



Class XI Class Notes

Linear Inequalities

A statement involving the symbols '>', '<', '≥', '≤' is called an inequality.

For example $5 > 3$, $x \leq 4$, $x + y \geq 9$.

- Inequalities which do not involve variables are called numerical inequalities. For example $3 < 8$, $5 \geq 2$.
- Inequalities which involve variables are called literal inequalities. For example, $x > 3$, $y \leq 5$, $x - y \geq 0$.
- Inequalities which involve variables are called literal inequalities. For example, $x > 3$, $y \leq 5$, $x - y \geq 0$.
- Inequalities involving the symbols $<$ or $>$ are called **Strict inequalities**
- Inequalities involving the symbols $\leq$ or $\geq$ are called **Slack inequalities**
- An inequality may contain more than one variable and it can be linear, quadratic or cubic etc. For example, $3x - 2 < 0$ is a linear inequality in one variable, $2x + 3y \geq 4$ is a linear inequality in two variables and $x^2 + 3x + 2 < 0$ is a quadratic inequality in one variable.

Solving an inequality

The value(s) of the variable(s) which makes the inequality a true statement is called its **solutions**. The set of all solutions of an inequality is called the **solution set** of the inequality.

For example, $x - 1 \geq 0$, has infinite number of solutions as all real values greater than or equal to one make it a true statement.

The inequality $x^2 + 1 < 0$ has no solution in **R** as no real value of x makes it a true statement.

To solve an inequality we can

- Add (or subtract) the same quantity to (from) both sides without changing the sign of inequality.



b) Multiply (or divide) both sides by the same positive quantity without changing the sign of inequality.

IMP: However, if both sides of inequality are multiplied (or divided) by the same negative quantity the sign of inequality is reversed, i.e., ' $>$ ' changes into ' $<$ ' and vice versa.

Representation of solution of linear inequality in one variable on a number line

To represent the solution of a linear inequality in one variable on a number line, we use the following conventions:

- i) If the inequality involves ' $\geq$ ' or ' $\leq$ ', we draw filled circle ($\bullet$) on the number line to indicate that the number corresponding to the filled circle is included in the solution set. (e.g. $x \geq 1$)



- ii) If the inequality involves ' $>$ ' or ' $<$ ', we draw an open circle ($\circ$) on the number line to indicate that the number corresponding to the open circle is excluded from the solution set. [e.g. $x < 3$]



Important

- If $a, b \in \mathbb{R}$ and $b \neq 0$,
 - i) $ab > 0$ or $\frac{a}{b} > 0$ implies a and b have the same sign
 - ii) $ab < 0$ or $\frac{a}{b} < 0$ implies a and b have opposite sign
- If a is any positive real number, $a > 0$
 - i) $|x| < a \Leftrightarrow -a < x < a$
 - ii) $|x| \leq a \Leftrightarrow -a \leq x \leq a$
 - iii) $|x| > a \Leftrightarrow x < -a \text{ or } x > a$
 - iv) $|x| \geq a \Leftrightarrow x \leq -a \text{ or } x \geq a$