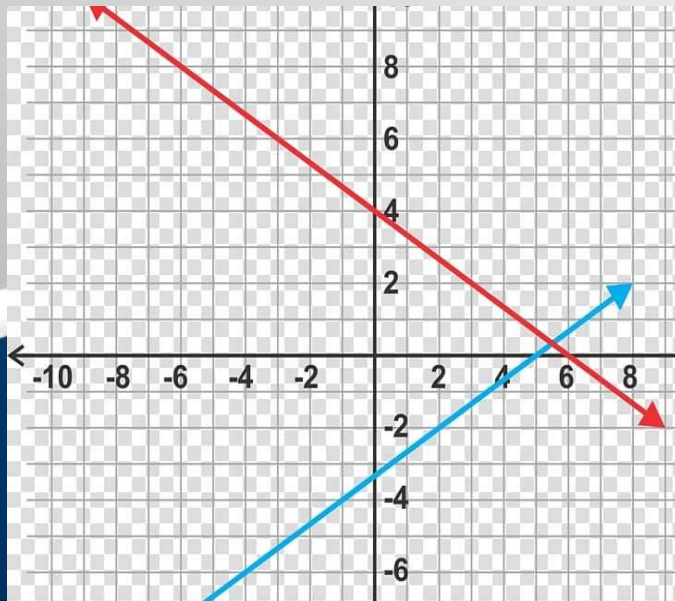




Linear Inequalities



LESS THAN	GREATER THAN
$<$	$>$
LESS THAN OR EQUAL TO	GREATER THAN OR EQUAL TO
$\leq$	$\geq$

INTRODUCTION

Is it always possible to translate a statement problem in the form of equation?

Yes!

With the help of certain mathematical signs($<$, $>$, $\leq$, $\geq$) it is possible which are known as inequalities.



Definitions

Inequality: Two real numbers or two algebraic expressions related to the symbol ($<$, $>$, $\leq$, $\geq$) form an inequality.

Linear Inequality: An inequality is said to be linear if each variable occur in first degree only and there is no term involving the product of variables.

Numerical inequalities

An inequality which does not involve any variable

e.g. $3 < 5$; $7 > 5$

Literal inequalities

An inequality which have variable and involve $>$, $<$, $\leq$, $\geq$

e.g. $x > 2$; $y \leq 5$

Types of inequalities

Linear inequalities

Inequality having degree 1 e.g.

$5x + 3y > 2$

Slack inequalities

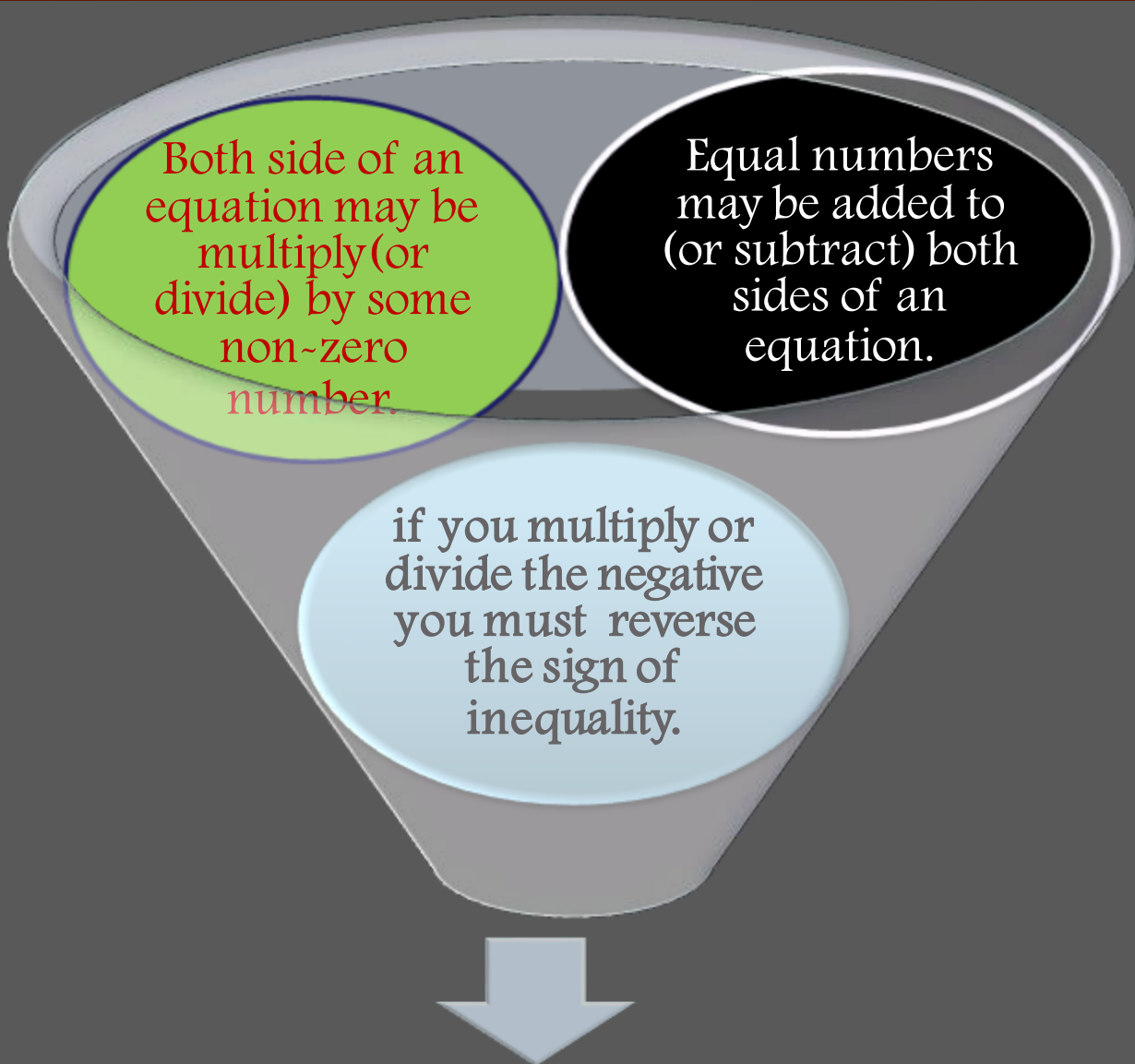
An inequality which has only $\geq$, $\leq$

