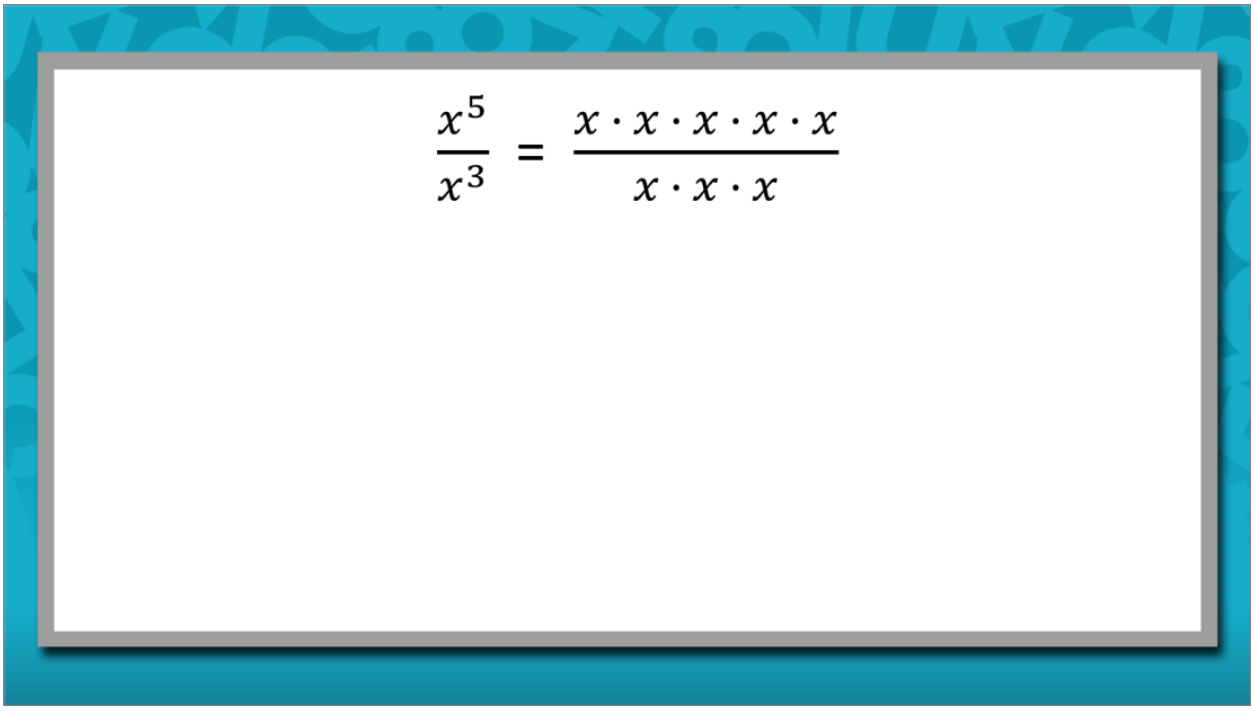
Module 2: Properties of Exponents
Topic 2: Quotient of Powers

Introduction

Hi there! I'm so glad to have you here for this lesson in Algebra I. In this lesson, you will apply your knowledge of exponents to discover a rule that allows you to easily determine the quotient of two exponential expressions.

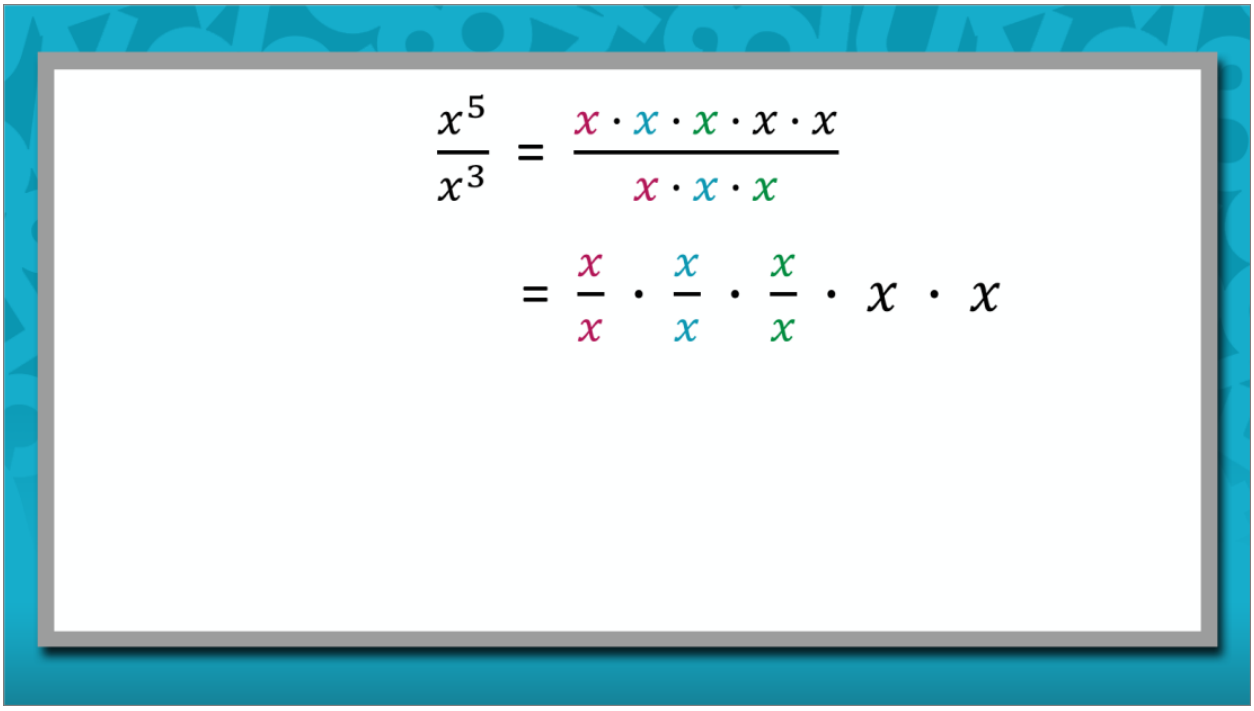
Module 2: Properties of Exponents
Topic 2: Quotient of Powers

Quotient of Powers Property



Consider the quotient of x^5 and x^3. Begin by expanding the numerator: x^5 represents the product of 5 x's. The denominator, x^3, represents the product of 3 x's.

Quotient of Powers Property (continued)



Now you have an expression that represents the quotient of products. Instead, represent this expression as the product of quotients.

Rewrite the expression as: x over x, times x over x, times x over x, and because there are no more x's left in the denominator, you will multiply these quotients times the final x factors.

Quotient of Powers Property (continued)

$$\frac{x^5}{x^3} = \frac{x \cdot x \cdot x \cdot x \cdot x}{x \cdot x \cdot x}$$

$$= \frac{x}{x} \cdot \frac{x}{x} \cdot \frac{x}{x} \cdot x \cdot x$$

$$= 1 \cdot 1 \cdot 1 \cdot x \cdot x$$

Now begin simplifying the expression. Recall that any value divided by itself is equal to 1. So, the quotients of x and x can each be simplified to 1, and you still are still multiplying these expressions by the remaining x factors.

