

## Module 2: Properties of Exponents

### Topic 1: Product of Powers

#### Introduction



**Today's Lesson**

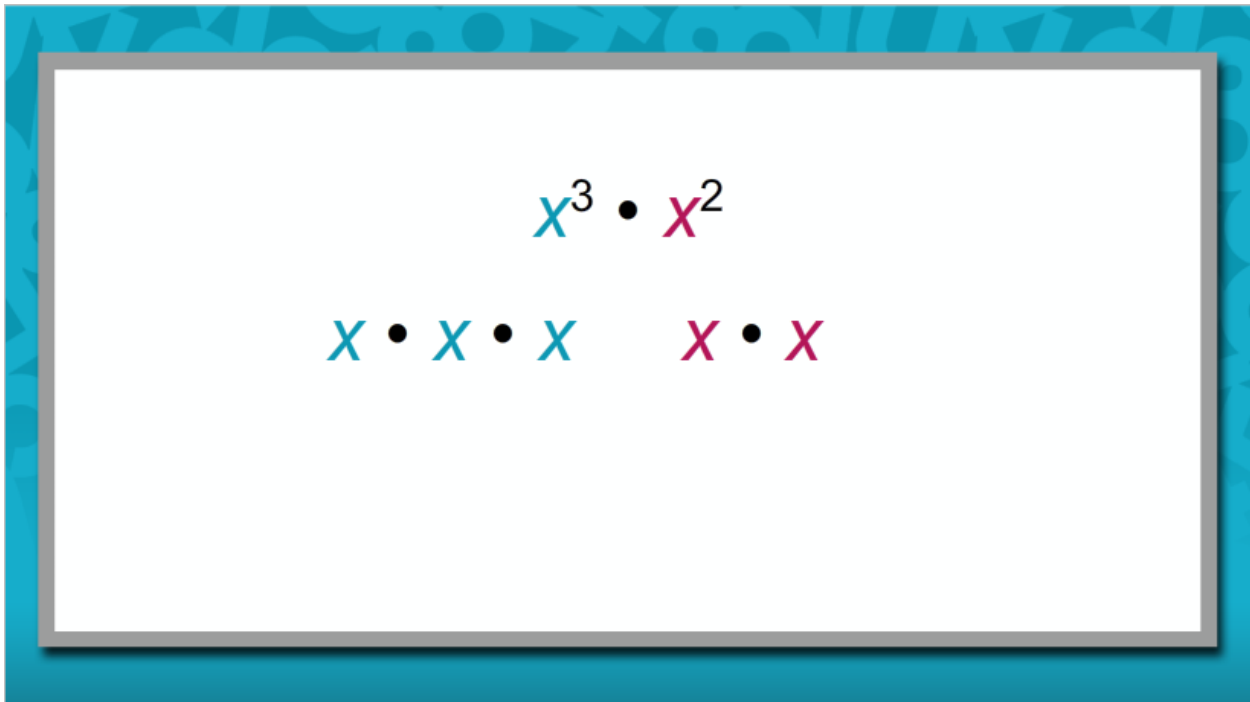
- You will apply your knowledge of exponents.
- You will learn how to determine the product of two exponential expressions with the same base.

Hi there! I'm so glad you could join me for this lesson in Algebra I. Before you dive into this lesson, take a moment to think back to some of your earlier math studies. Do you recall simplifying expressions that included exponents? In this lesson, you will apply your knowledge of exponents and discover a rule that allows you to easily determine the product of two exponential expressions that have the same base. Let's begin!

## Module 2: Properties of Exponents

### Topic 1: Product of Powers

#### Product of Powers Property



Consider the product of  $x$  cubed and  $x$  squared.

$x$  cubed, when expanded, is  $x$  times  $x$  times  $x$ .

$x$  squared, when expanded, is  $x$  times  $x$ .

## Module 2: Properties of Exponents

### Topic 1: Product of Powers

#### Product of Powers Property (continued)

$$x^3 \cdot x^2$$
$$x \cdot x \cdot x \cdot x \cdot x$$
$$x^5 = x^{3+2}$$

So,  $x$  cubed times  $x$  squared equals the product of 5  $x$ 's, or in other words,  $x^5$ .

