

# Linear Inequalities

## → Introduction: →

If the equality symbol (=) in a ~~linear~~ Linear equation is replaced by an inequality symbol ( $<$ ,  $>$ ,  $\leq$  or  $\geq$ ) then the statement is called as Linear ~~inequalities~~ inequalities.

## → Important: →

- $>$  → greater than
- $\geq$  → greater than equal to / minimum / at least
- $<$  → Less than
- $\leq$  → Less than equal to / maximum / at most.

## → Linear inequalities in one variable: →

[ $x$  or  $y$  or  $z$ ] → only one variable

Example

$$2x + 5 < 0$$

$$2x < 0 - 5$$

$$\frac{2x}{2} < \frac{-5}{2}$$

$$x < -\frac{5}{2}$$

Note — — —

$x$  or  $\div$  (-ve sign)

change  $>$   $\xrightarrow{\text{into}}$   $<$

change  $\geq$   $\longrightarrow$   $\leq$

Example

$$-2x + 8 \geq 0$$

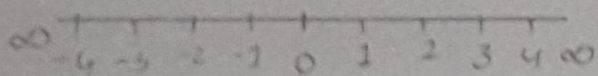
$$-2x \geq -8$$

$$\frac{-2x}{-2} \leq \frac{-8}{-2}$$

$$\boxed{x \leq 4}$$

$\rightarrow$  Graph linear inequation in one variable  $\rightarrow$

Line



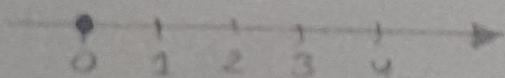
Sign

$>$  or  $<$   $\boxed{\bullet}$

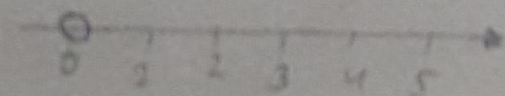
$\geq$  or  $\leq$   $\boxed{0}$

Example

•  $x \geq 0$



•  $x < 0$



$\rightarrow$  Linear inequation on one variable [range]  $\rightarrow$

The range where the equation satisfies is called as interval's or solution space.

• If  $a < b$ ,  $a < x \leq b$   
means  
 $a < x$ ,  $x < b$

• Like

$$\rightarrow 1 < x < 2, 1 \leq x \leq 2$$

Note — — —

$$\boxed{x \in [1, 2]}$$

belongs to

Example

The solution set of inequation

$x + 2 > 0$  and  $2x - 6 > 0$  is

(a)  $(-2, \infty)$  (c)  $(-\infty, -2)$

(b)  $(-3, \infty)$  (d)  $(-\infty, -3)$

$$x + 2 > 0$$

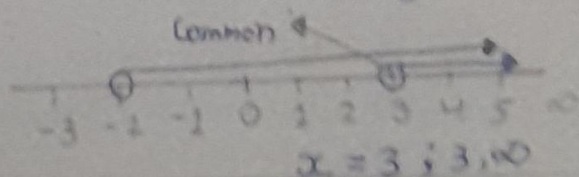
$$x > -2$$

$$2x - 6 > 0$$

$$2x > 6$$

$$x \geq \frac{6}{2}$$

$$x > 3$$





→ Linear inequality in two variable :

Inequality in two variable  
 $2x + 5y < 8$

Example

Rajesh has ₹100 and wants to buy some notebooks and pens. The cost of one notebook is ₹40 and that of a pen is ₹20. Draw Linear Inequality.

$$40x + 20y \leq 100$$

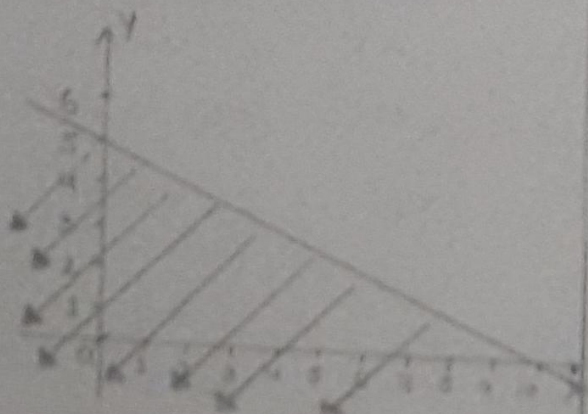
→ Linear inequality in two variable [Graph] :