Quotient of Powers Property (continued)

$$\frac{x^5}{x^3} = \frac{x \cdot x \cdot x \cdot x \cdot x}{x \cdot x \cdot x}$$

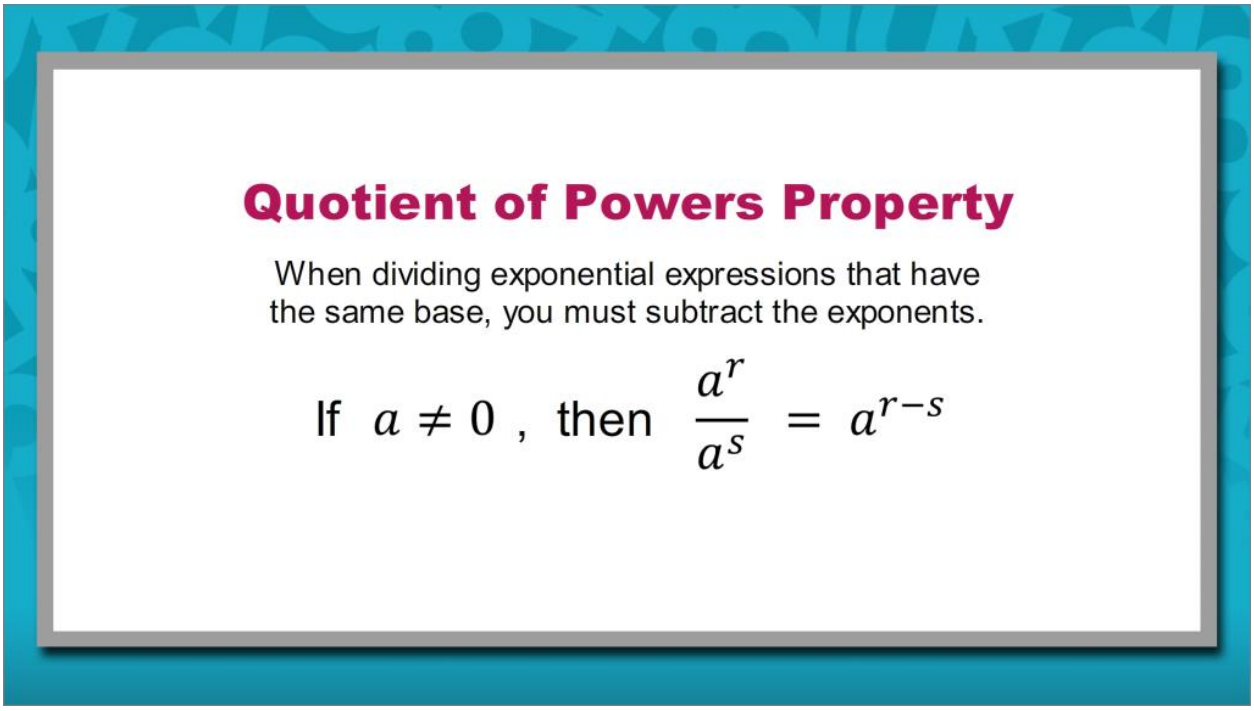
$$= \frac{x}{x} \cdot \frac{x}{x} \cdot \frac{x}{x} \cdot x \cdot x$$

$$= 1 \cdot 1 \cdot 1 \cdot x \cdot x$$

$$= x^2 = x^{5-3}$$

1 times 1 times 1 times x times x can be simplified to x^2. The exponent in the result is the difference of the exponents in the original expression.

Quotient of Powers Property (continued)



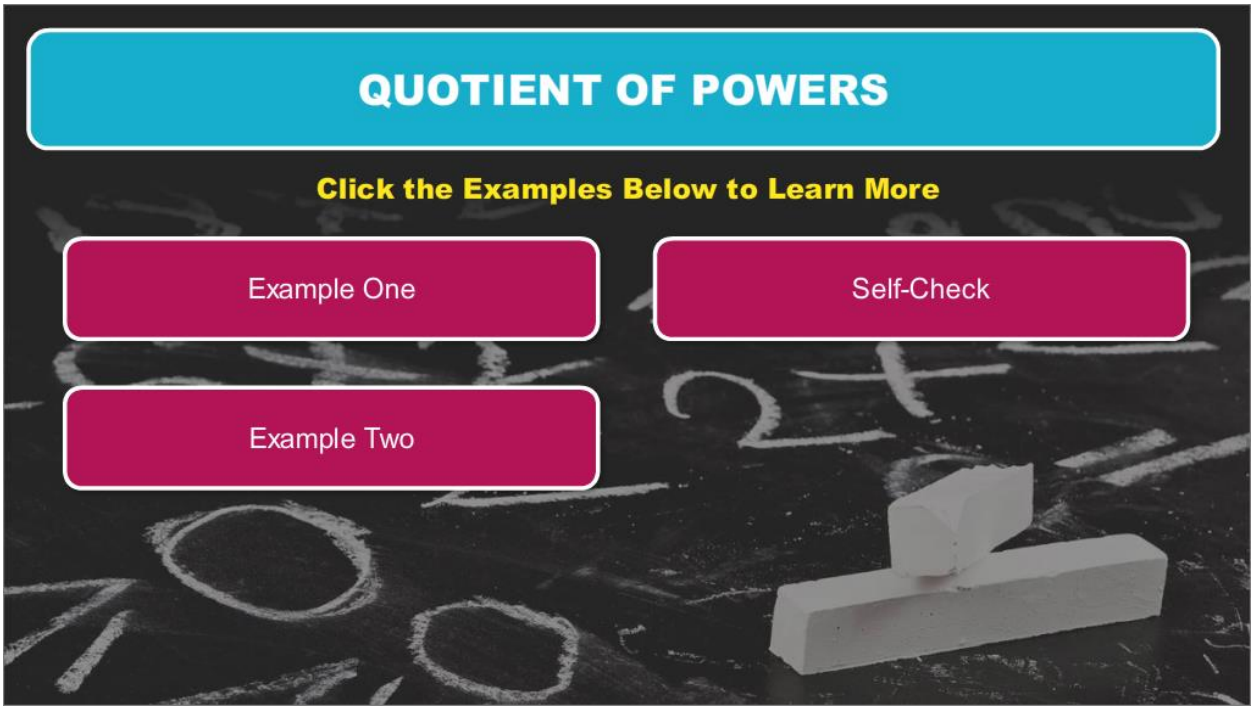
This example shows the pattern that appears when dividing exponential expressions that have the same base; you must subtract the exponents. This is known as the Quotient of Powers Property.

Quotient of Powers Property

If $a \neq 0$, then $\frac{a^r}{a^s} = a^{r-s}$.

