WELCOME!

We will explore lots of exciting topics in math and examine applications of the concepts learned in real world settings. Let's begin with the basics, and then see how we apply them to actual math problems that are encountered in every day math.

FACTORS, EXPONENTS, AND ORDER OF OPERATIONS

We will begin by looking at numbers written in powers and expressed in factors. Numbers may be raised to powers. A number is said to be "square" when it is raised to the second power. Numbers raised to the third power are said to be "cubed".

To evaluate mathematical expressions, there must be an order that everyone agrees upon; thus, mathematicians follow rules for evaluating expressions called "order of operations". In order of operations the rules state which operations must be completed first.

PRIME NUMBERS AND PRIME FACTORIZATION

Numbers can be grouped into primes and composites. A prime number is a number that has only two factors, itself and 1. Composite numbers have more than two factors.

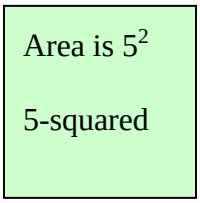
To find the prime factors of a composite number, write the number as a product of prime numbers called prime factorization.

Factors and Powers

5 to the second power, 5^2, equals 5×5 and can be read "5 squared".

Think of the area of a square whose side is 5 units long.

$5 \times 5 = 5^2$ or "5-squared" or 25.



Side = 5 units in length

$A = l \times w$

$A = 5 \times 5$

$A = 5^2$ or 25 square units

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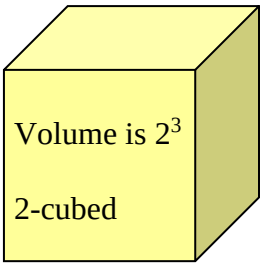
2 to the third power, 2^3, equals $2 \times 2 \times 2$ and can be read "2 cubed".

Think of the volume of a cube whose side is 2 units long.

$2 \times 2 \times 2 = 2^3$ or "2-cubed" or 8.



Side = 2 units in length

$V = l \times w \times h$

$V = 2 \times 2 \times 2$

$V = 2^3$ or 8 cubic units

Example: Evaluate 3^6.

3^6, read 3 to the sixth power, equals $3 \times 3 \times 3 \times 3 \times 3 \times 3$ or 729.

$3^6 = 729$

Order of Operations

Steps for Order of Operations	1. Do powers first.
	2. Working from left to right, do all multiplications and divisions.
	3. Working from left to right, do all additions and subtractions.
	If there are parentheses, simplify within parentheses first by the above order.

Evaluate

$25 - 2 \times (3 + 5)$ Simplify parentheses

$25 - 2 \times 8$ Multiply (Step 2)

$25 - 16$ Subtract (Step 3)

Answer is 9

Evaluate

$42 - 56 \div 7 + 3^2$ Powers first (Step 1)

$42 - 56 \div 7 + 9$ Divide (Step 2)

$42 - 8 + 9$ Subtract (Step 3)

$34 + 9$ Add (Step 3)

Answer is 43

Prime and Composite Numbers

A prime number is a number that has only **two factors, 1 and itself**.

1 is not considered **a prime** since it has only one factor, 1, $(1 \times 1 = 1)$. Prime numbers have **two factors**.

Prime Numbers under 20 → {2, 3, 5, 7, 11, 13, 17, 19…}

2 is prime because it has only two factors, 1×2.

3 is prime because it has only two factors, 1×3.

4 is not prime because, besides the factors of 1×4, there is another factor, 2, 2×2 makes 4.

5 is prime because it has only two factors, 1×5.

6 is not prime because, besides the factors of 1×6, there is another set of factors, 2×3.

7 is prime because it has only two factors, 1×7.

8 is not prime because, besides the factors of 1×8, there is another set of factors, 2×4.

9 is not prime because, besides the factors of 1×9, there is another factor of 3, 3×3 makes 9.

10 is not prime because, besides the factors of 1×10, there is another set of factors, 2×5.

4, 6, 8, and 10 are called **composite** numbers because they have more than two factors.

Prime Factorization

To find the prime factors of a composite number, you write the number as a product of prime numbers.

Prime Numbers Under 20
{2,3,5,7,11,13,17,19,…}

Find the prime factorization of 40

The steps for finding the prime factorization of 40:

40 = 2 × 20
40 = 2 × 2 × 10
40 = 2 × 2 × 2 × 5

The prime factorization of 40 is $2 \times 2 \times 2 \times 5$ which can be expressed as $2^3 \times 5$.