

Commutative Property: Definition, Explanation & Real-World Applications

Discover the commutative property's mathematical underpinnings and real-world applications. Learn how numbers can be arranged to make calculations easier.

Introduction

Consider changing the order of ingredients when cooking or rearranging groceries in a bag. The result is the same regardless of the sequence. The commutative property is being used here! This essential characteristic streamlines computations and boosts productivity in arithmetic, algebra, and even practical applications like computing and finance.

In this article, we'll explore:

- What is the commutative property?
- How commutative property is applied in addition and multiplication?
- How does it differ from associative property?
- Where is commutative property applied in real life?

What is the Commutative Property?

The word "commute," which means to travel around, is the root of the word "commutative." Therefore, shifting the numbers about is the subject of the commutative property. Mathematically speaking, an arithmetic operation is commutative if altering the operands' order has no effect on the operation's outcome.

Only addition and multiplication operations can use the commutative property. Therefore, when adding or multiplying any two integers, we can switch the numbers or modify their position. One of the main characteristics of integers is this.

Commutative Property of Addition

Changing the order of the addends has no effect on the sum's value, according to the commutative property of addition. The following formula gives the commutative property of number addition if 'A' and 'B' are two numbers.

Commutative Property of Addition Formula:

$$A + B = B + A$$

Example:

$$13 + 12 = 12 + 13$$

Let us add the given numbers 12 and 13. So, $12 + 13 = 25$ and $13 + 12 = 25$. Therefore, $12 + 13 = 13 + 12$ which proves the commutative property of addition.

Commutative Property of Multiplication

The commutative property of multiplication states that the product of two integers remains constant regardless of the order of the numbers. The commutative property of multiplication can be expressed using the following formula:

Commutative Law of Multiplication Formula

$$A \times B = B \times A$$

Example:

$$4 \times 3 = 3 \times 4$$

If 4 and 3 are the numbers, then $4 \times 3 = 12$, and 3×4 is also equal to 12. Thus $4 \times 3 = 3 \times 4$. Therefore, the commutative property holds true for the multiplication of numbers.

Subtraction and Division

The commutative property does not hold for subtraction and division operations. Let us take the example of numbers 8 and 2.

Example:

- $8 - 2 = 6$, but $2 - 8 = -6$. Thus, $8 - 2 \neq 2 - 8$.
- $8 \div 2 = 4$, but $2 \div 8 = \frac{1}{4}$. Thus, $8 \div 2 \neq 2 \div 8$

Difference between Commutative Property and Associative Property

Commutative property involves two numbers, while associative property involves more than two numbers. While the associative property deals with altering how numbers are grouped, the commutative property deals with altering the order of numbers.

Examples on Commutative Property of Addition and Multiplication

Example 1: If $(10 \times 20) = 200$, then use commutative property to find (20×10) .

Solution: According to the commutative property of multiplication,

$$(10 \times 20) = (20 \times 10).$$

Given that $(10 \times 20) = 200$,

$$(20 \times 10) = 200.$$

Example 2: Check whether the commutative property of addition is implied in the following equation. $(40 + 10) = (10 + 40)$

Solution: LHS = $(40 + 10) = 50$

RHS = $(10 + 40) = 50 = \text{LHS}$

Thus, the commutative property of addition is implied in this equation.

Practice Questions

Test yourself with these problems:

1. Complete the following equation: $(_ \times 4) = (_ \times 2)$
2. Fill in the blanks: $12 + _ = _ + 5$.
3. If $(6 \times 5) = 30$, find the product of (5×6) using the associative property.
4. Solve for y using the associative property formula: $(y + 8) = (8 + 5)$.

Where Do We Use This in Real Life?

- **Arithmetic Simplification:** Makes mental math and calculations faster.
- **Computer Science:** Used in data processing and parallel computing.
- **Finance:** Helps in rearranging calculations for faster processing.
- **Physics & Engineering:** Simplifies formulas in force, motion, and circuits.

Conclusion

The **commutative property** is an essential mathematical rule that simplifies calculations across various fields, from computing to engineering. By understanding and applying this property, you can solve problems more efficiently.

Frequently Asked Questions – FAQs

Q1. Can the commutative property be used with negative numbers?

Yes! For example, $(-3 + 4) = (4 + (-3))$, both resulting in 1.

The same applies to multiplication.

Q2. Why doesn't the commutative property work for division?

Division is order-sensitive.

Q3. Can commutative property be used with fractions?

Yes. Example: $\left(\frac{1}{2} + \frac{1}{3}\right) = \left(\frac{1}{3} + \frac{1}{2}\right)$

Q4. What is the difference between associative and commutative properties?

The commutative property is about changing the order of numbers, while the associative property is about changing the grouping of numbers.