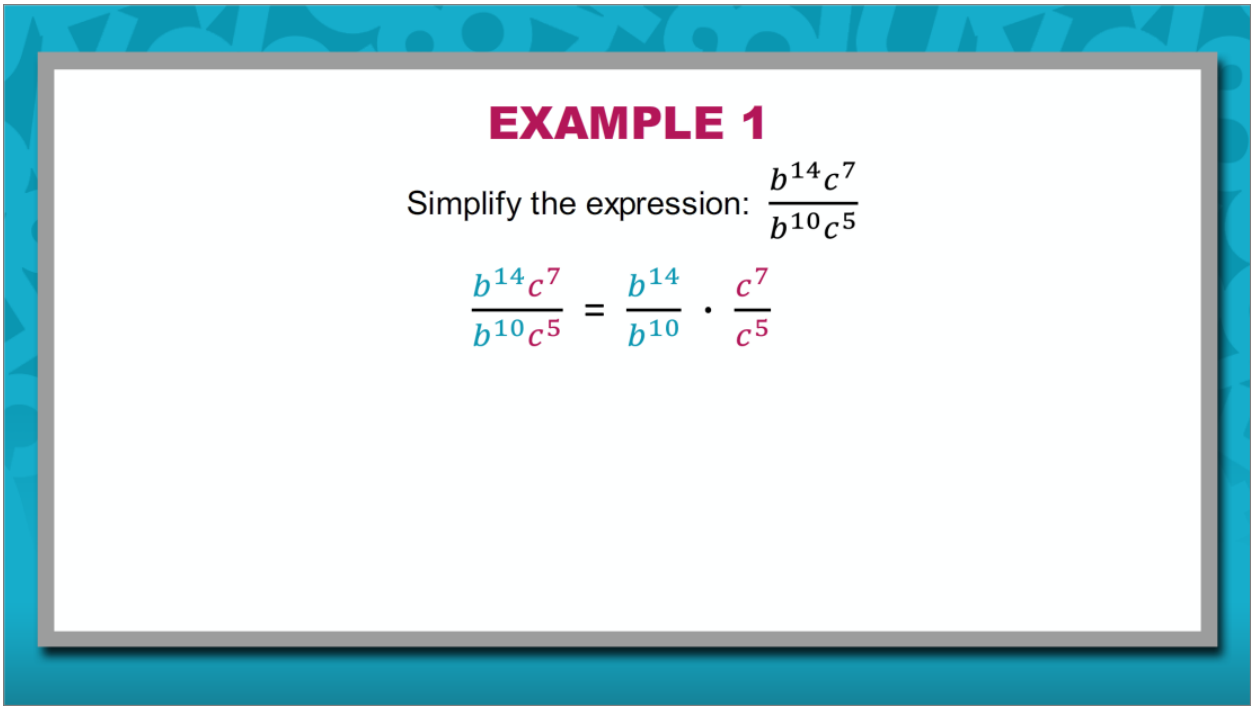
Module 2: Properties of Exponents
Topic 2: Quotient of Powers

Quotient of Powers



Click the examples below to learn more.

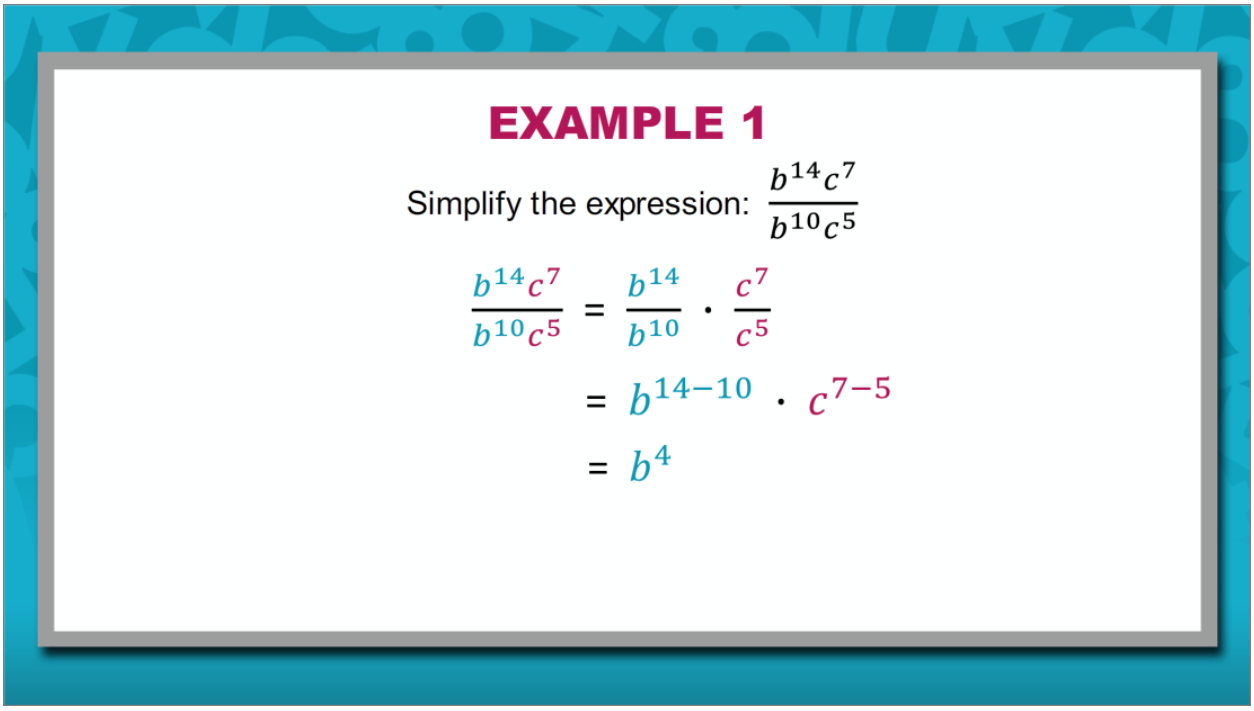
Example 1



Simplify the expression: $\frac{b^{14}c^7}{b^{10}c^5}$

In this example, begin by representing the expression as the product of two quotients: $\frac{b^{14}}{b^{10}}$ times $\frac{c^7}{c^5}$.