The exponent in the result is the sum of the exponents in the product.

## Module 2: Properties of Exponents

### Topic 1: Product of Powers

#### Product of Powers Property (continued)

### Product of Powers Property

When multiplying exponential expressions that have the same base, you add the exponents.

$$a^r + a^s = a^{r+s}$$

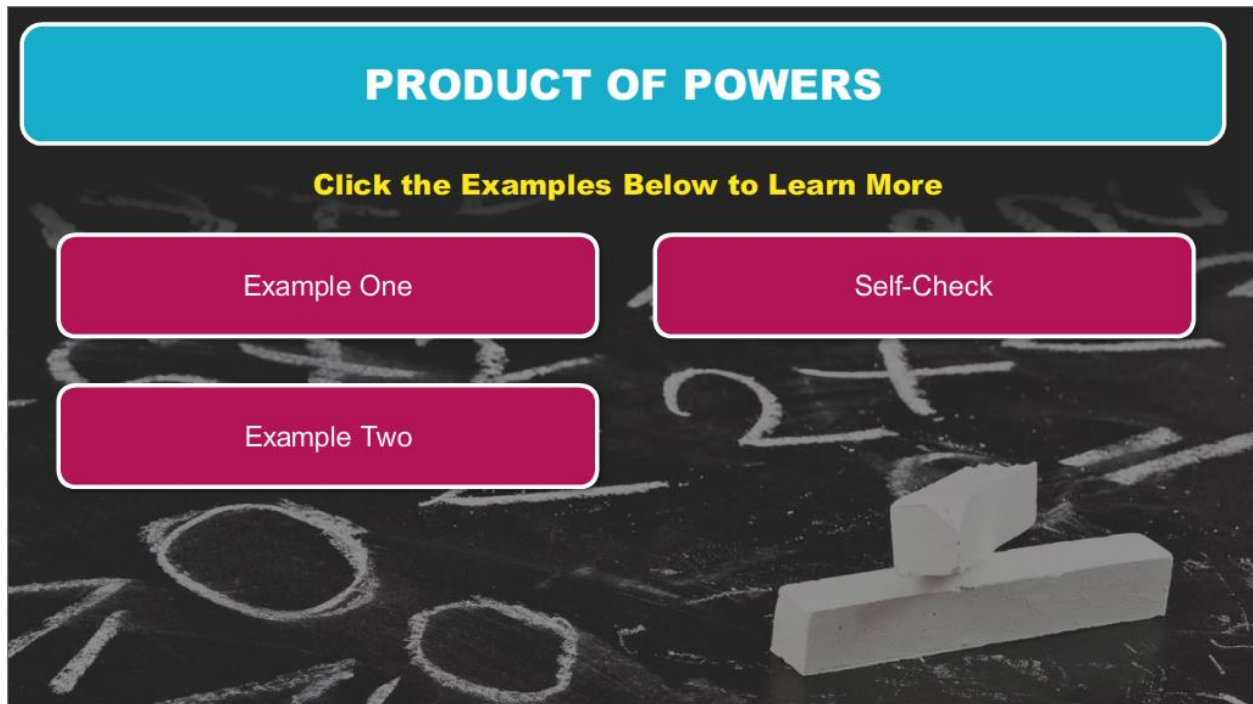
This example shows the pattern that appears when multiplying exponential expressions that have the same base; you add the exponents. This is known as the Product of Powers Property.

$$a^r \cdot a^s = a^{r+s}$$

## Module 2: Properties of Exponents

### Topic 1: Product of Powers

#### Product of Powers



**PRODUCT OF POWERS**

**Click the Examples Below to Learn More**

Example One

Self-Check

Example Two

The graphic features a dark background with faint chalkboard-style numbers and symbols. In the bottom right corner, there is a 3D rendering of a white rectangular block with a smaller white cube-like shape on top of it.

Click the examples below to learn more.

**Module 2: Properties of Exponents**  
**Topic 1: Product of Powers**

**Example 1**

**EXAMPLE 1**

$$y^{12} \cdot y^4 = y^?$$

$$y^{12} \cdot y^4 = y^{12 + 4} = \boxed{y^{16}}$$

$$y^{12} \cdot y^4 = y^?$$

In this example, you are asked to find the product of  $y^{12}$  and  $y^4$ . Because each of the expressions have the same base, you will simply need to add the exponents.

