LINEAR INEQUALITIES

INEQUALITIES :-

A statement involving variable (s) and the sign of inequality viz $>, <, \geq$, or $\leq$ is called inequation or an equality.

LINEAR INEQUATION IN ONE VARIABLE :-

Let a be a non zero real number and x be a variable then inequations of the form $ax+b<0$, $ax+b\leq 0$, $ax+b>0$, $ax+b\geq 0$ are known as linear inequation in one variable

eg $2x+3>0$, $x+3<0$, $3x+5\geq 0$, $6x-5\leq 0$

LINEAR INEQUATION IN TWO VARIABLES :-

Let a, b be non zero real numbers and x, y be two variables. Then inequations of the form $ax+by<c$, $ax+by>c$, $ax+by\geq c$, $ax+by\leq c$ are known as linear inequations in two variables.

eg $2x+3y\geq 5$, $2x+6y\leq 8$, $2x+y>5$

INEQUALITY

- STRICT INEQUALITY: $>, <$; $5>2$
- SLACK INEQUALITY: $\geq, \leq$; $2x\geq 8$.

Brackets: closed [ ] ; open ( ) or] [

Let $x\in N$ Solution Set Interval

$2<x<5 \Rightarrow x=\{3,4\} \Rightarrow]2,5[$

$2\leq x\leq 5 \Rightarrow x=\{2,3,4,5\} \Rightarrow [2,5]$

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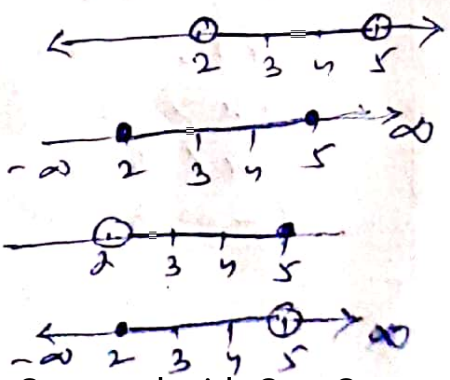
$2\leq x<5 \Rightarrow x=\{2,3,4\} \Rightarrow [2,5[$

Number line.



RULES

① Adding and Subtracting the same number or expression to each side of an equations does not change the inequality

② Multiplying or dividing each side of an inequation by the same positive number does not change the inequality.

③ Multiplication and dividing each side of an inequation by the same negative number reverse the inequality.

$5 > 2 \Rightarrow -10 < -4$

Q1 Solve the following inequation:-

(i) $3x+17 \leq 2(1-x)$ (ii) $\frac{3(x-2)}{5} \geq \frac{5(2-x)}{3}$

(i) Sol^n:- $3x+17 \leq 2(1-x)$

$\Rightarrow 3x+17 \leq 2-2x$

$\Rightarrow 5x \leq -15$

$x \leq -3$

$\Rightarrow (-\infty, -3]$ Ans

(ii) $\frac{3(x-2)}{5} \geq \frac{5(2-x)}{3}$

$\Rightarrow 9(x-2) \geq 25(2-x)$

$\Rightarrow 9x-18 \geq 50-25x$

$\Rightarrow 9x+25x \geq 50+18$

$\Rightarrow 34x \geq 68 \Rightarrow x \geq 2 \Rightarrow x = [2, \infty)$ Ans

Q2 Solve: $x+5 > 2(x+1)$, $2-x < 3(x+2)$

$x+5 > 2x+2$

$-x > -3$

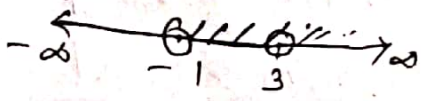
$x < 3$

$(-\infty, 3)$ —①

$2-x < 3x+6$

$-4x < 4 \Rightarrow 4x > -4 \Rightarrow x > -1$

$(-1, \infty)$ —②



Final Sol^n $(-1, 3)$

MODEL QUESTION PAPER

1) Solve $3x+8>2$ if x is an integer

(i) $\{\dots -1, 0, 1\}$ (ii) $\{\dots -1, 0, 1, 2\}$ (iii) $\{-1, 0, 1, 2, 3 \dots\}$

(iv) $(-\infty, 2)$

Sol^n:- $3x+8>2$

$\Rightarrow 3x > 2-8 \Rightarrow 3x > -6 \Rightarrow x > -2$, $x \in \{-1, 0, 1, \dots\}$

2) Solve $4x+3 < 6x+7$ where x is a real number.