e.g. $ax + by \geq 0$

Strict inequalities

An inequality which has only $<$, $>$ sign

e.g. $ax + by < 0$ $ax + by > 0$



Both side of an equation may be multiply(or divide) by some non-zero number.

Equal numbers may be added to (or subtract) both sides of an equation.

if you multiply or divide the negative you must reverse the sign of inequality.

Properties Of Numerical Inequality

Linear Inequality In one Variable :

A Linear inequality which has only one variable .

Solution of Linear Inequality In one Variable:

It is a value of variable which makes the inequality as a true statement .

Set of all solutions of the inequality is called solution set of inequality

Representation of Solution of Linear Inequality In one Variable on Number Line

If the inequality involve $\geq$ $\leq$ then draw a filled circle ($\bullet$) on number line to show corresponding number is included in solution set.

If the inequality involve $>$, $<$ then draw an open circle ($^{\circ}$) on number line to show corresponding number is excluded in solution set.

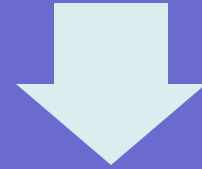
Solution of System of linear inequalities in one variable :

It is defined as the intersection of the solution set of the linear inequalities in the system.

Linear inequality in two variables: An inequality is of the form $ax + by + c \geq 0$, $ax + by + c \leq 0$ where $a \neq 0, b \neq 0$ where x and y are two variables.



Solution Region: The region contains all the solutions of inequality is called Solution Region.