Therefore,  $y^{12} \cdot y^4 = y^{16}$ .

**Module 2: Properties of Exponents**  
**Topic 1: Product of Powers**

**Example 2**

**EXAMPLE 2**

Simplify the expression:  $5t^{16}j^9 \cdot 4t^3j$

$$\begin{aligned} 5t^{16}j^9 \cdot 4t^3j &= 5 \cdot 4 \cdot t^{16} \cdot t^3 \cdot j^9 \cdot j \\ &= (5 \cdot 4) \cdot (t^{16} \cdot t^3) \cdot (j^9 \cdot j) \end{aligned}$$

Enter your answer below and click submit.

$5 \cdot 4 =$

**Submit**

Simplify the expression:  $5t^{16}j^9 \cdot 4t^3j$

In this example, you must find the product of exponential expressions that include coefficients and more than one base. Recall that the Commutative Property of Multiplication states that you can multiply values in any order. Apply that property in this example by changing the order of multiplication, so that you multiply the coefficients first, then  $t^{16}$  and  $t^3$ , and lastly,  $j^9$  and  $j$ .

$5 \cdot 4 = ?$

Enter your answer below and click submit.

## Module 2: Properties of Exponents

### Topic 1: Product of Powers

Example 2 (continued)

#### EXAMPLE 2

Simplify the expression:  $5t^{16}j^9 \cdot 4t^3j$

$$\begin{aligned}5t^{16}j^9 \cdot 4t^3j &= 5 \cdot 4 \cdot t^{16} \cdot t^3 \cdot j^9 \cdot j \\ &= (5 \cdot 4) \cdot (t^{16} \cdot t^3) \cdot (j^9 \cdot j) \\ &= 20\end{aligned}$$

The product of 5 and 4 is 20.

$$5 \cdot 4 = 20$$

Next

Feedback:  $5 \cdot 4 = 20$



## Module 2: Properties of Exponents

### Topic 1: Product of Powers

Example 2 (continued)

### EXAMPLE 2

Simplify the expression:  $5t^{16}j^9 \cdot 4t^3j$

$$\begin{aligned}5t^{16}j^9 \cdot 4t^3j &= 5 \cdot 4 \cdot t^{16} \cdot t^3 \cdot j^9 \cdot j \\ &= (5 \cdot 4) \cdot (t^{16} \cdot t^3) \cdot (j^9 \cdot j) \\ &= 20\end{aligned}$$

Enter the correct exponent below and click submit.

$$t^{16} \cdot t^3 = t^{\boxed{\phantom{000}}}$$

Submit

In order to multiply  $t^{16}$  and  $t^3$ , you will need to add the exponents.

$$t^{16} \cdot t^3 = t^?$$

## Module 2: Properties of Exponents

### Topic 1: Product of Powers

Example 2 (continued)

### EXAMPLE 2

Simplify the expression:  $5t^{16}j^9 \cdot 4t^3j$

$$\begin{aligned}5t^{16}j^9 \cdot 4t^3j &= 5 \cdot 4 \cdot t^{16} \cdot t^3 \cdot j^9 \cdot j \\ &= (5 \cdot 4) \cdot (t^{16} \cdot t^3) \cdot (j^9 \cdot j) \\ &= 20 \cdot t^{19}\end{aligned}$$

$t^{16}$  times  $t^3$  equals  $t^{19}$ .

$$t^{16} \cdot t^3 = t^{16+3} = t^{19}$$

Next

Feedback:  $t^{16} \cdot t^3 = t^{16+3} = t^{19}$

**Module 2: Properties of Exponents**  
**Topic 1: Product of Powers**

Example 2 (continued)

**EXAMPLE 2**

Simplify the expression:  $5t^{16}j^9 \cdot 4t^3j$

$$\begin{aligned}5t^{16}j^9 \cdot 4t^3j &= 5 \cdot 4 \cdot t^{16} \cdot t^3 \cdot j^9 \cdot j \\ &= (5 \cdot 4) \cdot (t^{16} \cdot t^3) \cdot (j^9 \cdot j) \\ &= 20 \cdot t^{19}\end{aligned}$$

Enter the correct exponent below and click submit.

$$j^9 \cdot j = j \text{$$

Submit

In order to multiply  $j^9$  and  $j$ , you will need to add the exponents.