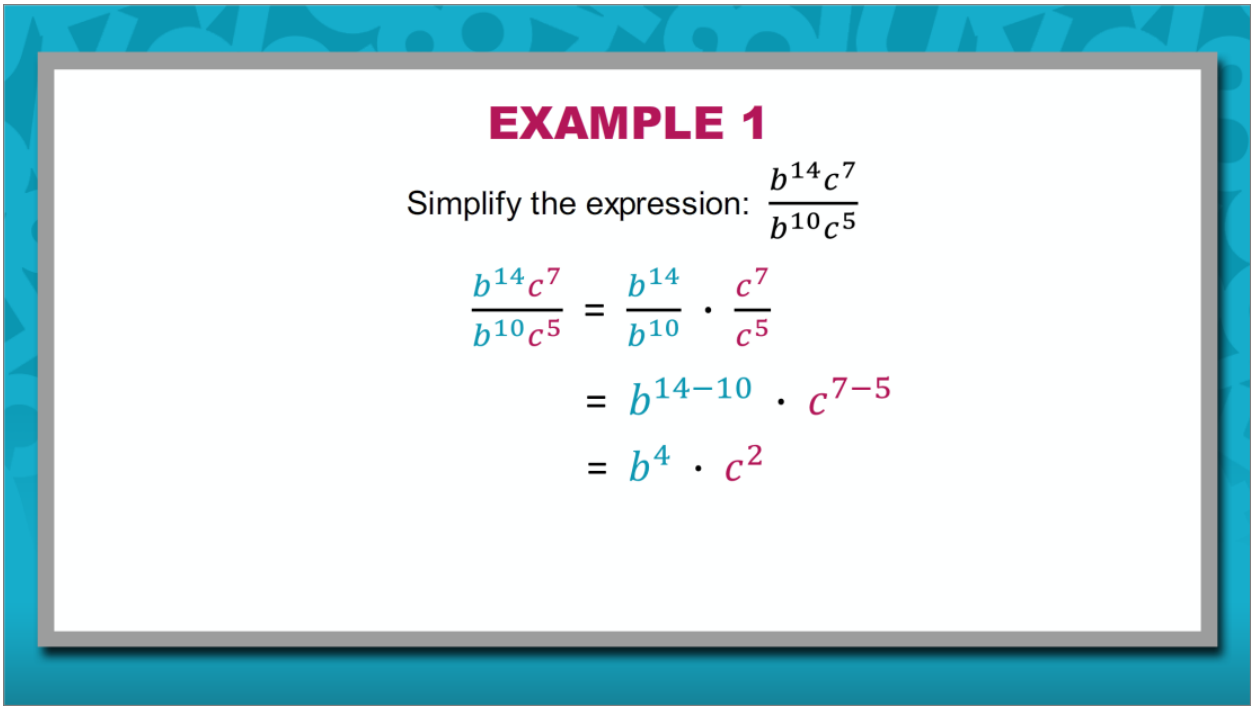
Example 1 (continued)



Now apply the Quotient of Powers Property to simplify each quotient. To do this, you must subtract the exponents.

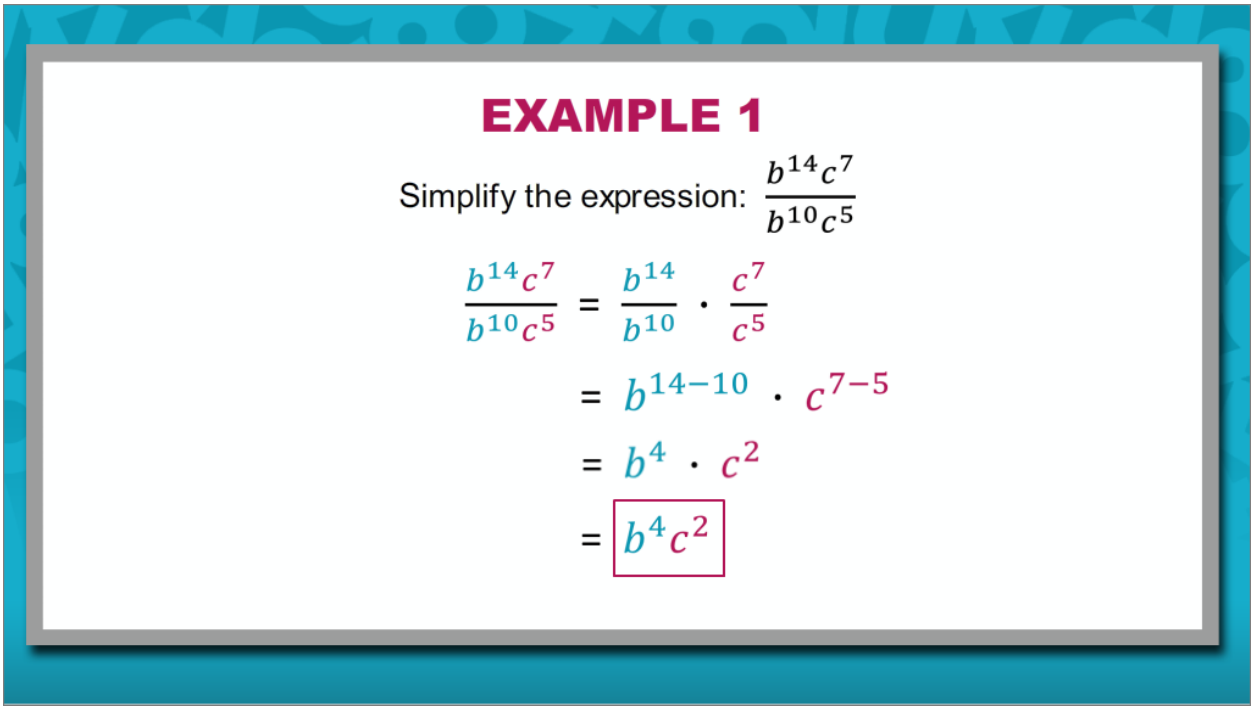
In the first quotient, $14 - 10$ is 4, so this expression simplifies to b^4.

Example 1 (continued)



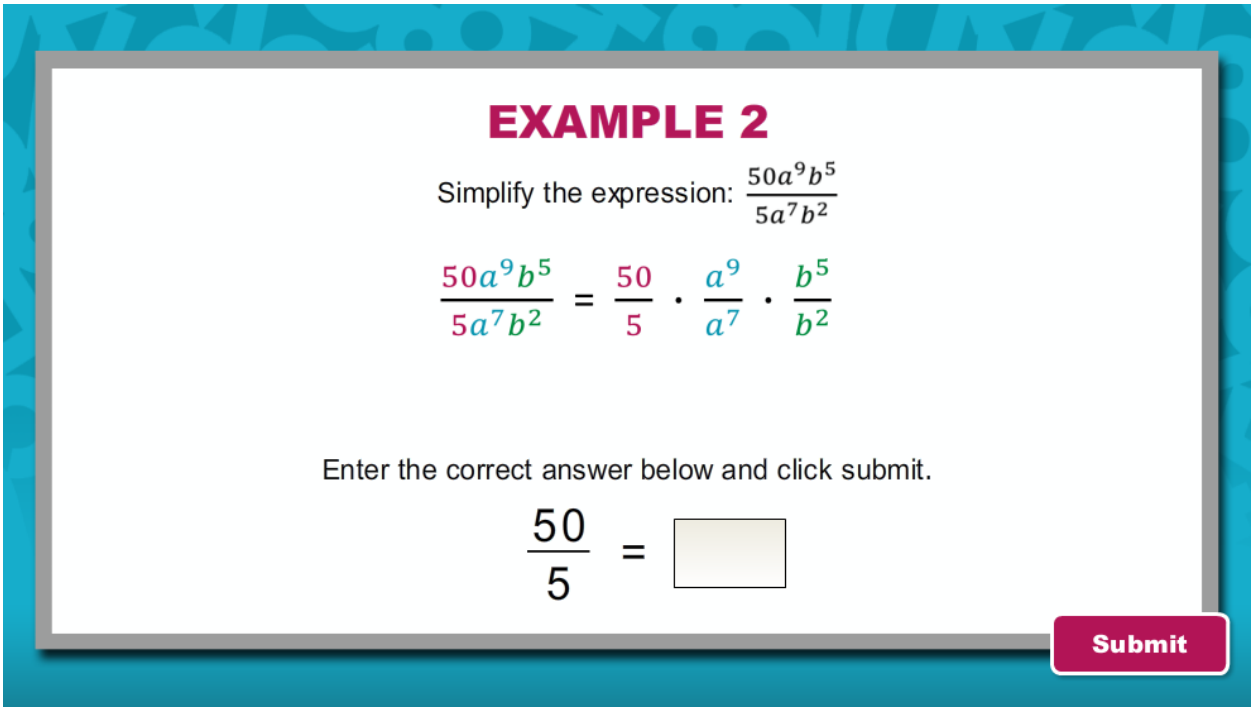
In the second quotient, $7 - 5$ is 2., so this expression simplifies to c^2.