Example

$$x + 2y \leq 10$$

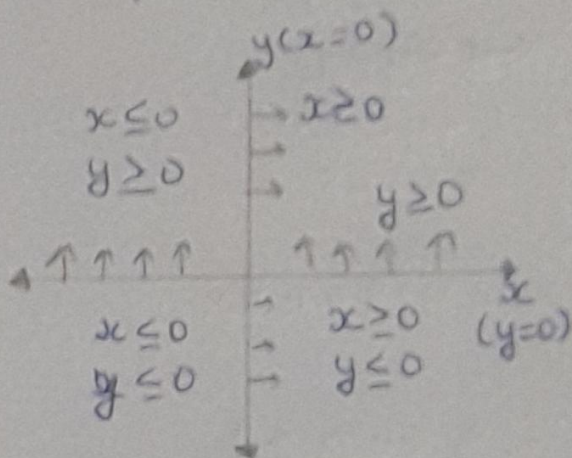
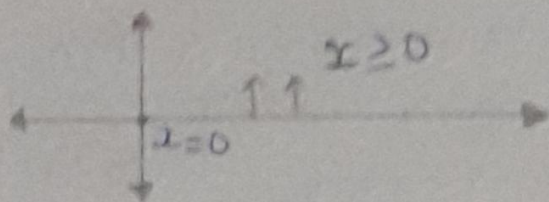
x	0	10
y	5	0

→  $0 + 2y \leq 10$   
 $y = \frac{10}{2} = 5$



Note →  
 If  $0 \leq 10$  [downwards] → arrow lines  
 If  $0 \leq -10$  [upwards] → arrow lines

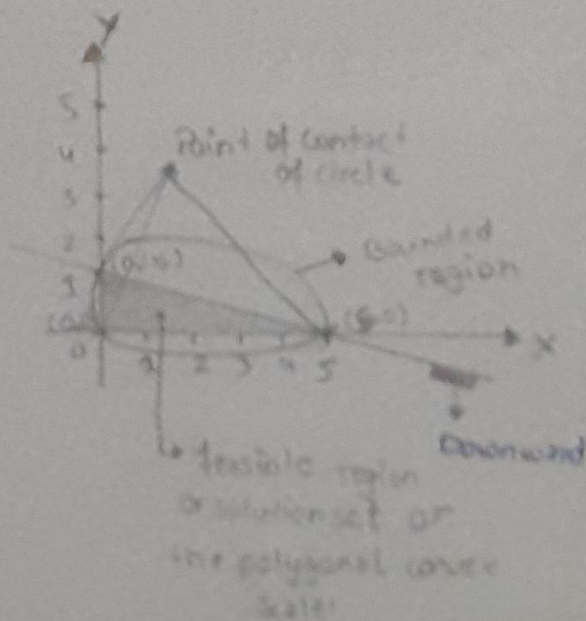
Important



→ Important points :

(a)  $x + 3y \leq 5, x \geq 0, y \geq 0$

x	0	5
y	1.6	0



## Question,

1. If  $y = 4 + 9 \sin 5x$  then  
which hold good

(a)  $-5 \leq y \leq 13$  [July 2021]

(b)  $4 \leq y \leq 8$

(c)  $0 < y < 1$

(d)  $-5 < y < 5$

$$y = 4 + 9 \sin 5x$$

$$-1 \leq \sin 5x \leq 1$$

$$9 \times -1 \leq 9 \times \sin 5x \leq 1 \times 9$$

$$-9 \leq 9 \sin 5x \leq 9$$

$$(4+) - 9 \leq 4 + 9 \sin 5x \leq 4 + 9$$

$$-5 \leq 4 + 9 \sin 5x \leq 13$$

$$\boxed{-5 \leq y \leq 13}$$