

NUMBER SYSTEM



BASIC CONCEPTS OF THE NUMBER SYSTEM

- 1. Digits:** The basic symbols used to form numbers: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.
- 2. Place Value:** The value of a digit depends on its position in a number.
Example, in 528, the digit 5 is in the hundreds place, so its **value** is 500.
- 3. Face Value:** The value of the digit itself, regardless of its position.
Example, in 528, the face value of 5 is 5.
- 4. Successor:** The number that comes right after a given number. For any number n , the successor is $n + 1$.
Example: The successor of 7 is 8, and the successor of -3 is -2 .
- 5. Predecessor:** The number that comes right before a given number. For any number n , the predecessor is $n - 1$.
Example: The predecessor of 7 is 6, and the predecessor of -3 is -4 .
- 6. Operations:** Basic math operations include addition (+), subtraction ($-$), multiplication ($\times$), and division ($\div$).

Types of Numbers

1. Natural Numbers (N):

- Counting numbers starting from 1: 1, 2, 3, and so on.
- **Example:** 4 (successor: 5, predecessor: 3).
- Used for counting objects, like 6 books.

2. Whole Numbers (W):

- Natural numbers plus 0: 0, 1, 2, 3, and so on.
- **Example:** 0 (successor: 1, predecessor: not defined in whole numbers).
- Used when zero is needed, like no books left.

3. Integers (Z):

- Whole numbers and their negatives: ..., -3 , -2 , -1 , 0, 1, 2, 3, ...
- **Example:** -5 (successor: -4 , predecessor: -6).
- Used for negative values, like temperatures below zero.

4. Rational Numbers (Q):

- Numbers that can be written as a fraction $\frac{a}{b}$, where a and b are integers and b is not 0.

➤ **Examples:** $\frac{2}{3}$, 0.5, 7 (since $7 = \frac{7}{1}$).

➤ Include decimals that end (like 0.75) or repeat (like 0.666...).

➤ **Note:** Successor and predecessor are not usually defined for rational numbers because there are infinitely many numbers between any two.

5. Irrational Numbers:

➤ Numbers that cannot be written as a fraction $\frac{a}{b}$.

➤ Their decimals are infinite and do not repeat.

➤ **Examples:** $\sqrt{2} \approx 1.414$, $\pi \approx 3.141$.

➤ Successor and predecessor are not defined due to their density on the number line.

6. Real Numbers (R):

➤ All numbers on the number line, including rational and irrational numbers.

➤ Examples: -4, 0, 2.718, $\sqrt{3}$.

7. Prime Numbers:

➤ Natural numbers greater than 1 with only two factors: 1 and themselves.

➤ **Examples:** 2 (successor: 3, predecessor: 1), 5 (successor: 6, predecessor: 4).

8. Composite Numbers:

➤ Natural numbers greater than 1 with more than two divisors.

➤ **Examples:** 4 (successor: 5, predecessor: 3), 9 (successor: 10, predecessor: 8).

9. Even Numbers:

➤ Numbers divisible by 2.

➤ **Examples:** 6 (successor: 7, predecessor: 5), -2 (successor: -1, predecessor: -3).

10. Odd Numbers:

➤ Numbers not divisible by 2.

➤ **Examples:** 3 (successor: 4, predecessor: 2), -1 (successor: 0, predecessor: -2).

11. Fractions:

➤ Represent parts of a whole, written as $\frac{a}{b}$, where a is the numerator and $b \neq 0$ is the denominator.

➤ **Example:** $\frac{4}{5}$.

12. Decimals:

➤ Numbers with a decimal point, often representing fractions.

➤ **Examples:** 0.25, 3.14.

KEY PROPERTIES

- **Commutative Property:** The order doesn't matter in addition or multiplication.
 - **Example:** $5 + 2 = 2 + 5$, $3 \times 4 = 4 \times 3$.
- **Associative Property:** Grouping doesn't affect the result in addition or multiplication.
 - **Example:** $(2 + 3) + 4 = 2 + (3 + 4)$, $(2 \times 3) \times 4 = 2 \times (3 \times 4)$.
- **Distributive Property:** Multiplication distributes over addition.
 - **Example:** $3 \times (4 + 5) = 3 \times 4 + 3 \times 5$.
- **Identity Property:**
 - **Addition:** $n + 0 = n$ (e.g., $6 + 0 = 6$).
 - **Multiplication:** $n \times 1 = n$ (e.g., $6 \times 1 = 6$).
- **Inverse Property:**
 - **Addition:** A number plus its opposite equals 0 (e.g., $4 + (-4) = 0$).
 - **Multiplication:** A number times its reciprocal equals 1 (e.g., $5 \times \frac{1}{5} = 1$).

Comparing and Ordering Numbers

- On a number line, numbers to the right are larger.
- For integers, compare digits directly (e.g., $-3 < -1$ because -1 is to the right of -3).
- For fractions, use a common denominator or convert to decimals.
 - **Example:** Compare $\frac{1}{2} = 0.5$ and $\frac{2}{5} = 0.4$; since $0.5 > 0.4$, $\frac{1}{2} > \frac{2}{5}$.
 - **Example:** Arrange 3, -2 , 0, 1 from least to greatest: $-2, 0, 1, 3$.