Example 1 (continued)



Now simplify the product. Your work is complete. The final answer is b^4c^2.

Example 2



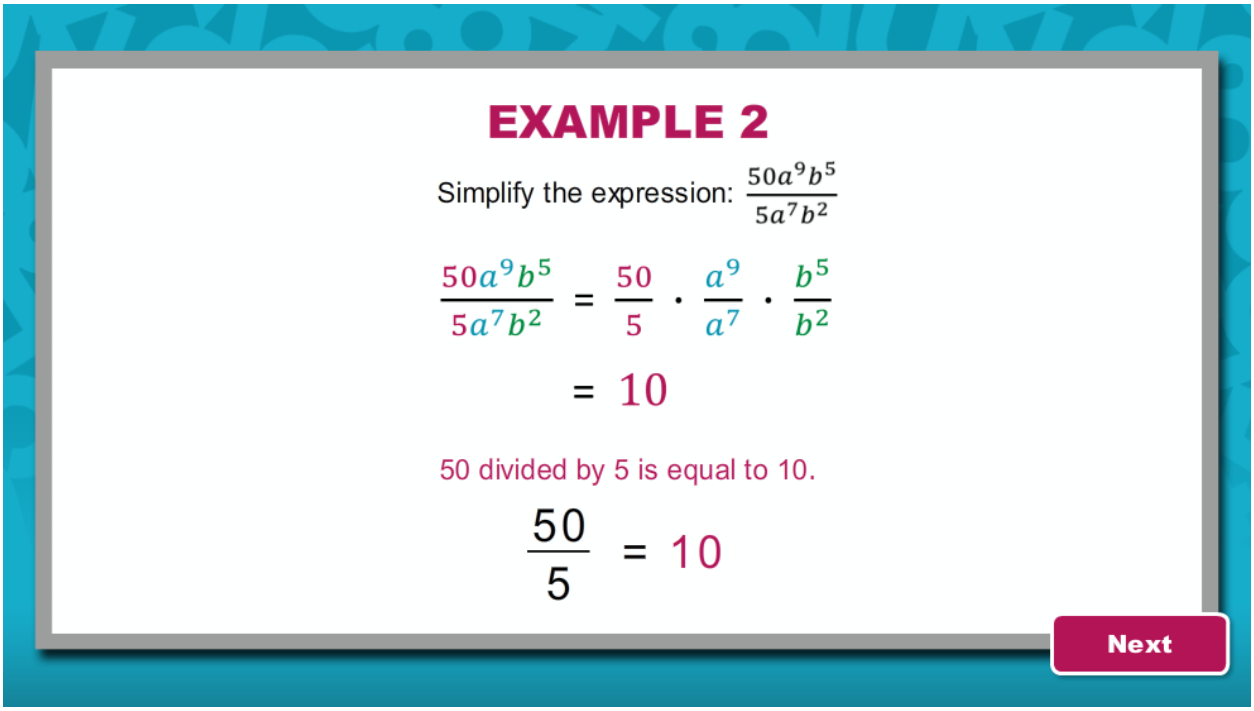
Simplify the expression: $\frac{50a^9b^5}{5a^7b^2}$

In this example, begin by representing the expression as the product of quotients: $\frac{50}{5}$ times $\frac{a^9}{a^7}$ times $\frac{b^5}{b^2}$. Now simplify.

$\frac{50}{5} = ?$

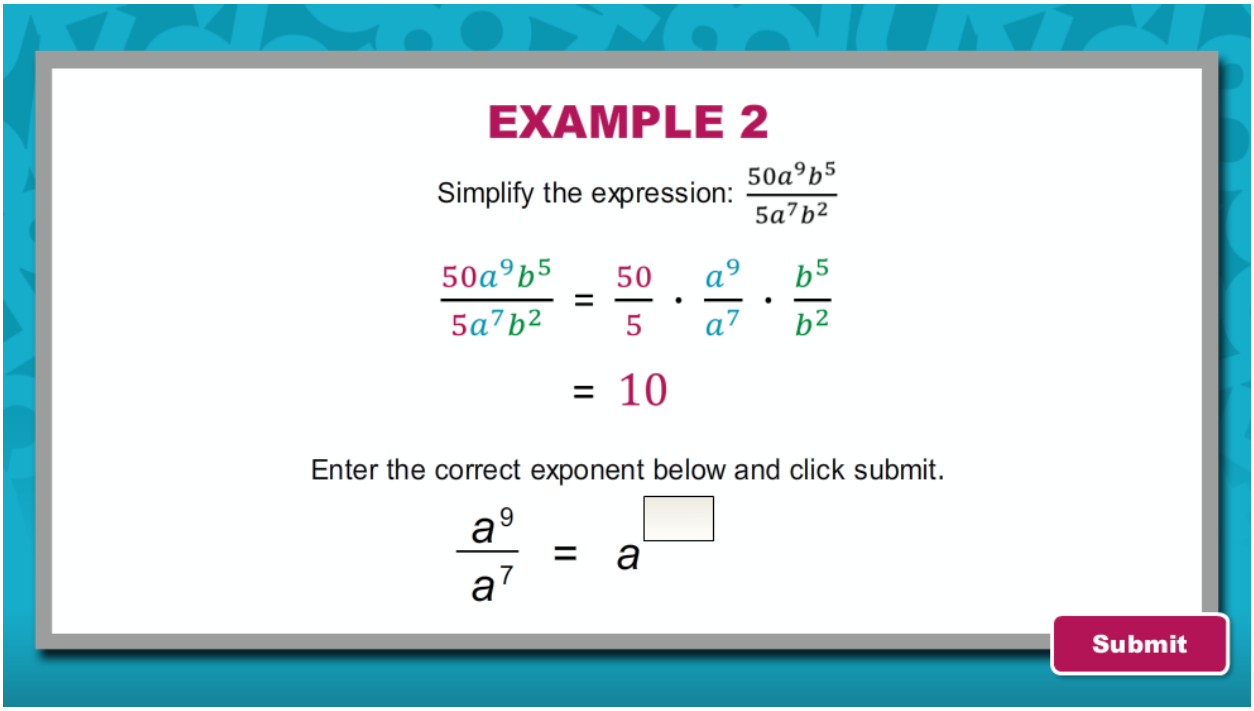
Enter the correct answer below and click submit.

