

Name: LEY Hour: _____ Date: _____

NOTES: Section 8.1 – Multiplication Properties of Exponents

Goals: #1 - I can use multiplication properties of exponents.



Homework: Section 8.1 Worksheet

Exploration #1: Work with a partner and answer the following questions.

1. How could you write 7^2 as products?

$$7 \cdot 7$$

2. How could you write 7^3 as products?

$$7 \cdot 7 \cdot 7$$

3. How could you multiply $7^2 \cdot 7^3$? What about $x^3 \cdot x^4$?

$$7 \cdot 7 \cdot 7 \cdot 7 \cdot 7$$

$$7^5 = 16807$$

$$\begin{aligned} x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \\ = x^7 \end{aligned}$$

4. Complete: $a^m \cdot a^n = a^{\boxed{m+n}}$

Notes:

base \rightarrow **5** ^{power/exponent} **3**

To multiply powers that have the same base, we add the exponents.

Example: $7^2 \cdot 7^3 = 7^{2+3} = 7^5$

Example #1: Write the expression as a single power of the base.

1. $5^3 \cdot 5^6$

$$5^{3+6}$$

$$\boxed{5^9}$$

2. $(-2)(-2)^4$

$$(-2)^{4+1}$$

$$\boxed{(-2)^5}$$

3. $x^2 \cdot x^3 \cdot x^4$

$$x^{2+3+4}$$

$$\boxed{x^9}$$

You practice: Write the expression as a single power of the base.

1. $4^2 \cdot 4^3$

$$4^{2+3}$$

$$\boxed{4^5}$$

2. $a \cdot a^7$

$$a^{1+7}$$

$$\boxed{a^8}$$

3. $(-3)^2(-3)^1$

$$(-3)^{2+1}$$

$$\boxed{(-3)^3}$$

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Exploration #2: Work with a partner and answer the following questions.

1. How could you write $(7^3)^2$ as products? Can you simplify this?

$$(7 \cdot 7 \cdot 7)^2 \rightarrow (7 \cdot 7 \cdot 7)(7 \cdot 7 \cdot 7)$$

$$7^6 = 117649$$

2. How could you write $(x^5)^3$ as products? Can you simplify this?

$$(x \cdot x \cdot x \cdot x \cdot x) \rightarrow (x \cdot x \cdot x \cdot x \cdot x)(x \cdot x \cdot x \cdot x \cdot x)(x \cdot x \cdot x \cdot x \cdot x)$$

$$x^{15}$$

3. Complete: $(a^m)^n = a^{\boxed{m \cdot n}}$

Notes:

base \rightarrow power

$$(5^3)^2$$

power \rightarrow power

To raise a power to another power we multiply the exponents.

Example: $(7^3)^2 = 7^{3 \cdot 2} = 7^6$

Example #2: Write the expression as a single power of the base.

1. $(3^3)^2$

$$3^{3 \cdot 2}$$

$$\boxed{3^6}$$

2. $[(-3)^5]^2$

$$(-3)^{5 \cdot 2}$$

$$\boxed{(-3)^{10}}$$

3. $(p^4)^4$

$$p^{4 \cdot 4}$$

$$\boxed{p^{16}}$$

You practice: Write the expression as a single power of the base.

1. $(4^4)^3$

$$4^{4 \cdot 3}$$

$$\boxed{4^{12}}$$

2. $(n^4)^5$

$$n^{4 \cdot 5}$$

$$\boxed{n^{20}}$$

3. $[(-5)^2]^3$

$$(-5)^{2 \cdot 3}$$

$$\boxed{(-5)^6}$$

Exploration #3: Work with a partner and answer the following questions.

1. How could you write $(5 \cdot 4)^2$ as products? Can you simplify this?

$$(5 \cdot 4)(5 \cdot 4) \rightarrow 5 \cdot 4 \cdot 5 \cdot 4 \rightarrow 5^2 \cdot 4^2 = 400$$

2. How could you write $(x \cdot y)^3$ as products? Can you simplify this?

$$(x \cdot y)(x \cdot y)(x \cdot y) = x^3 y^3$$

3. Complete: $(a \cdot b)^m = a^{\boxed{m}} b^{\boxed{m}}$

Notes:

base exponent

$$\boxed{(5 \cdot 2)}^3$$

To find a power of a product, find the power of each factor and multiply

Example: $(5 \cdot 2)^3 = 5^3 \cdot 2^3 = 125 \cdot 8 = 1000$

Example #3: Simplify the expression.

1. $(-6 \cdot 5)^2$

$$\boxed{(-6)^2 \cdot 5^2}$$

2. $(4yz)^3$

$$4^3 \cdot y^3 \cdot z^3$$

$$\boxed{4^3 y^3 z^3}$$

3. $(2w)^6$

$$2^6 \cdot w^6$$

$$\boxed{2^6 w^6}$$

You practice: Simplify the expression.

1. $(2 \cdot 4)^3$

$$\boxed{2^3 \cdot 4^3}$$

2. $(4xy)^4$

$$4^4 x^4 y^4$$

$$\boxed{4^4 x^4 y^4}$$

3. $(-3 \cdot 4)^2$

$$\boxed{(-3)^2 \cdot 4^2}$$

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Notes:

• Multiplication Properties of Exponents:

Property:	Algebraic Expression:	Example:
Product of Powers Property	$a^m \cdot a^n = a^{m+n}$	$3^2 \cdot 3^5 = 3^{2+5} = 3^7$
Power of a Power Property	$(a^m)^n = a^{m \cdot n}$	$(3^2)^5 = 3^{2 \cdot 5} = 3^{10}$
Power of a Product Property	$(a \cdot b)^m = a^m b^m$	$(3 \cdot 2)^5 = 3^5 2^5 = 243 \cdot 32 = 7776$

Example #4: Simplify the expression.

$$\begin{aligned}
 &1. (4x^2)^3 \cdot x^5 \\
 &4^3 x^{2 \cdot 3} \cdot x^5 \\
 &64 x^6 \cdot x^5 \\
 &64 x^{6+5} \\
 &\boxed{64 x^{11}}
 \end{aligned}$$

You practice: Simplify the expression.

$$\begin{aligned}
 &1. (n^2)^3 \cdot n^7 \\
 &n^{2 \cdot 3} \cdot n^7 \\
 &n^6 \cdot n^7 \\
 &n^{6+7} \\
 &\boxed{n^{13}}
 \end{aligned}$$

$$\begin{aligned}
 &2. 9 \cdot (9z^5)^2 \\
 &9 \cdot 9^2 z^{5 \cdot 2} \\
 &9 \cdot 9^2 z^{10} \\
 &9^{1+2} z^{10} \\
 &9^3 z^{10} \\
 &\boxed{729 z^{10}}
 \end{aligned}$$

$$\begin{aligned}
 &2. (3x^4)^2 \cdot x^3 \\
 &3^2 x^{4 \cdot 2} \cdot x^3 \\
 &9 x^8 \cdot x^3 \\
 &9 x^{8+3} \\
 &\boxed{9 x^{11}}
 \end{aligned}$$