

CLASS-X;CH-3

PAIR OF LINEAR EQUATIONS IN TWO VARIABLES



PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

- **PAIR** – a set of two things used together
- **LINEAR EQUATIONS** - equations with degree one
- **TWO VARIABLES** - having two different variables like ; x and y

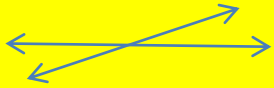
(Means- two linear equations have two same variables when taken together are called pair of linear equations in two variables)

TOPICS TO BE COVERED

- EQUATIONS
- LINEAR EQUATIONS
- LINEAR EQUATION IN ONE VARIABLE
- LINEAR EQUATION IN TWO VARIABLES
- GENERAL FORM OF PAIR OF LINEAR EQUATION IN TWO VARIABLES
- GRAPHICAL/GEOMETRICAL REPRESENTATION OF PAIR OF LINEAR EQUATION IN TWO VARIABLES
- SOLUTIONS OF PAIR OF LINEAR EQUATIONS IN TWO VARIABLES
- METHODS TO SOLVE PAIR OF LINEAR EQUATIONS IN TWO VARIABLES
 1. GRAHICAL METHOD
 2. ALEBRAIC METHODS
 - SUBSTITUTION METHOD
 - ELIMINATION METHOD
 - CROSS- MULTIPLICATION METHOD
- EQUATIONS REDUCIBLE TO PAIR OF LINEAR EQUATIONS IN TWO VARIABLES
- WORD PROBLEMS BASED ON DIFFERENT TOPICS (MOST IMPOETANT)

CONCEPT MAP

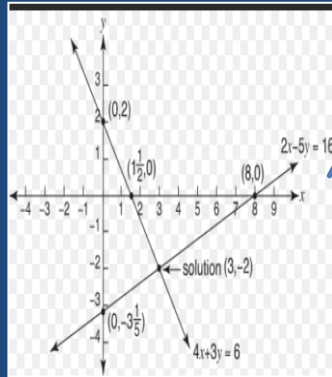
a. Intersecting lines



b. Parallel lines



c. Coincident lines



PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

$$a_1x + b_1y + c_1 = 0; a_1^2 + b_1^2 \neq 0$$

$$a_2x + b_2y + c_2 = 0; a_2^2 + b_2^2 \neq 0$$

METHODS TO SOLVE

GRAPHICAL METHOD

ALGEBRAIC METHOD

SUBSTITUTION
METHOD

ELIMINATION
METHOD

CROSS
MULTIPLICATION
METHOD

CONDITIONS OF SOLVABILITY OF
PAIR OF LINEAR EQUATIONS

CONDITION	TYPE OF SOLUTION	GRAPHICAL REPRESENTATION	TYPE OF SYSTEM
$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$	Unique solution	Intersecting lines	consistent
$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$	Infinitely many solutions	Coincident lines	consistent
$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$	No solution	Parallel lines	inconsistent

Steps to solve the pair of linear equations by method of Substitution.

Step1: Obtain two equations, and write them both in standard form

$$a_1x + b_1y + c_1 = 0 \dots (i)$$

$$a_2x + b_2y + c_2 = 0 \dots (ii)$$

Step2: Choose either of the two equations, say (i) and find find the value of one variable, say x in terms of y

Step3: Substitute the value of x, obtained in the previous step in equation (ii) to get an equation in one variable y

Step4: Solve the linear equation in one variable obtained in the previous step to get the value of y

Step5: Now do back substitution of y and get the value of x

Step6: check the solution and write the solution set.

Steps to solve the pair of linear equations by method of Elimination

Step1: Obtain two equations, and write them both in standard form

$$\begin{cases} a_1x + b_1y + c_1 = 0 \dots (i) \\ a_2x + b_2y + c_2 = 0 \dots (ii) \end{cases}$$

Step2: make the coefficient of one pair of variable terms (multiply one or both equations by appropriate number so that the sum or difference of coefficients of either X or Y will be zero)

Step3: add or subtract the new equations to eliminate a variable

Step4: solve the linear equation in one variable X or Y obtained in step 3

Step 5: substitute the value of X or Y obtained in step 4 into either of the original equations and solve for the other value.

