

# Basic Arithmetic Laws Explained with Examples

Arithmetic has four main operations: addition, subtraction, multiplication, and division. These operations have some simple rules, called laws, that make math easier to understand and solve. Let's go over these laws with definitions and examples to help you understand them better.

## 1. Commutative Law

The commutative law says that you can change the order of the numbers, and the answer will still be the same. This works for **addition** and **multiplication**.

- **Addition:**  $a + b = b + a$
- **Multiplication:**  $a \times b = b \times a$

**Examples:**

- **Addition:**  $1 + 6 = 6 + 1$
- **Multiplication:**  $2 \times 5 = 5 \times 2$

## 2. Associative Law

The associative law says that it doesn't matter how you group the numbers when adding or multiplying, the result will still be the same.

- **Addition:**  $(a + b) + c = a + (b + c)$
- **Multiplication:**  $(a \times b) \times c = a \times (b \times c)$

**Examples:**

- **Addition:**  $(2 + 3) + 4 = 2 + (3 + 4) = 9$
- **Multiplication:**  $(2 \times 3) \times 4 = 2 \times (3 \times 4) = 24$

### 3. Distributive Law

The distributive law helps when you need to multiply a number by a group of numbers that are being added or subtracted. You can multiply the number by each part separately and then add or subtract the results.

- **Multiplication over Addition:**  $a \times (b + c) = (a \times b) + (a \times c)$
- **Multiplication over Subtraction:**  $a \times (b - c) = (a \times b) - (a \times c)$

**Examples:**

- **Addition:**  $3 \times (4 + 2) = (3 \times 4) + (3 \times 2) = 12 + 6 = 18$
- **Subtraction:**  $5 \times (7 - 3) = (5 \times 7) - (5 \times 3) = 35 - 15 = 20$

### 4. Identity Law

The identity law is about special numbers that don't change the value of other numbers when you use them in addition or multiplication.

- **Addition Identity:** Adding 0 to a number doesn't change its value.
  - $a + 0 = a$
- **Multiplication Identity:** Multiplying a number by 1 doesn't change its value.
  - $a \times 1 = a$

**Examples:**

- **Addition:**  $7 + 0 = 7$
- **Multiplication:**  $8 \times 1 = 8$

## 5. Zero Property of Multiplication

The zero property says that any number multiplied by zero is always zero.

- $a \times 0 = 0$

**Example:**

- $9 \times 0 = 0$

## 6. Properties of Division

Division doesn't follow the same rules as addition and multiplication. If you change the order or grouping, you will usually get a different answer.

- **Division Example:**  $6 \div 3 \neq 3 \div 6$

To help understand division, you can think of it as multiplying by the reciprocal (the number you multiply by to get 1):

- $a \div b = a \times (1/b)$ , as long as  $b$  is not zero.

## Summary Table

Law	Applies To	Example
Commutative	Addition, Multiplication	$3 + 5 = 5 + 3$
Associative	Addition, Multiplication	$(2 + 3) + 4 = 2 + (3 + 4)$
Distributive	Multiplication over Addition/Subtraction	$3 \times (4 + 2) = 18$
Identity	Addition (0), Multiplication (1)	$7 + 0 = 7$ , $8 \times 1 = 8$
Zero Property	Multiplication	$9 \times 0 = 0$

These basic laws are important tools that make arithmetic easier and help you build a strong foundation for more advanced math. 🍏🧠