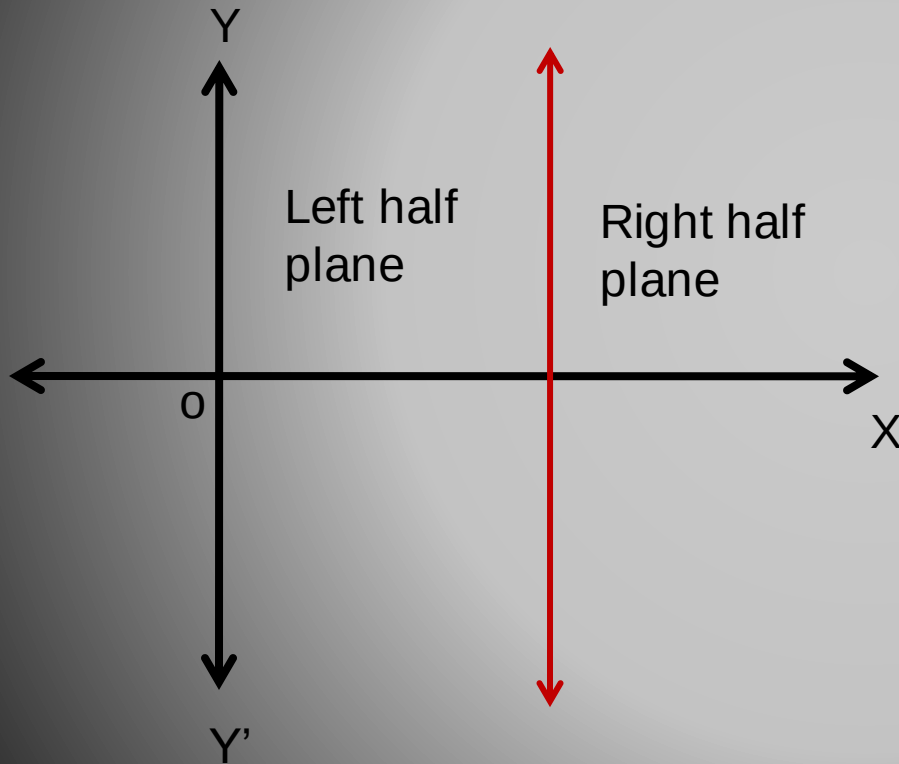


The graph of a line $ax + by + c = 0$ is a Straight line which divide the plane XY into two parts . Each Part is known as Half Plane.

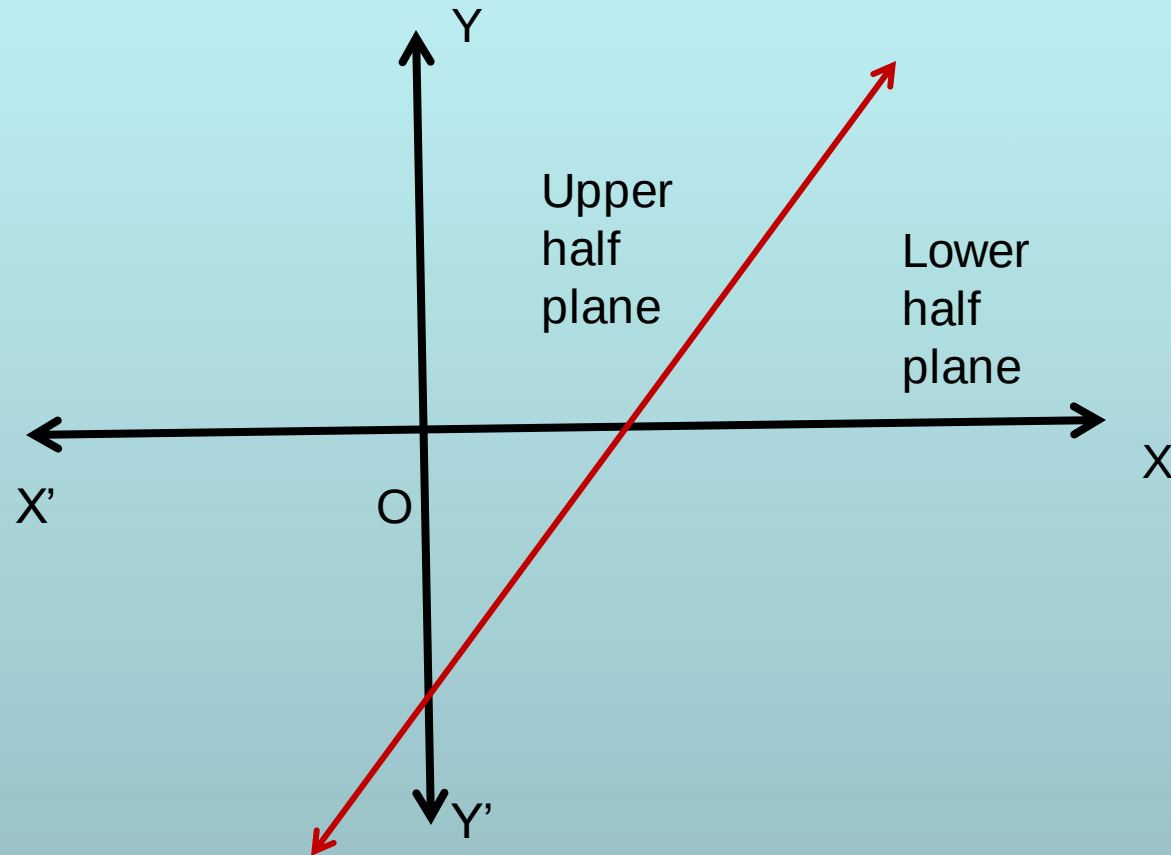


Concept of Half Plane

A vertical line will divide XY – Plane in two parts, Left half plane, right half plane.



- *A Non-vertical line divide XY – Plane in two parts, Lower half plane, upper half plane.*



- *If the line separating the half plane is included the half plane, then the half plane is called Closed Half Plane and if it is not included then plane is Open Half Plane.*

Solution of System of Linear Inequalities in two Variables.

- The common region is required solution of given inequalities if there is no common region then the solution set is an empty set.

Concept of Intervals on Number Line

On Number Line or Real Line Various types of infinite Subsets known as Intervals.