Step6: check the solution and write the solution set.

x	y	1
Coefficient of y	Constant term	Constant term
Coefficient of x	Coefficient of x	Coefficient of y
b_1	c_1	a_1
b_2	c_2	a_2
$\frac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1}$	$\frac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}$	$\frac{1}{a_1b_2 - a_2b_1}$

TOPIC1:-
INTRODUCTION OF
PAIR OF LINEAR
EQUATIONS IN TWO
VARIABLES
(KEY WORDS)

EQUATION

An equation is called an equation because the root of the word

'equation' is the verb '**to equate**'.

- That is, an equation says that **two quantities are equal**.
- **When two expressions are linked by an equals sign it is called an equation?**
- **Eg: $3x+5y=10$**
- **$4t+9=74$**

LINEAR EQUATION

- Linear equation is an equation which is consisting , involving, or describable by terms of the first degree.
- EX: $2X+3=9$
 $4X+3Y+7Z=5$
 $9t-3s=10$

LINEAR EQUATION IN ONE VARIABLE

What's a Linear Equation in One Variable ?

A linear equation in one variable is an equation that can be written in the form

$$ax + b = 0$$

Where $a \neq 0$

For example:

$$2x + 6 = 0$$



LINEAR EQUATION IN TWO VARIABLES

WHAT IS LINEAR EQUATION IN TWO VARIABLE?

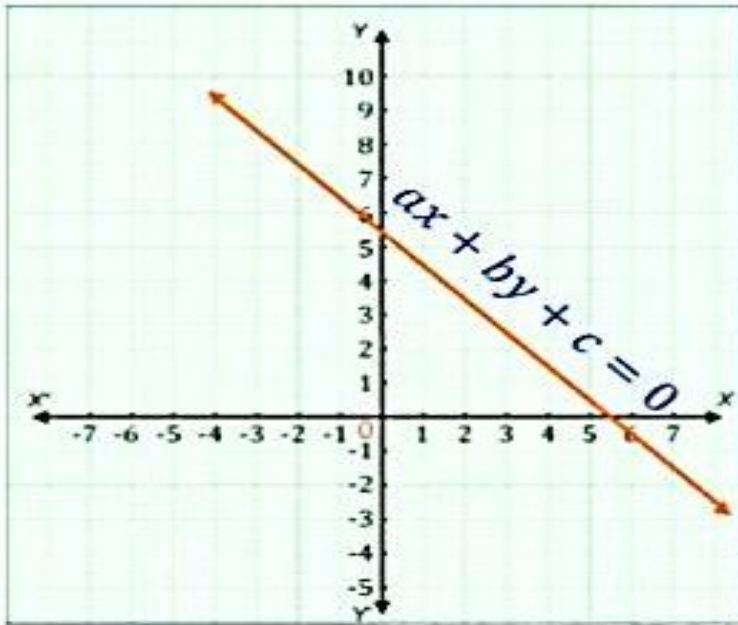
AN EQUATION WHICH CAN BE WRITTEN IN THE FORM

$ax+by+c=0$, where a, b and c are real numbers, and a and b are not both zero, is called linear equation in two variables.

