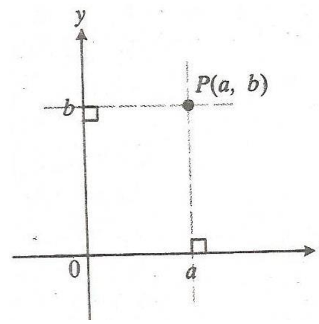
(1-1) Coordinate and graphs in the plan (Cartesian coordinate):

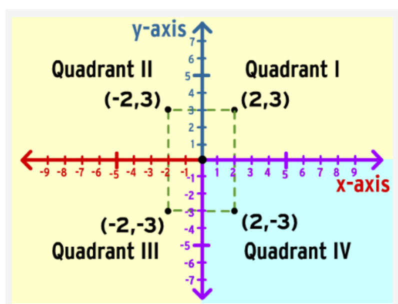
In any plane P, choose a pair of perpendicular lines ,let one of the lines be horizontal (x-axis). Then the other line must be vertical (y-axis).

We can plot any point P on the plane by pair of real number (a,b).

a is coordinate of the point on x-axis and b is coordinate of the point on y-axis Or {p: (x, y); x, y ϵ R }

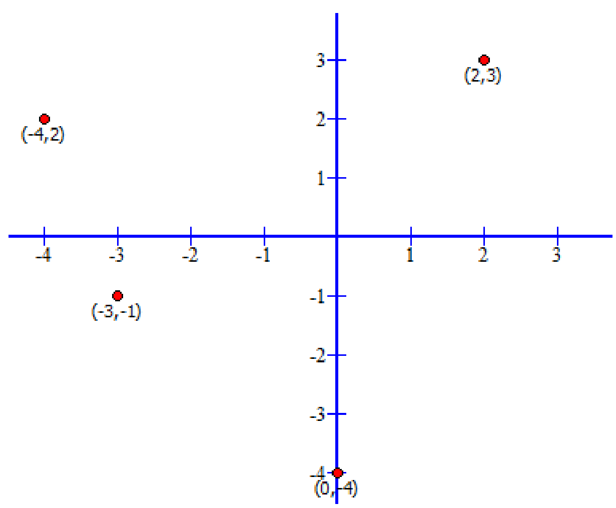


EX.1: Plot the following points (2,3),(-2,3),(-2,-3),(2,-3).



Ex2: Plot the following points:

(2,3),(-4,2),(-3,-1),(0,-4).

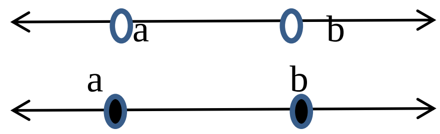


(1-2-1) Finite Intervals:

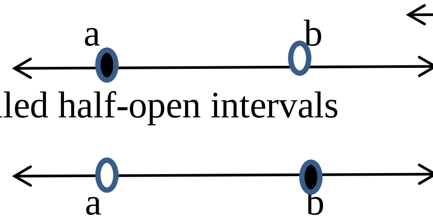
Let a and b be two real numbers, then:

a- If a$< x < b$ or (a,b) is called open interval.

b- If a$\leq$ x $\leq$ b or [a,b] is called closed interval.



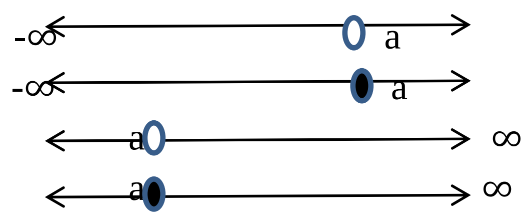
$$\left.\begin{array}{l} \text{c} - \text{if a} \leq \text{x} < \text{b or } [\text{a}, \text{b}) \\ \text{d} - \text{if a} < \text{x} \leq \text{b or } (\text{a}, \text{b}] \end{array}\right\} \text{are called half-open intervals}$$



(1-2-2) Infinite Intervals:

Let a real number, then:

1- If x $< a$ is denoted by (-∞, a)
2- If x $\leq a$ is denoted by (-∞, a]
3- If x $> a$ is denoted by (a,∞)
4- If x $\geq a$ is denoted by [a,∞)

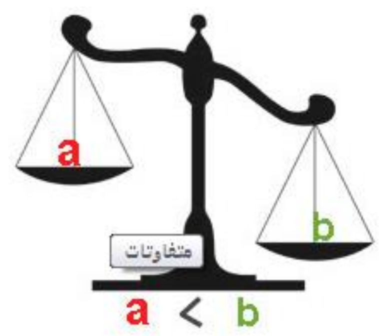


All these Infinite Intervals.

(1-3-1) Inequalities:

Such as **5x-7 < 8** and **5 < 3x+10 ≤16** define intervals on a line .

Properties of Inequalities used in this section:



1. **a < b → a+c < b+c ,** **ex: x-3 < 4 → x < 7**
2. **a < b → a-c < b-c** **ex: x+1 < 0 → x < -1**
3. **a < b and c > 0 → ac < bc** **ex:** $\frac{x}{2}$ **<1 → x < 2**
4. **a < b and c > 0 →** $\frac{a}{c} < \frac{b}{c}$ **ex: 2x < 4 → x < 2**
5. **a < b and c < 0 → ac > bc** **ex:** $\frac{x}{-2}$ **< 1 → x > -2**
6. **a < b and c < 0 →** $\frac{a}{c} > \frac{b}{c}$ **ex: -2x < 4 → x > -2**
7. **a < b →** $\frac{1}{a} > \frac{1}{b}$ requires **a** and **b** both positive or both negative.

Ex: 2 < 3 → $\frac{1}{2} > \frac{1}{3}$ **and -3 < -2 →** $-\frac{1}{3} > -\frac{1}{2}$

These hold for ≤ as well for < .

(1-3-2) Domain of Inequality (D):

The set of all values that the variable x of an inequality can have.

Ex1:

solve 2x-3 > 0

2x > 3 (adding 3) → x > 3/2 (dividing by 2)

Then the domain D : x > 3/2 or D: (3/2, ∞)

Ex2:

Solve 5 < 3x+10 ≤16

-5 < 3x ≤ 6 (subtracting 10) → -5/3 < x ≤ 2 (dividing by 3)

Then D: -5/3 < x ≤ 2 or D: (-5/3,2]

Ex3:

Solve -2x+3 < 7

-2x < 4 →x > -2 (reverse inequality)

Then D: -2 < x or (-2, ∞)

Ex.4: solve $\frac{14}{x} < 7$

a) If x > 0 → 14 < 7x → 2 < x → then x > 0 ∩ x > 2 is x > 2.
b) If x < 0 → 14 > 7x → 2 > x → then x < 0 ∩ x < 2 is x < 0 .

a ∪ b is R/[0, 2].

Exercise: Solve the inequalities and find their domain:

$a)$ $\frac{2x-1}{-3} < 3$ Solutions: (-4,∞)

b) $\frac{2}{x} - 3 < 5$ Solutions: R/[0,1/4]

c) $\frac{2x-1}{x} < 3$ Solutions: R/[-1,0]