## Module 2: Properties of Exponents

### Topic 1: Product of Powers

Example 2 (continued)

### EXAMPLE 2

Simplify the expression:  $5t^{16}j^9 \cdot 4t^3j$

$$\begin{aligned}5t^{16}j^9 \cdot 4t^3j &= 5 \cdot 4 \cdot t^{16} \cdot t^3 \cdot j^9 \cdot j \\ &= (5 \cdot 4) \cdot (t^{16} \cdot t^3) \cdot (j^9 \cdot j) \\ &= 20 \cdot t^{19} \cdot j^{10}\end{aligned}$$

Remember that  $j = j^1$ . Therefore  $j^9$  times  $j$  equals  $j^{10}$ .

$$j^9 \cdot j = j^{9+1} = j^{10}$$

Next

Feedback: Remember,  $j = j^1$ .

## Module 2: Properties of Exponents

### Topic 1: Product of Powers

Example 2 (continued)

### EXAMPLE 2

Simplify the expression:  $5t^{16}j^9 \cdot 4t^3j$

$$\begin{aligned}5t^{16}j^9 \cdot 4t^3j &= 5 \cdot 4 \cdot t^{16} \cdot t^3 \cdot j^9 \cdot j \\ &= (5 \cdot 4) \cdot (t^{16} \cdot t^3) \cdot (j^9 \cdot j) \\ &= 20 \cdot t^{19} \cdot j^{10} \\ &= \boxed{20t^{19}j^{10}}\end{aligned}$$

[Menu](#)

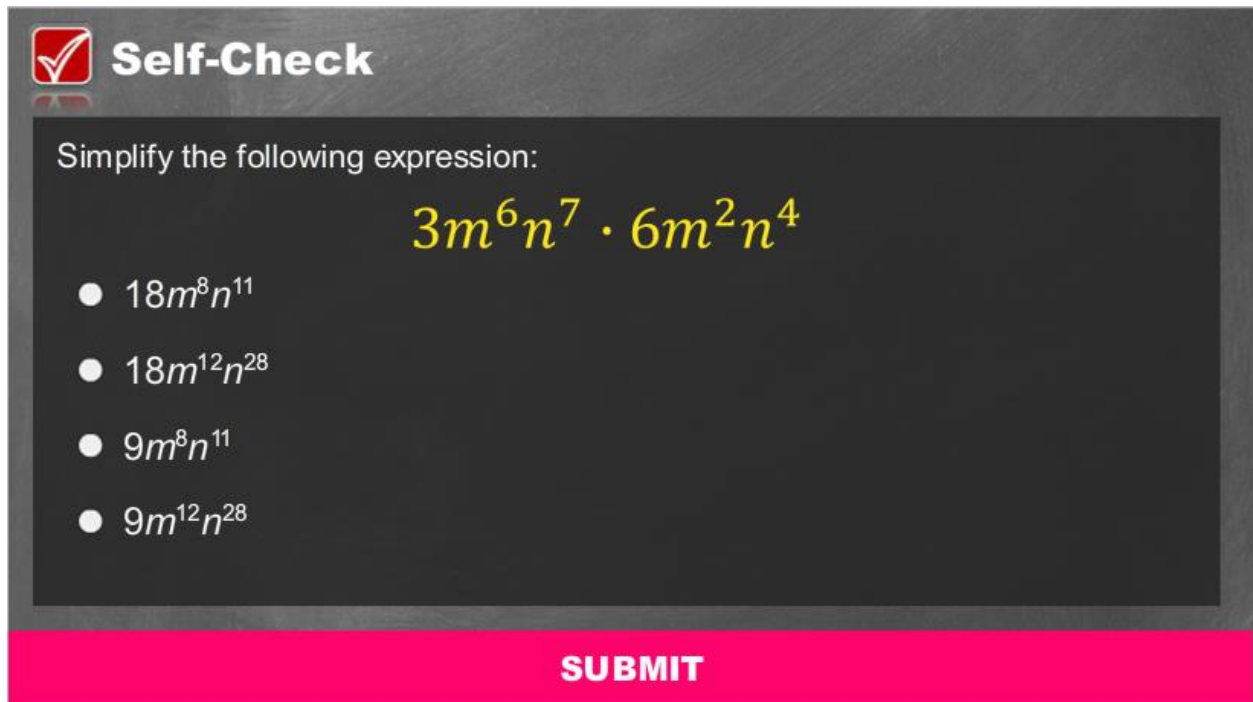
Now that you have determined the product of the coefficients and the exponential portions, simplify the expression.