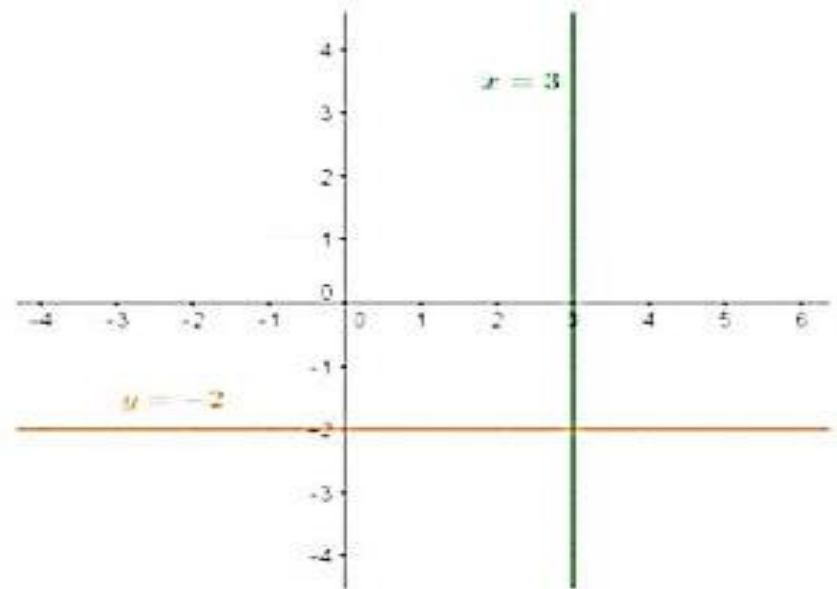
Condition a and b not both zero is denoted by

$$a^2 + b^2 \neq 0$$

GRAPHICAL REPRESENTATION OF LINEAR EQUATION IN ONE AND TWO VARIABLE



TWO VARIABLE



ONE VARIABLE

SOLUTION OF AN EQUATION

- The solution of an equation is the value(s) of Variable(s) that make the equation a true statement .
- A linear equation in one variable $ax+b$, $a \neq 0$ has a maximum one solution.
- A linear equation in two variables $ax+by+c=0$, (where a, b and c are real numbers ,and a and b are not) has infinite many solutions.

SOLUTION OF LINEAR EQUATION IN TWO VARIABLES

pair of values one of X and other for y , which make the two sides of the equation equal. Eg: $2x+3y=5$, let $x=1$ and $y=1$

$$2(1)+3(1)=5$$

$$5=5$$

LHS=RHS there fore $x =1$ and $y=1$ are solution of equation $2x+3y=5$

GEOMETRIC MEANING OF SOLUTION OF LINEAR EQUATION IN TWO VARIABLES

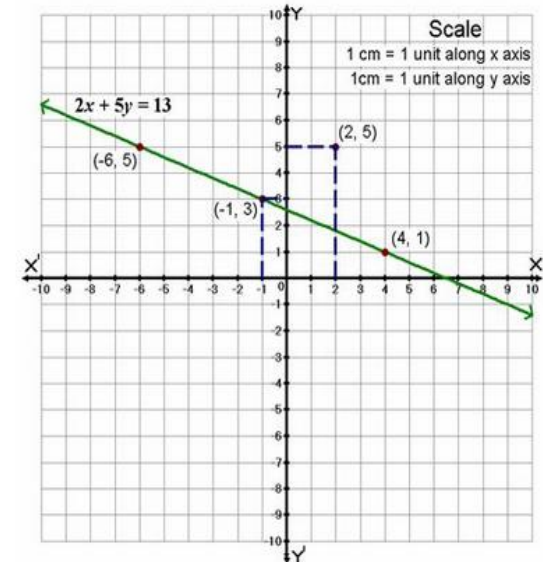
Every solution of equation is a point on the line representing it, each solution (x,y) of a linear equation in two variables $ax+by+c=0$, corresponding to a point on the line representing the equation, and vice versa.

The graph of linear equation in two variable is always a straight line.

Table

x	4	-1	-6
y	1	3	5

Graphical Representation



$x = 2, y = 5$ is not the solution.

$x = -1, y = 3$ is the solution.

