## Central Topic: Linear Inequalities

### Notations
- The notation a<b means that 'a is less than b'.
- The notation a>b means that 'a is greater than b'.
- The notation a≥b means that 'a is greater than or equal to b'.
- The notation a≤b means that 'a is less than or equal to b'.
- The notation a≠b means that 'a is not equal to b'.

### Solution of Linear Inequality in One Variable
**Solution and Solution set**
**Solution:** Values of $x$, which make inequality a true statement.
e.g.: '3' is the solution for x<7.
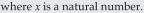**Solution Set:**
The set of values of $x$ is called its solution set.
e.g.: {1,2,3,4,5,6} is solution set for x<7, where $x$ is a natural number.

### Types of Inequalities
**Numerical Inequalities :** Relation between numbers e.g.: 3<5, 4>7
**Literal or Variable Ineqalities :** Relation between two variables or variable and numbers.
e.g.:y<8
**Double Inequalities**: Relationship from two sides e.g.:2<x<5
**Strict Inequalities:** An inequality that uses the symbol <or> e.g.: x<5, 3<5
**Slack Inequality:** An inequality that uses the symbols ≤ or ≥. e.g.: y≤5
**Linear Inequalities in One Variable:** An inequality which involves a linear function in one variable e.g.: x<5
**Linear Inequalities in two variables:** An inequality which involves a linear function in two variables, e.g.: 3x+2y<5
**Quadratic Inequalities:** An inequality which involves a quadratic function, eg.: $x^2+2x ≤5$.

### Representation
To represent x<a (x>a) on a number line, put a circle on the number 'a' and dark line to the left (or right) of the number 'a'.
**e.g:**
x<3
$$-3 \quad -2 \quad -1 \quad 0 \quad 1 \quad 2 \quad 3 \quad 4$$
x>-2
$$-3 \quad -2 \quad 0 \quad 1 \quad 2 \quad 3$$

To represent x≤a (or x≥a) on a number line, put a dark circle on the number 'a' and dark the line to the left (or right) of the number 'a'.
**e.g:**
x≤3
$$-3 \quad -2 \quad -1 \quad 0 \quad 1 \quad 2 \quad 3 \quad 4$$
x≥−2
$$-3 \quad -2 \quad -1 \quad 0 \quad 1 \quad 2 \quad 3 \quad 4$$

### Conditions
- An inequality is an relation that holds between two values, when they are different eg.: $x$<5, here, there is a relation between $x$ & 5.
- Two real numbers or algebraic expressions related by symbol '<', '>', '≤' or '≥' form inequality. eg.: $y≤4, 2x+3y≥5, 3>x$.

### Rules of Inequality
- Equal numbers may be added to (or subtracted from) both the sides of an inequality without affecting the sign of inequality:
  **e.g:** x<7 is same as x+2 < 7+2
- Both sides of an inequality can be multiplied (or divided) by the same positive number without affecting the sign of inequality.
  **e.g:** x+y< 7 is same as $(x+y) × 3<7×3$
- When both sides are multiplied or divided by a – ve number, then sign of inequality is reversed.
  **e.g:** x+y< 7 is same as (x+7) × (−3) > 7 × (−3)

### Graphical Solution of Linear Inequalities in Two Variables
- A line divides the cartesian plane into two equal parts. A point in cartesian plane will either lie on a line or will lie in either of half planes. The region containing all the solutions of inequality is called the solution region.
- In order to identify the half plane reprsented by an inequality, it is just sufficient to take any point (a, b) (not on line) and check whether it satisfies the inequality or not. If it satisifes, then inequality represents the half plane and shade the region, which contain the point otherwise the inequality repersents the half plane which does not contain the point within it.