Your work is complete. The final answer is  $20t^{19}j^{10}$ .

## Module 2: Properties of Exponents

### Topic 1: Product of Powers

#### Self-Check



 **Self-Check**

Simplify the following expression:

$$3m^6n^7 \cdot 6m^2n^4$$

- $18m^8n^{11}$
- $18m^{12}n^{28}$
- $9m^8n^{11}$
- $9m^{12}n^{28}$

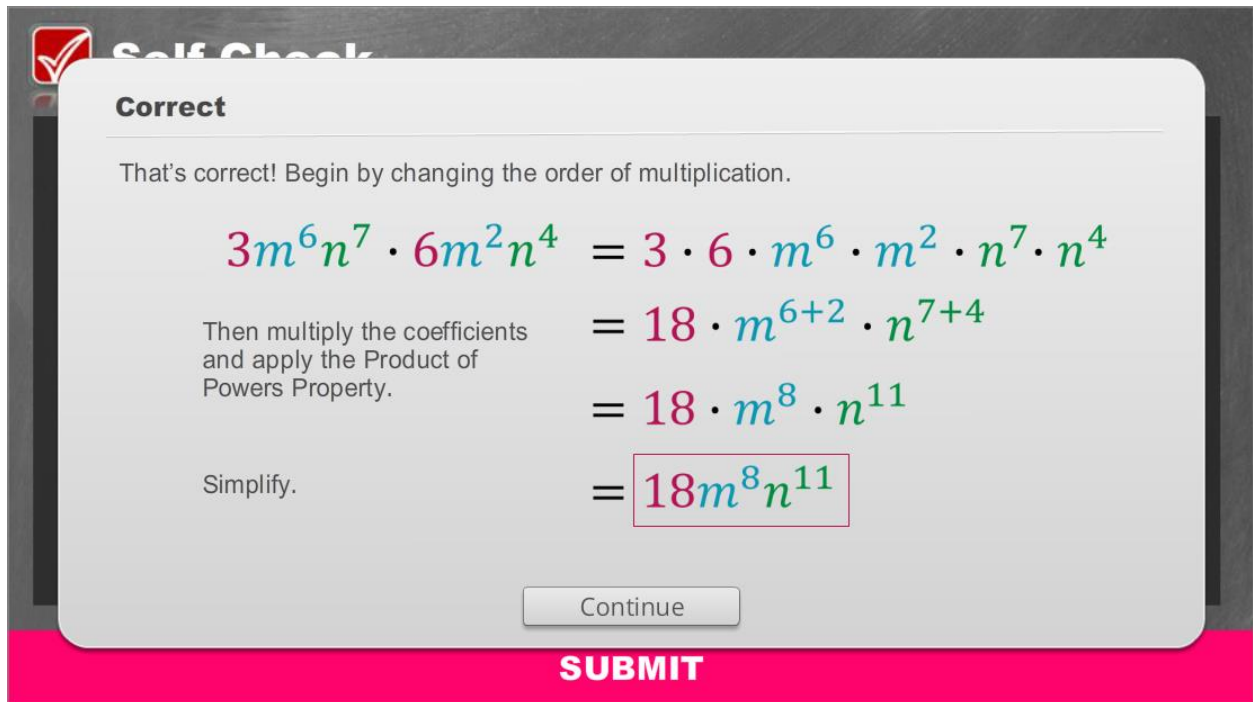
**SUBMIT**

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

## Module 2: Properties of Exponents

### Topic 1: Product of Powers

#### Self-Check: Answer



**Correct**

That's correct! Begin by changing the order of multiplication.

