**Mathematics**

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**Parent Handbook**

**Grade 6**

**Module 4 Topic B: Special Notations of Operations**

Grade 6: Module 4

The fourth module for 6th grade mathematics is on expressions and equations (algebra). The module is divided into 8 sections; Topics A- H.

Topic B:

In Topic B, students differentiate between the product of two numbers and whole numbers with exponents. They differentiate between the two through exploration of patterns, specifically noting how squares grow from a 1×1 measure. They determine that a square with a length and width of three units in measure is constructed with nine square units. This expression is represented as 3² and is evaluated as the product of 3×3=9, not the product of the base and exponent (3 x 2) which would be 6.

Students also build on their previous understanding of the order of operations by including work with exponents. They follow the order of operations to evaluate numerical expressions.

**Terminology**

New or Recently Introduced Terms

**Exponential Notation for Whole Number Exponents:** Let 𝑚 be a non-zero whole number. For any number 𝑎, we define 𝑎𝑚 to be the product of 𝑚 factors of 𝑎. The number 𝑎 is called the *base,* and 𝑚 is called the *exponent,* or *power* of 𝑎.



**Numerical Expression**: A *numerical expression* is a number, or it is any combination of sums, differences, products or divisions of numbers that evaluates to a number.

Statements like, “𝟑+” or “𝟑÷𝟎,” are not numerical expressions because neither represents a point on the number line. Note: Raising numbers to whole number powers are considered numerical expressions as well, since the operation is just an abbreviated form of multiplication, e.g., 𝟐𝟑=𝟐∙𝟐∙𝟐.

**Value of a Numerical Expression:** The *value* of a numerical expression is the number found by evaluating the expression. For example: 𝟏𝟑∙(𝟐+𝟒)+𝟕 is a numerical expression and its value is 𝟗.

**Lesson 5: Exponents**

Objective:

* Students discover that 3𝑥 = 𝑥 + 𝑥 + 𝑥 is not the same thing as 𝑥3 which is 𝑥 · 𝑥 · 𝑥.
* Students understand that a base number can be represented with a positive whole number, positive fraction, or positive decimal and that for any number 𝑎, we define 𝑎𝑚 to be the product of 𝑚 factors of 𝑎. The number 𝑎 is the base and 𝑚 is called the exponent or power of 𝑎.

Example 1:

Exponents can be written using whole numbers, fractions, decimals and algebraically. Here are several examples:

3³= 3 X 3 X 3 Answer: 27

4.9²= 4.9 x 4.9 Answer: 24.01

⅛³ = ⅛ x ⅛ Answer: 2/16

m³= m x m x m

Write 8 x 8 x 8 written in exponential form? Answer: 8³



**Lesson 6: Order of Operations (PEMDAS)**

Objective:

* Students evaluate numerical expressions. They recognize that in the absence of parentheses, exponents are evaluated first.

When evaluating expressions, there is a specific order in which operations are to be performed. Hence, this order is referred to as the Order of Operations. Some students may have been taught a short cut to remember the order: PEMDAS.

**Example 1:**

Expressions with only Addition, Subtraction, Multiplication, and Division.

What operations are evaluated first? *Multiplication and division, from left to right.*

What operations are always evaluated last? *Addition and subtraction, from left to right.*

When we evaluate expressions that have any of these four operations, we always calculate multiplication and division before doing any addition or subtraction. Since multiplication and division are equally powerful, we simply evaluate these two operations as they are written in the expression, from left to right.

Addition and subtraction are at the same level in the order of operations and are evaluated from left to right in an expression.

**1.** 𝟒 + 𝟐 × 𝟕

 𝟒 +𝟏𝟒

 𝟏𝟖

**2.** 𝟑𝟔 ÷ 𝟑 × 𝟒

 𝟏𝟐 × 𝟒

 𝟒𝟖

Exponents are more powerful than multiplication or division. If exponents are present in an expression, they are evaluated before any multiplication or division.

These rules are based on doing the most powerful operations first (exponents), then the less powerful ones (multiplication and division, going from left to right), and finally the least powerful ones last (addition and subtraction, going from left to right).

Evaluate the expression 4 + 6 × 6 ÷ 8.

4 + (6×6) ÷ 8

4 + (36÷8)

4 + 4.5

 8.5

16

16

16

16

16

**Lesson 6: Order of Operations (PEMDAS)--continued**

The last important rule in the order of operations involves grouping symbols (usually parentheses). These tell us that in certain circumstances or scenarios, we need to do things out of the usual order. Operations inside grouping are always evaluated **first**, before exponents.

Example 2:

𝟐·(𝟏𝟑+𝟓−𝟏𝟒÷(𝟑+𝟒) =𝟑𝟐