Example 2 (continued)



Feedback: $\frac{50}{5} = 10$

Example 2 (continued)

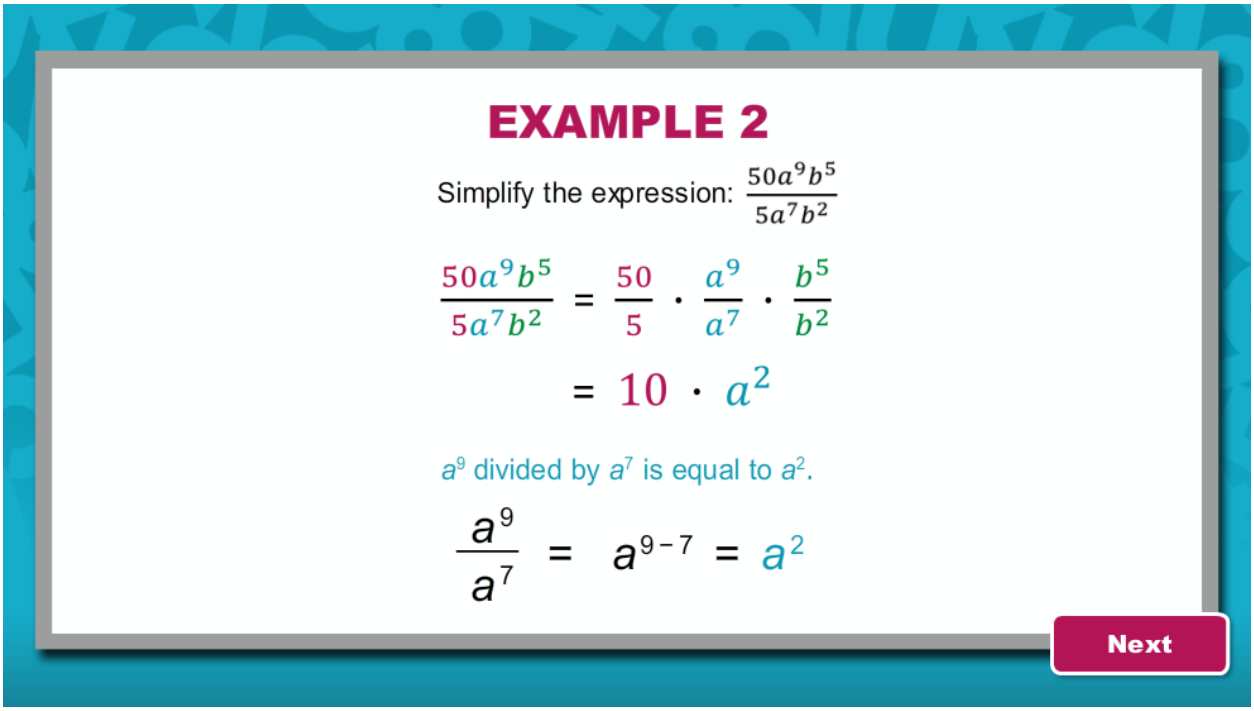


In order to divide a^9 and a^7, you will need to subtract the exponents.

$$\frac{a^9}{a^7} = a^{?}$$

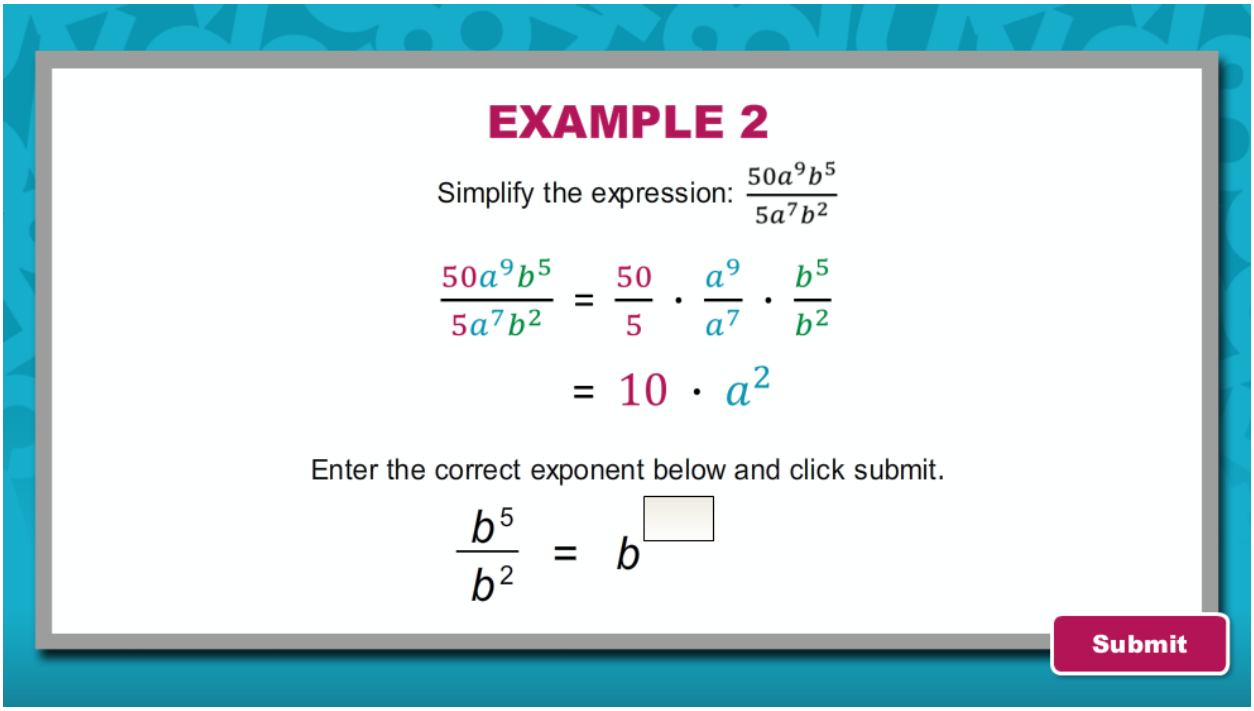
Enter the correct exponent below and click submit.

Example 2 (continued)



Feedback: $\frac{a^9}{a^7} = a^{9-7} = a^2$

Example 2 (continued)