PAIR OF LINEAR EQUATIONS IN TWO VARIABLES (INTRODUCTION)

- If two linear equations are in the same two variables x and y . Equations like these are called a pair of linear equations in two variables.
- Let us see what such pairs look like algebraically.
- The **general form** for a pair of linear equations in two variables x and y is

$$a_1x + b_1y + c_1 = 0 \text{ and}$$

$$a_2x + b_2y + c_2 = 0$$

where $a_1, b_1, c_1, a_2, b_2, c_2$ are all real number

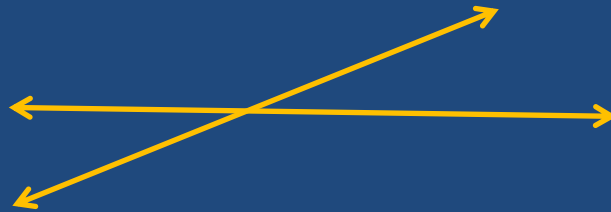
$$a_1^2 + b_1^2 \neq 0, a_2^2 + b_2^2 \neq 0$$

- examples of pair of linear equations in two variables are:
- $2x + 3y - 7 = 0$ and $x - 2y + 8 = 0$
- $5x = y$ and $-7x + 2y + 3 = 0$
- $x + y = 7$ and $17 = y$

