Find the Exponent Rule

PROPERTIES OF EXPONENTS	
Property	Example
$x^0 = 1$	$2357^0 = 1$
$(x^a)(x^b) = x^{(a+b)}$	$(2^3)(2^5) = 2^7$
$(x^a)^b = x^{(a \cdot b)}$	$(2^3)^5 = 2^{15}$
$\frac{x^a}{x^b} = x^{(a-b)}$	$\frac{2^5}{2^3} = 2^2$ $\frac{2^3}{2^5} = 2^{-2}$
$\frac{1}{x^a} = x^{(-a)}$	$\frac{1}{2^3} = 2^{-3}$ $\frac{1}{2^{-3}} = 2^3$
$x^{\left(\frac{a}{b}\right)} = \sqrt[b]{x^a}$ or $\left(\sqrt[b]{x}\right)^a$	$4^{\left(\frac{1}{2}\right)} = \sqrt[2]{4^1}$ or $\left(\sqrt[2]{4}\right)^1$ $5^{\left(\frac{4}{2}\right)} = \sqrt{5^4}$ or $\left(\sqrt{5}\right)^4$

STANDARD: TEKS A.11(B) Simplify numeric and algebraic expressions usingthe laws of exponents including integral and rational exponents.

CCSS.MATH.CONTENT.8.FF.A.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.

PLAYERS: 1-4

MATERIALS: Exponent Laws/Rules Reference Page, Exponent Practice Cards, Opaque Markers (3 per pair of students), Paper and Pencil, Recording Sheet

DIRECTIONS:

1. Have each player review the Exponent Laws/Rules Reference Page.
2. Place the self-checking Exponent Practice Cards in the middle of the group so that all players can see the expression. (Keep top card covered until ready to play, then reveal the next card the expression has been simplified on the recording sheets.)
3. Have all players get markers ready and place hands on shoulders.
4. The Leader reveals the top expression and pairs race to see who can be first to place their marker on the Exponent Rule that applies to that expression. If more than one rule applies, then a marker must be placed on the additional rule.
5. The Leader determines which pair was first and asks them to explain how they know that Exponent Rule applies to simplifying that expression.
6. If correct, that pair will reveal the next card.
7. All players simplify the expression on their Recording Sheet.
8. Continue with the remaining cards.

Alternative Play Structure: Glue exponent rules & examples to poster board. Use flyswatters with holes cut out of centers to "swat" the rule or example when one person holds up one Exponent Practice Card.

Exponent Laws/Rules

Product Rule

$$a^m \times a^n = a^{m+n}$$

To **multiply** when two bases are the same, write the base and **ADD** the exponents.

$x^3 \cdot x^8 = x^{11}$ $\quad$ $(x^2y)(x^3y^4) = x^5y^5$

Quotient Rule

$$\frac{a^m}{a^n} = a^{m-n}$$

To **divide** when two bases are the same, write the base and **SUBTRACT** the exponents.

$\frac{x^5}{x^2} = x^3$ $\quad$ $\frac{x^2y^5}{xy^3} = xy^2$

Power Rule

$$(a^m)^n = a^{mn}$$

To **raise a power to another power**, write the base and **MULTIPLY** the exponents.

$(x^3)^2 = x^6$ $\quad$ $(z^5)^2 = z^{10}$

Negative Exponent Rule

$$a^{-m} = \frac{1}{a^m}$$

A negative exponent means that the base, the x, belongs on the other side of the fraction line. 1. Convert to fraction 2. Move base to other side. 3. Change sign on exponent. 4. Solve.

$x^{-3} = \frac{1}{x^{-3}}$ $\quad$ $-4x^5y^{-2} = \frac{-4x^5}{y^2}$

Power of One Rule

$$a^1 = a$$

Any number raised to the power of **one** equals the number itself.

$x^1 = x$ $\quad$ $3^1 = 3$

Zero Power Rule

$$a^0 = 1$$

Any base (except 0) raised to the **zero power is equal to 1.**

$x^0 = 1$ $\quad$ $(7a^3b^{-2})^0 = 1$

1. $3 \cdot 4^3$

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

3. $x^5 \cdot x^3$

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

5. $\dfrac{6^5}{6^3}$

6. $\dfrac{x^4}{x^7}$

7. 8^0

8. $-(9x)^0$

9. $(y^4)^3$

10. $(x^2y)^4$

11. $\dfrac{6x^7}{2x^4}$

12. $\frac{8x^5}{4x^2}$

13. $(2cd^4)^2\,(cd)^5$

14. y^{-7}

15. 7^{-2}

Product Rule

Product Rule

Quotient Rule

Quotient Rule

Power Rule

Power Rule

Negative Exponent Rule

Negative Exponent Rule

$$a^m \cdot a^n = a^{m+n}$$

$$\frac{a^m}{a^n} = a^{m-n}$$

$$(a^m)^n = a^{mn}$$

$$a^1 = a$$

$$a^{-m} = \frac{1}{a^m}$$

$$a^0 = 1$$

Find the Exponent Rule **Recording Sheet**
Name_____

Use Exponent Rules to simplify each expression with positive exponents. Name the exponent rule and create a different expression that illustrates the need for that rule.

Expression	Simplified Expression	Rule(s)	New Expression
1. $3 \cdot 4^3$			
2. $4x^3 \cdot 2x^3$			
3. $x^5 \cdot x^3$			
4. $2x^3 \cdot 2x^2$			
5. $\frac{6^5}{6^3}$			
6. $\frac{x^4}{x^7}$			
7. 8^0			
8. $-(9x)^0$			
9. $(y^4)^3$			
10. $(x^2y)^4$			
11. $\frac{6x^7}{2x^4}$			
12. $\frac{8x^5}{4x^2}$			
13. $(2cd^4)^2\,(cd)^5$			
15. y^{-7}			
14. 7^{-2}			

Name

ROTATION

Find the Exponent Rule

1. Read the word problem. Use what you know about exponents to determine your answer. Show your work.

A seed on a dandelion flower weighs 10^{-3} grams. The dandelion itself can weigh up to 10^{3} grams. How many times heavier is a dandelion than its seed?

A biologist is studying green peach aphids. In the lab, the population doubles every week. The expression $1000 \cdot 2^{w}$ models an initial population of 1000 insects after w weeks of growth.

c. Evaluate the expression for $w = 0$, then describe what that value represents in this situation.

d. Evaluate the expression when $w = -3$, then describe what that value of the expression represents in the situation.

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a. Evaluate the expression for $w = 0$, then describe what that value represents in this situation.

b. Evaluate the expression when $w = -3$, then describe what that value of the expression represents in the situation.