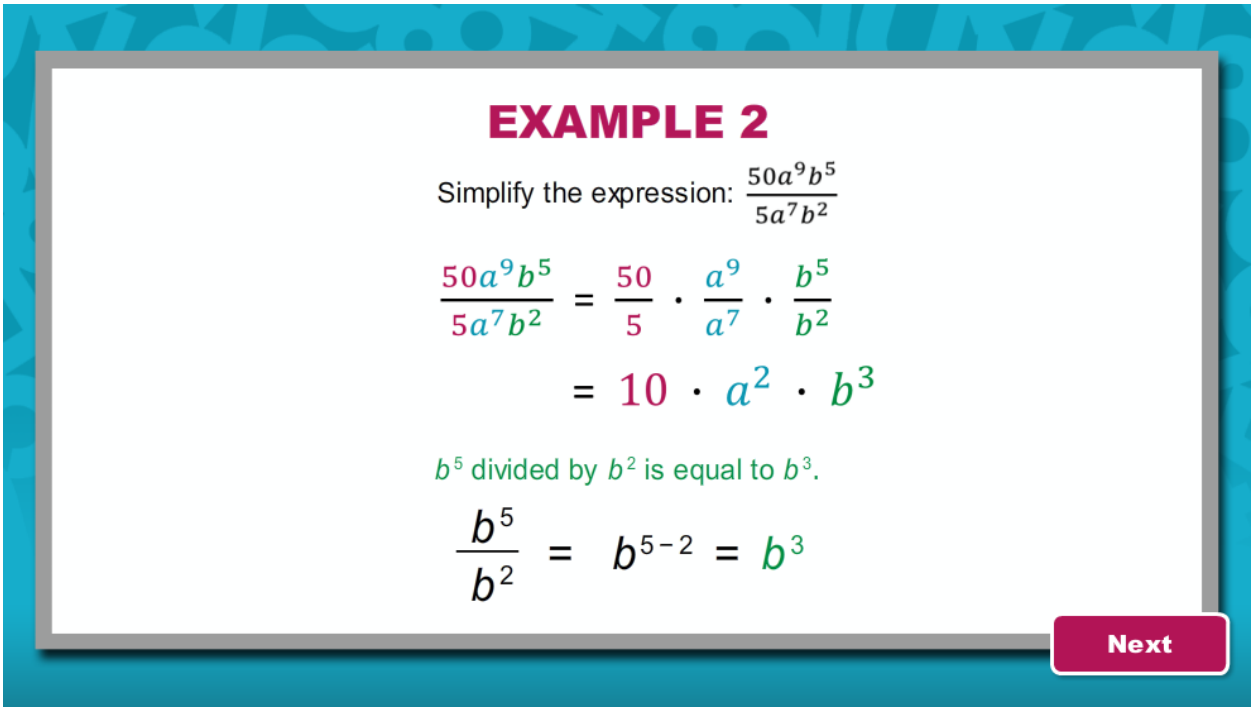


In order to divide b^5 and b^2, you will need to subtract the exponents.

$$\frac{b^5}{b^2} = b^{?}$$

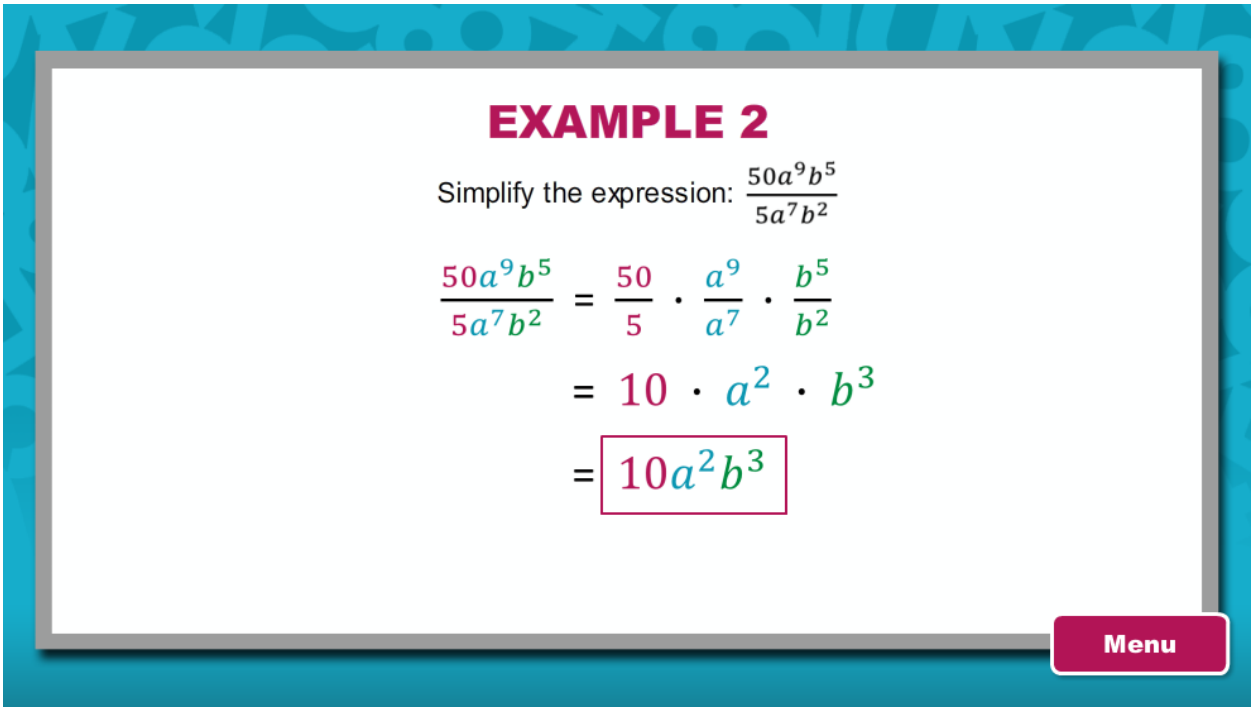
Enter the correct exponent below and click submit.

Example 2 (continued)



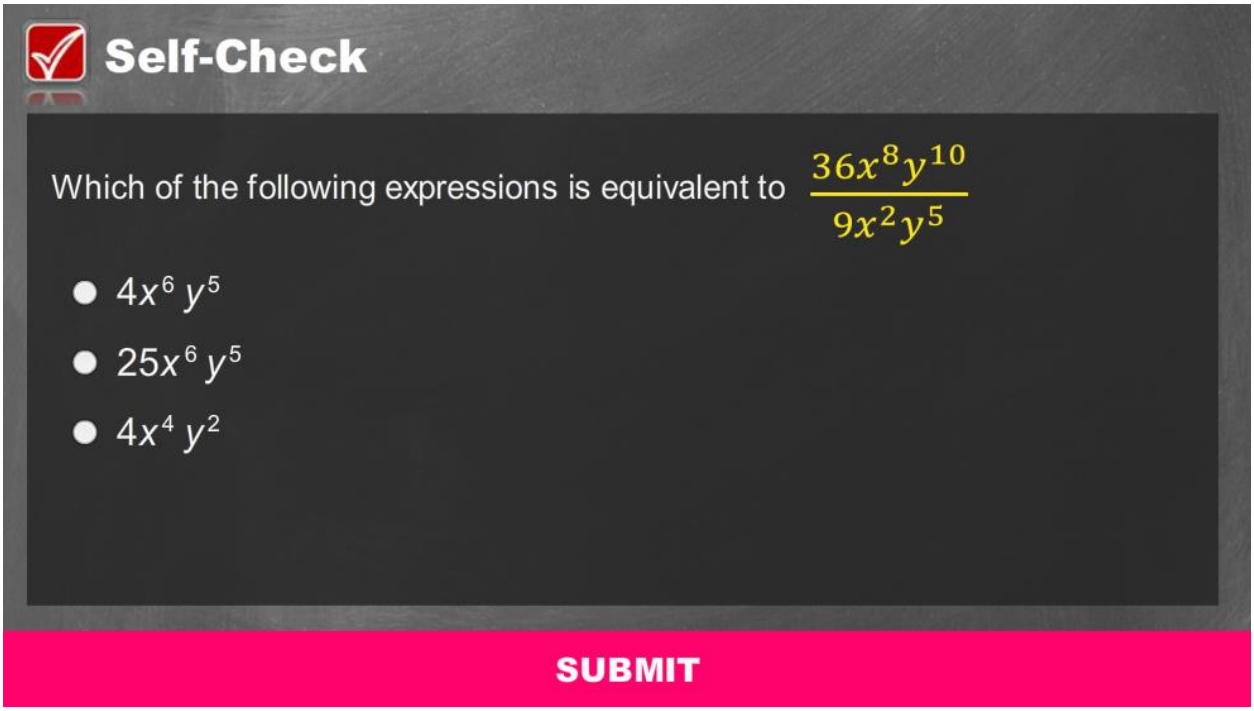
Feedback: $\frac{b^5}{b^2} = b^{5-2} = b^3$