Closed Interval : $[a,b] = \{ x: a \leq x \leq b \}$

Open Interval: $(a,b) = \{ x: a < x < b \}$

Semi Open or Semi Closed Intervals:

$$[a,b) = \{ x: a \leq x < b \}$$

$$(a,b] = \{ x: a < x \leq b \}$$

Solve $7x+3 < 5x+9$. show the graph of solution on number line.

Ans: $7x+3 < 5x+9$

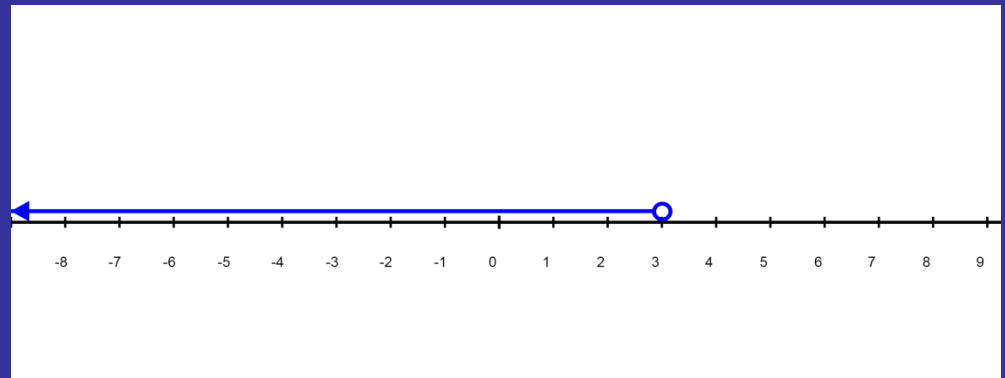
$$7x+3-3 < 5x+9-3$$

$$7x < 5x+6$$

$$7x-5x < 5x+6-5x$$

$$2x < 6$$

$$x < 3$$



Solve $3x+2y>6$ graphically

Sol:

Step 1: Assume that $3x+2y=6$ and find the following values.

Step 2: plot these points on graph.

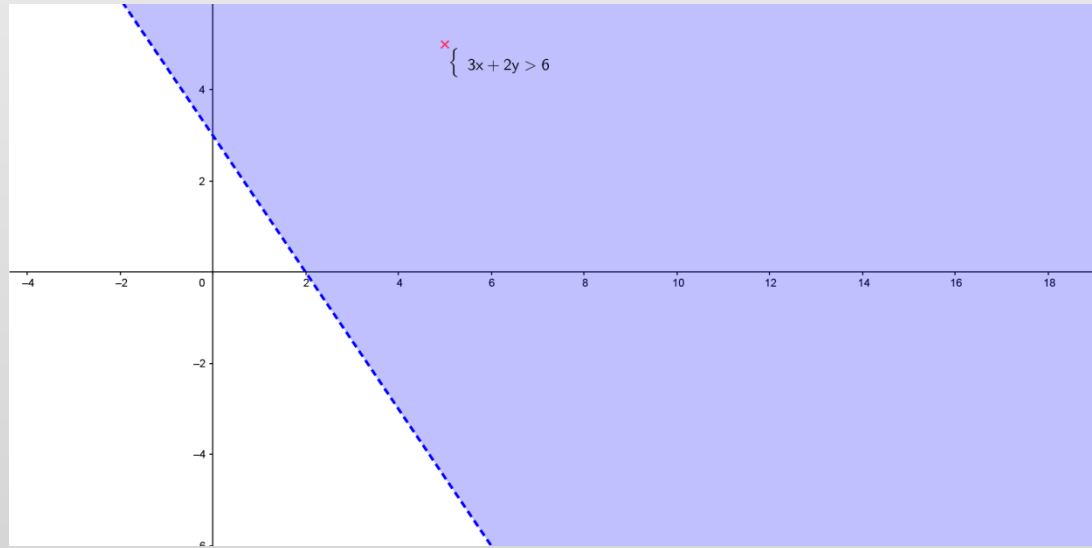
This line divides the x y -plane in two half planes I and II.

Step 3: select a point $(0,0)$ and determine if this point satisfies the given inequality.

$$\text{i.e. } 3(0)+2(0)>6$$

$$0>6 \quad (\text{Which is false}).$$

Step IV: any point on line does not satisfy the given strict inequalities.



Hence shaded half plane II excluding points on the line is the solution of the inequality.

Solve the system graphically

$$X+2y \leq 8, 2x+y \leq 8, X \geq 0, y \geq 0$$

Step I: Draw the graph of linear equalities

$$x+2y=8, 2x+y=8$$

Step II: $X \geq 0, y \geq 0$ represent first quadrant

Step III: combining step I and step II we get our common region where the solution of the given system of inequalities exist.

