



## Even and Odd Numbers

### i. Definition and Explanation

At its core, the concept of even and odd numbers is about whether an integer can be perfectly divided by 2.

**Even Numbers:-** An even number is an integer that is exactly divisible by 2, meaning it can be divided by 2 with no remainder.

- **Key Idea:** If you have an even number of items, you can always group them into pairs with none left over.
- **The Last Digit Rule:** A number is even if its last digit is 0, 2, 4, 6, or 8.
- **Algebraic Definition:** An integer  $n$  is even if it can be written in the form  $n = 2k$ , where  $k$  is any integer.

**Examples:** 8, 14, 76, 150, -22, -100.

**Odd Numbers:-** An odd number is an integer that is not exactly divisible by 2, meaning there is a remainder of 1 when it is divided by 2.

- **Key Idea:** If you have an odd number of items, you will always have one left over after making as many pairs as possible.
- **The Last Digit Rule:** A number is odd if its last digit is 1, 3, 5, 7, or 9.
- **Algebraic Definition:** An integer  $n$  is odd if it can be written in the form  $n = 2k + 1$ , where  $k$  is any integer.

**Examples:** 7, 15, 83, 299, -3, -101.

### ii. Key Points and Important Terms

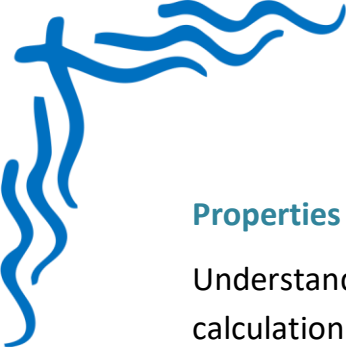
**Integer:** A whole number (not a fraction or decimal) that can be positive, negative, or zero. The concept of even and odd applies only to integers.

**Divisible:** A number is divisible by another number if the division results in an integer with a remainder of 0.

**Remainder:** The amount "left over" after a division operation. For even/odd numbers, we only care if the remainder is 0 or 1 when dividing by 2.

**Zero (0) is an Even Number:** This is a very important point. Zero is even because  $0 \div 2 = 0$  with a remainder of 0. It also fits the algebraic definition:  $0 = 2 \times 0$ .

**Negative Numbers:** Negative integers can also be even or odd. The same rules apply. For example, -4 is even ( $-4 = 2 \times -2$ ) and -7 is odd ( $-7 = 2 \times -4 + 1$ ).



## Properties of Operations with Even and Odd Numbers

Understanding these rules can help you solve problems without doing the full calculation.

Operation	Numbers	Result	Example
Addition	Even + Even	Even	$4 + 6 = 10$
	Odd + Odd	Even	$3 + 5 = 8$
	Even + Odd	Odd	$4 + 3 = 7$
Subtraction	Even - Even	Even	$8 - 2 = 6$
	Odd - Odd	Even	$9 - 3 = 6$
	Even - Odd	Odd	$10 - 3 = 7$
	Odd - Even	Odd	$9 - 2 = 7$
Multiplication	Even $\times$ Even	Even	$2 \times 4 = 8$
	Odd $\times$ Odd	Odd	$3 \times 5 = 15$
	Even $\times$ Odd	Even	$4 \times 3 = 12$

**Key Multiplication Takeaway:** If you multiply any integer by an even number, the result will always be even.

### iii. Detailed Examples with Solutions

**Example 1:** Identifying Numbers Is the number 3,456 even or odd?

**Solution:**

Look at the last digit. The last digit is 6. Since 6 is an even digit, the number 3,456 is even.

**Verification:**  $3456 \div 2 = 1728$  (no remainder).

**Example 2:** Using Properties of Addition Is the sum of 147 and 892 even or odd? (Solve without finding the actual sum).

**Solution:**

Identify the nature of each number.

147 ends in 7, so it is Odd.

892 ends in 2, so it is Even.



Apply the addition rule:  $\text{Odd} + \text{Even} = \text{Odd}$ .

Therefore, the sum of 147 and 892 is odd.

**Example 3:** Using Properties of Multiplication What is the nature (even or odd) of the product of 51, 23, and 9?

**Solution:**

Identify the nature of each number.

51 is Odd.

23 is Odd.

9 is Odd.

Apply the multiplication rule:

First, multiply the first two:  $\text{Odd} \times \text{Odd} = \text{Odd}$ .

Now, multiply that result by the third number:  $\text{Odd} \times \text{Odd} = \text{Odd}$ .

Therefore, the product is odd.

#### iv. Summary of Main Concepts

- **Even Numbers:** Integers ending in 0, 2, 4, 6, or 8. They are divisible by 2.
- **Odd Numbers:** Integers ending in 1, 3, 5, 7, or 9. They have a remainder of 1 when divided by 2.
- **Zero:** Is an even number.
- **Scope:** The even/odd classification applies only to integers (positive, negative, and zero).
- **Key Rules:**
  - $\text{Odd} + \text{Odd} = \text{Even}$
  - $\text{Even} + \text{Even} = \text{Even}$
  - $\text{Odd} + \text{Even} = \text{Odd}$
  - $\text{Odd} \times \text{Odd} = \text{Odd}$
  - $\text{Even} \times (\text{Any Integer}) = \text{Even}$