Example 2 (continued)



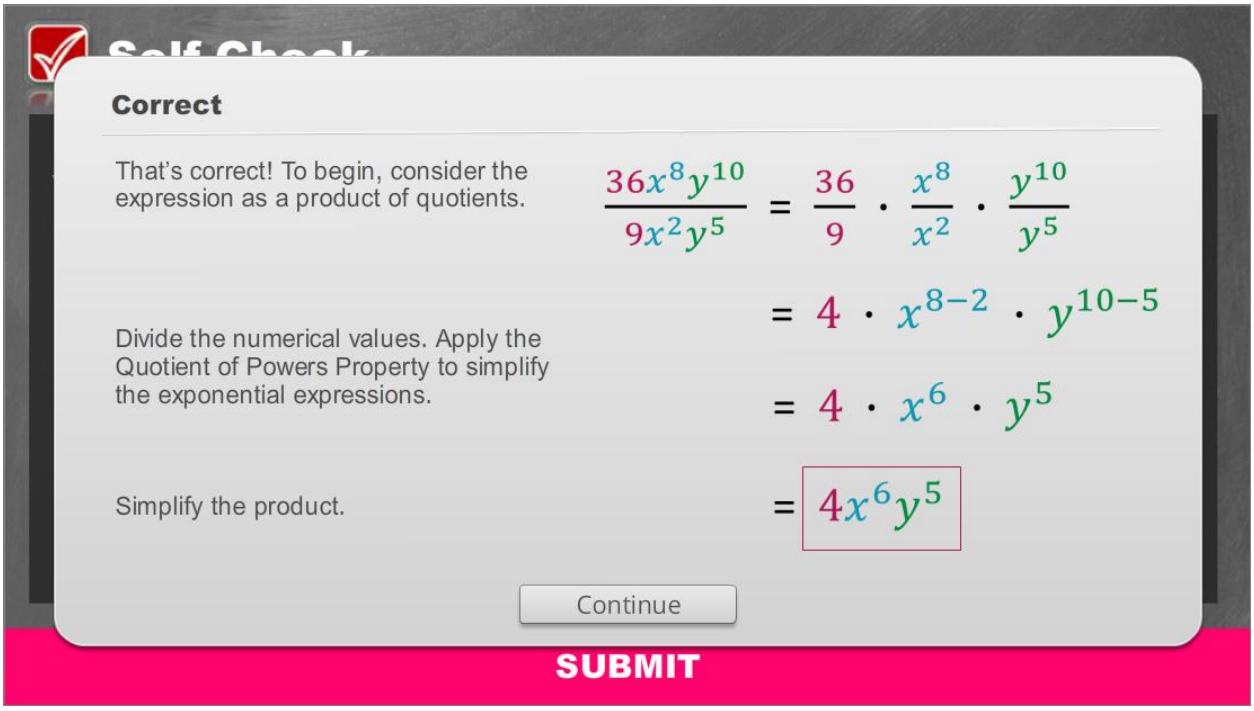
Now simplify the product. Your work is complete. The final answer is $10a^2b^3$.

Self-Check



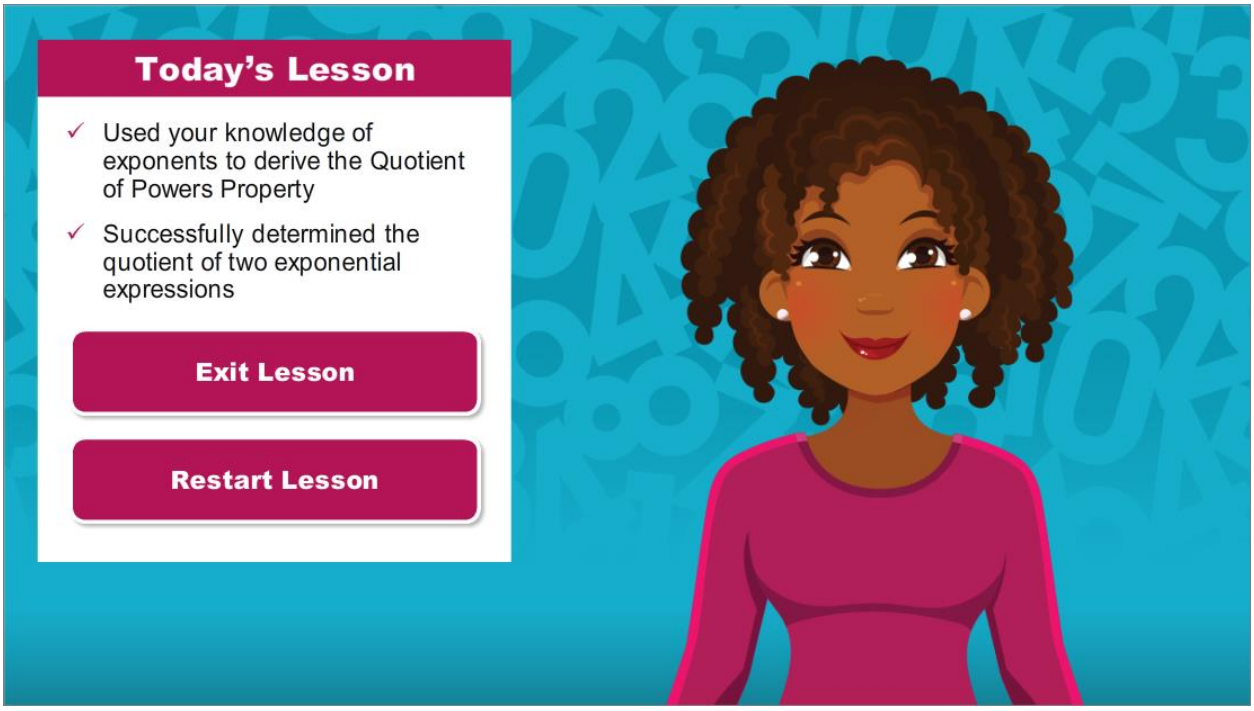
Solve the problem in the image above to check your understanding of the content.

Self-Check: Answer



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

Conclusion



Congratulations! You have reached the conclusion of this lesson in Algebra I. In this lesson, you used your knowledge of exponents to discover a rule that allowed you to easily determine the quotient of two exponential expressions.