$$3m^6n^7 \cdot 6m^2n^4 = 3 \cdot 6 \cdot m^6 \cdot m^2 \cdot n^7 \cdot n^4$$

Then multiply the coefficients and apply the Product of Powers Property.

$$= 18 \cdot m^{6+2} \cdot n^{7+4}$$

Simplify.

$$= 18m^8n^{11}$$

Continue

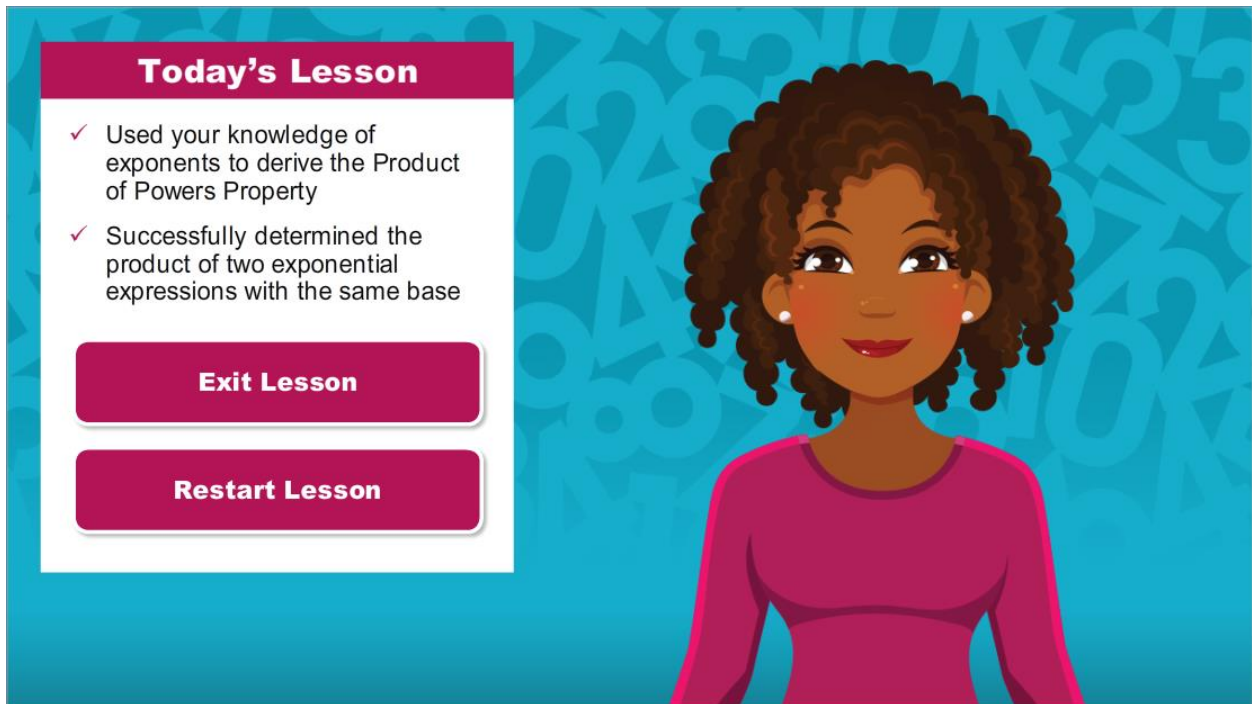
**SUBMIT**

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

## Module 2: Properties of Exponents

### Topic 1: Product of Powers

#### Conclusion



The image shows a digital interface for a lesson conclusion. On the right side, there is a cartoon illustration of a young woman with dark, curly hair, wearing a pink long-sleeved top. The background is a light blue with a pattern of faint mathematical symbols like pi, infinity, and numbers. On the left side, there is a white box with a pink header that says "Today's Lesson". Inside this box, there are two bullet points with checkmarks, followed by two pink buttons labeled "Exit Lesson" and "Restart Lesson".

**Today's Lesson**

- ✓ Used your knowledge of exponents to derive the Product of Powers Property
- ✓ Successfully determined the product of two exponential expressions with the same base

**Exit Lesson**

**Restart Lesson**

Congratulations! You have reached the conclusion of this lesson in Algebra I. In this lesson, you used your knowledge of exponents to derive the Product of Powers Property, which allowed you to easily determine the product of two exponential expressions that have the same base.