Lesson 3: Order of Operations and Exponents

Objectives	Terms
• To understand how to identify the correct order of operations. • To simplify expressions using order of operations. • To understand the three main properties of exponents. • To define and use negative exponents.	• Order of Operations • Simplify • Base • Power • Product Property • Quotient Property • Power Property

Think about this:

What can you do with the following expressions?

1. $2 + 5 - 3 - 1 + 10$	2. $2 \times (5 - 3) \times 1 + 10$	3. $2 \times 5 - (3 \times 1) \times 10$

Answer these questions in the space provided:

1. What steps did you take to get to each value?

2. Did you get the same answers? Why or why not?

3. What does it mean to simplify?

Definitions:

Order of Operations: Tells us how to _____ expressions that have more than one operation. Also known as _____.

Simplify: To apply _____ indicated in an expression to write in the most _____, concise form.

Use Order of Operations to simplify the expressions:

1. $(1 + 4) \times 3 -$ _____

2. _____ $- (28 \div 2) - 1$

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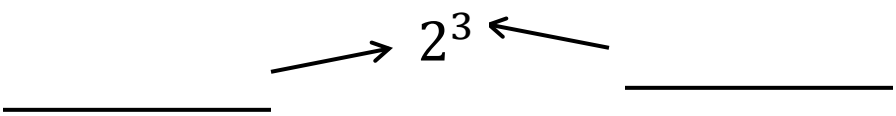
Think about this:

How do you simplify the following?

1. $2^3 + 3^2$	2. $(1+4)^2 \times 3 +$ _____	3. $(1+4)^2 \times 3 -$ _____

Label the Diagram:



Discuss: In this example, what does this format tell us to do?

- This tells us to: _____ the _____ of _____ by itself _____ times.
- We read it as: _____
- If there is no exponent stated: _____

Product Property

How do we simplify this expression?

Original Expression
Write in _____ form
Write as a single exponential expression

Definition:

Product Property of Exponents: When we multiply two exponential expressions with the same _____ we can _____ the exponents and keep the _____.

General Rule: $x^a \cdot x^b =$ **Example:** $m^2 \cdot m^3 =$

Practice: simplify the expression by using the Product Property of Exponents.

$y^{15} \cdot y^4$ $2^2 \cdot 2^4$

Answer: **Answer:**

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Practice: expand and simplify the expressions.

$\frac{n^7}{n^3} =$ **Answer:** $\frac{8^8}{8^5} =$ **Answer:**

Quotient Property

How do we simplify this expression?

$\frac{x^5}{x^2}$	*Original expression*
	Write in expanded form
	Factor forms of one
	Write as a single exponential expression

Definition:

Quotient Property of Exponents: When we divide two exponential expressions with the same _____ we can _____ the exponents and keep the _____.

General Rule: $\frac{x^a}{x^b}=$ **Example:** $\frac{g^5}{g^2}=$

Practice: expand and simplify the expression by using the Power Property of Exponents.

$(m^2n^3)^5$ **Answer:** $(2m^6)^2$ **Answer:**

Power Property

How do we simplify this expression?

$(x^4)^2$	*Original expression*
	Expand the outside exponent
	Expand each exponential expression
	Write as a single exponential expression

Definition:

Power Property of Exponents: When we have an exponential expression raised to another exponent, we can _____ the exponents and keep the _____.

General Rule: $(x^a)^b =$ **Example:** $(3z^3)^2=$

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Negative Exponents: How do we define a negative exponent?

10^3	10^2	10^1	10^0	10^{-1}	10^{-2}	10^{-3}

How do we simplify this expression?

2^{-3}	*Original Expression*
	Rewrite without negative exponents
	Evaluate 2^{-3}

Definition:

Negative exponent: to rewrite an expression with a negative exponent to have a positive exponent, find the _____.

General Rule: $x^{-n} =$ **Example:** x^{-2}**=**

Practice: simplify the expression by using the Power Property of Exponents.

$x^2 \cdot x^{-6}$

Answer:

$\frac{1}{a^{-3}}$

Answer:

Discuss:

1. Where do exponents occur in PEMDAS?

2. If you aren't sure about a rule, what can you do to help simplify exponential expressions?

3. **Note:** Almost anything to the power of _____ is _____.

Where will you see these concepts in upcoming material?	What are the calculator skills you needed?