

Linear Inequalities

Introduction

A **Linear Inequality** is an algebraic inequality in which the highest power of the variable is **1**. Unlike linear equations, inequalities compare two expressions using inequality symbols. They are used to represent conditions involving quantities that may have a range of values and have applications in economics, engineering, business, and optimization.

Linear Inequalities

What is a Linear Inequality?

A **linear inequality** is an inequality of the form:

- $ax + b > 0$
- $ax + b < 0$
- $ax + b \geq 0$
- $ax + b \leq 0$

where:

- $a \neq 0$
- a and b are real numbers.

The solution consists of all values of the variable that satisfy the inequality.

Symbols of Inequalities

Types of Inequality Symbols

The commonly used inequality symbols are:

- $>$: Greater than
- $<$: Less than
- $\geq$: Greater than or equal to
- $\leq$: Less than or equal to

These symbols compare two mathematical expressions.

Properties of Linear Inequalities

Basic Rules

The following rules are used while solving inequalities:

- Adding or subtracting the same number on both sides does not change the inequality.
- Multiplying or dividing both sides by a **positive number** does not change the inequality sign.
- Multiplying or dividing both sides by a **negative number** reverses the inequality sign.

These properties help simplify and solve inequalities correctly.

Solution of Linear Inequalities

Method of Solving

To solve a linear inequality:

- Simplify both sides of the inequality.
- Bring all variable terms to one side.
- Bring constant terms to the other side.
- Divide by the coefficient of the variable.
- Reverse the inequality sign if dividing by a negative number.

The final answer gives the solution set.

Graphical Representation

Number Line

The solution of a linear inequality can be represented on a **number line**.

- **Open Circle (○)**: The endpoint is **not included** ($>$ or $<$).
 - **Closed Circle (●)**: The endpoint is **included** ($\geq$ or $\leq$).
 - The arrow shows all values satisfying the inequality.
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Linear Inequalities in Two Variables

Graphical Solution

A linear inequality in two variables has the general form:

- $ax + by > c$
- $ax + by < c$
- $ax + by \geq c$
- $ax + by \leq c$

Its solution is represented by a **region** on the Cartesian Plane.

The boundary line divides the plane into two regions, and the region satisfying the inequality is called the **solution region**.

Applications of Linear Inequalities

Importance

Linear inequalities are used in:

- Business and economics.
- Resource allocation.
- Engineering.
- Production planning.
- Optimization problems.
- Decision-making.

They help determine possible values under given conditions.

Key Points

- A linear inequality has the variable raised to the first power.
 - Four inequality symbols are $>$, $<$, $\geq$, and $\leq$.
 - Multiplying or dividing by a negative number reverses the inequality sign.
 - Solutions are represented on a number line or Cartesian Plane.
 - Linear inequalities in two variables produce a solution region.
 - They are widely used in mathematics and real-life situations.
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Chapter Summary

This chapter explains linear inequalities, their properties, and methods of solving them. Students learn to represent solutions on a number line and on the Cartesian Plane. The chapter also covers inequalities in one and two variables and their applications in optimization, economics, and decision-making. Understanding linear inequalities is essential for solving practical mathematical problems.