Exponential notation is used to represent repeated multiplication. Instead of multiplying 2, four times, we can use an exponent. The number which is being multiplied repeatedly is called the __________.

\[ 2 \cdot 2 \cdot 2 \cdot 2 = \]

Note: If there is no exponent indicated, we assume it is a “1”. For example, \( 2^1 \). If there is an exponent of 0 then it is equal to 1 unless the base is also 0 than it is undefined.

\[ 2^1 = 2 \quad \text{“2 to the first power”} \]
\[ 2^2 = 4 \quad \text{“2 to the second power” or “2 squared”} \]
\[ 2^3 = 8 \quad \text{“2 to the third power” or “2 cubed”} \]
\[ 2^4 = 16 \quad \text{“2 to the fourth power”} \]

Remember that \( 2^3 \neq 2 \cdot 3 \).

Example 1: Evaluate \( 6^3 \).

An exponent applies only to its base. For example, in \( 3 \cdot 2^4 \) the exponent “4” applies only to its base, 2.

Example 2: Evaluate \( 3 \cdot 2^4 \).

Example 3: Rewrite the following products by using exponents:

A. \( 3 \times 3 \times 3 \times 3 \)  B. \( 2 \times 2 \times 3 \times 3 \times 5 \times 5 \)

Order of Operations

Mathematics is ruled by the order of operations. All operations in mathematics are governed by this order. When simplifying, you must follow the order below:

1. Grouping Symbols (Parentheses, Brackets, Fraction Bars, etc.)
   a. Innermost grouping symbols first
   b. For fractions, simplify the numerator and denominator separately!

2. Exponential Expressions

3. Multiplication/Division in order from left to right

4. Addition/Subtraction in order from left to right

P E M D A S
Example 3: Simplify the following, using the order of operations.

a) \( 24 + 6 \cdot 3 \)

b) \( 32 + \frac{8}{2} \)

c) \( 12 - 3[8 - (2 + 4)] \)

d) \( 4 - 9 \div 3 + 2^2 \)

e) \( 2 \cdot 3 - 3 \div 3 \)

f) \( \frac{5(12 - 7) - 4}{5^2 - 2^3 - 10} \)