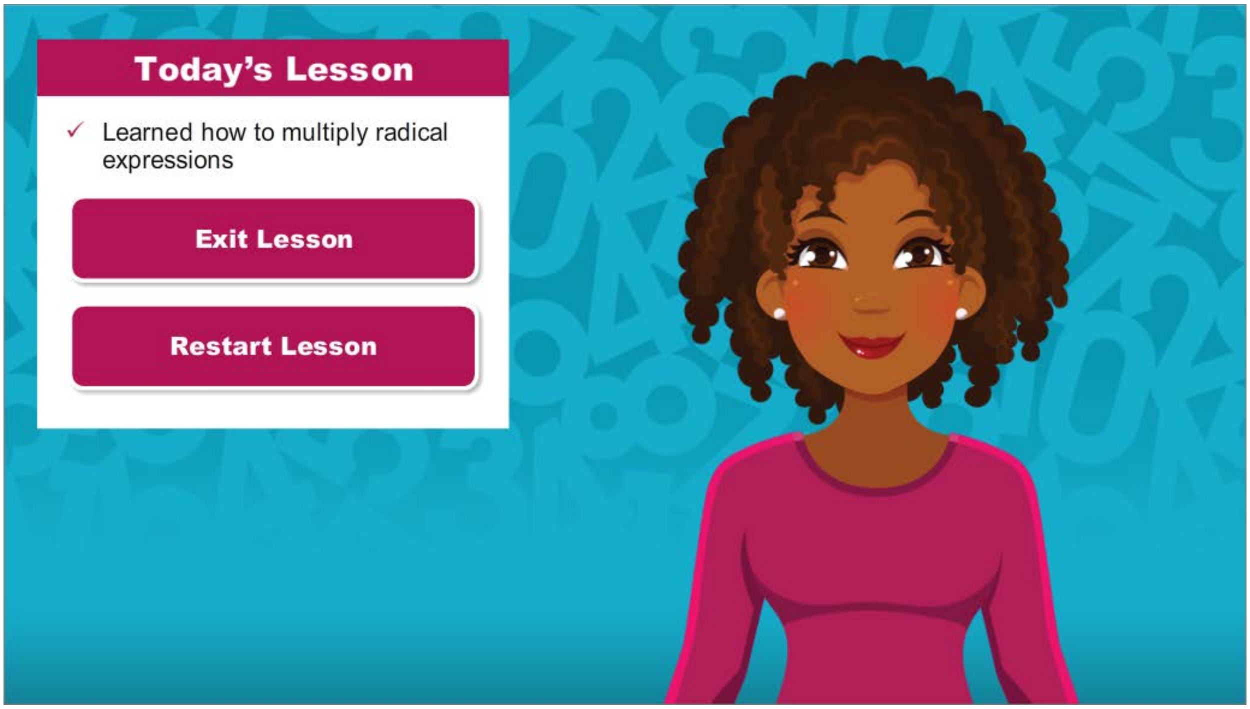
Solve the problem in the image above to check your understanding of the content.

Self-Check 2: Answer



For your reference, the 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 multiply radical expressions.