(i) $(-\infty, 2)$ (ii) $(-2, \infty)$ (iii) $(\infty, -2)$ (iv) $\{\dots -2, -1, 0, -\}$

Sol^n:- $4x+3 < 6x+7$

$\Rightarrow 4x-6x < 7-3 \Rightarrow -2x < +4 \Rightarrow -2x > 4 \Rightarrow \frac{-2x}{2} > 4/2$

$-x > 2 \Rightarrow x < -2 \Rightarrow (-\infty, -2)$

3) If $-3x+17 < -13$ then

(a) $x \in (10, \infty)$ (b) $x \in [10, \infty)$ (c) $x \in (-\infty, 10]$ (d) $x \in [-10, 10]$

Sol^n:- $-3x+17 < -13$

$\Rightarrow -3x < -13-17$

$\Rightarrow -3x < -30 \Rightarrow 3x > 30 \Rightarrow x > 10$, $(10, \infty)$

4) The Solution Set of inequations $4x+3 \geq 2x+17$, $3x-5 < -2$

(a) $[7, 1]$ (b) $[7, \infty)$ (c) $[7, \infty) \cup (-\infty, 1)$ (d) none of these

Sol^n:- $4x+3 \geq 2x+17$

$4x-2x \geq 17-3$

$\Rightarrow 2x \geq 14$

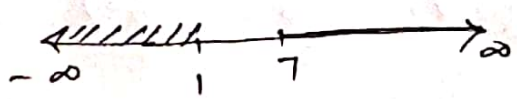
$\Rightarrow x \geq 7 \Rightarrow x \in [7, \infty)$

$3x-5 < -2$

$\Rightarrow 3x < -2+5$

$\Rightarrow 3x < 3$

$x < 1 \Rightarrow x \in (-\infty, 1)$



LINEAR INEQUATION IN TWO VARIABLES.

1) Exhibit graphically the solution set of the linear inequations.

$3x+4y \leq 12$, $4x+3y \leq 12$, $x \geq 0$, $y \geq 0$.

Sol^n :- Consider the given inequation as -

$3x+4y=12$ —(1)

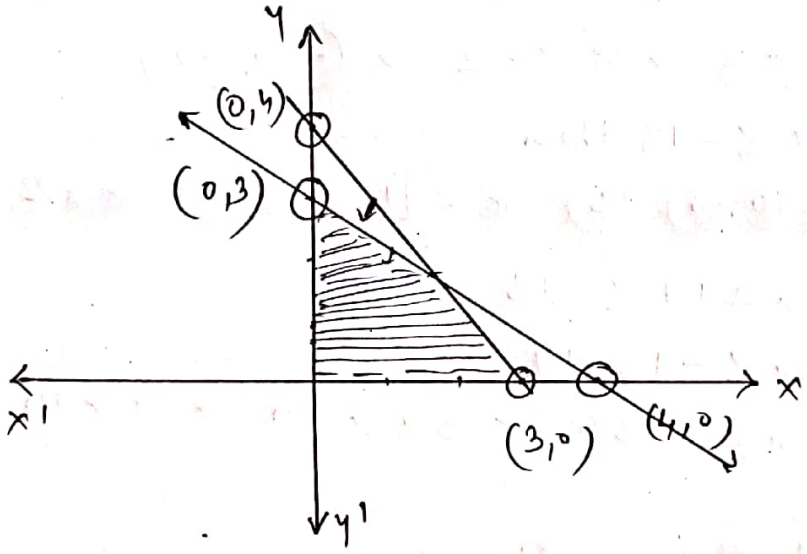
$4x+3y=12$ —(2)

from eq^n (1) putting $x=0$, $y=3$, $(0,3)$

$y=0$ $x=4$ $(4,0)$

from eq^n (2) putting $x=0$, $y=4$ $(0,4)$

$y=0$, $x=3$ $(3,0)$



Hence the shaded region be the required solution set.

2) Represent the solution set of the following inequation graphically.

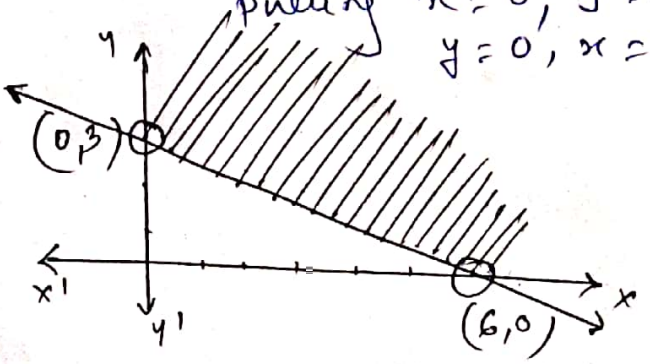
$x+2y \geq 6$.

Considering the inequation as -

$x+2y=6$

putting $x=0$, $y=3$ $(0,3)$

$y=0$, $x=6$ $(6,0)$



Hence the shaded region be the required solution set.