NATURE OF 2 STRAIGHT LINES IN A PLANE

For a pair of straight lines on a plane, there are three possibilities

a. Intersecting lines



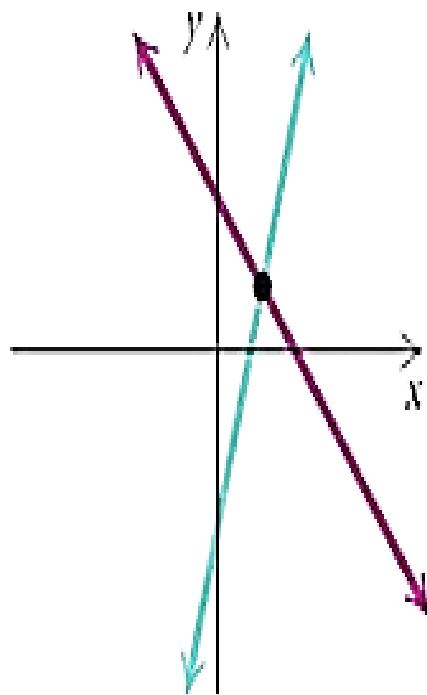
b. Parallel lines



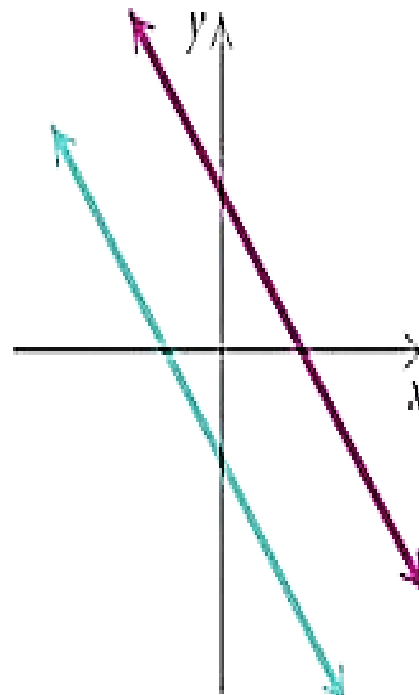
c. Coincident lines



Graphical representation of pair of linear equations in two variables

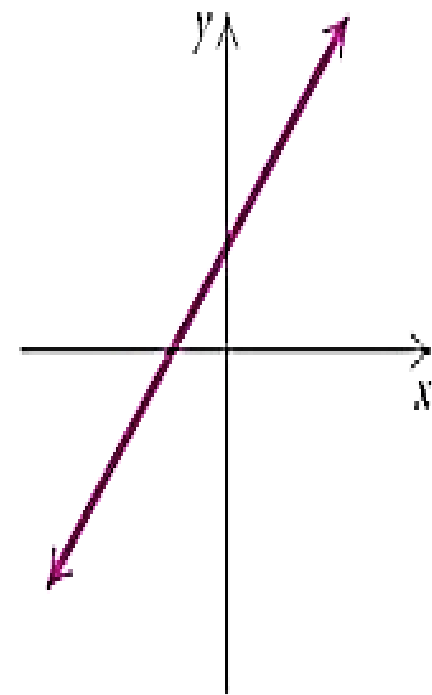


Exactly one common point



Parallel lines

No common points

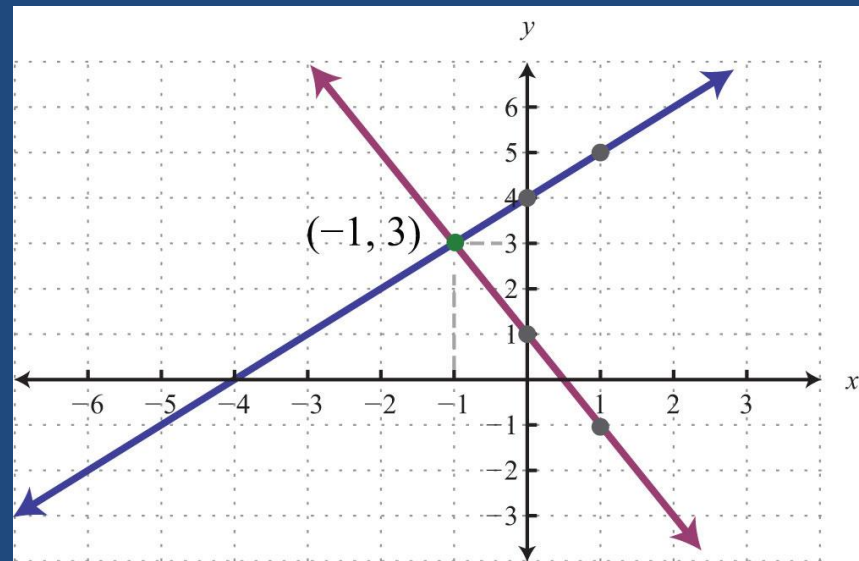


Lines are identical.

Infinitely many common points

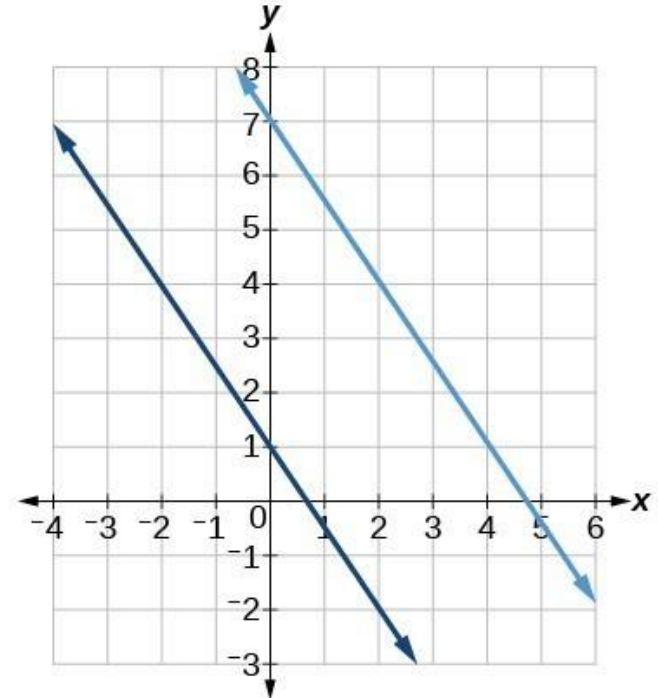
I) THEY INTERSECT AT EXACTLY ONE POINT

- pair of linear equations which intersect at a single point.



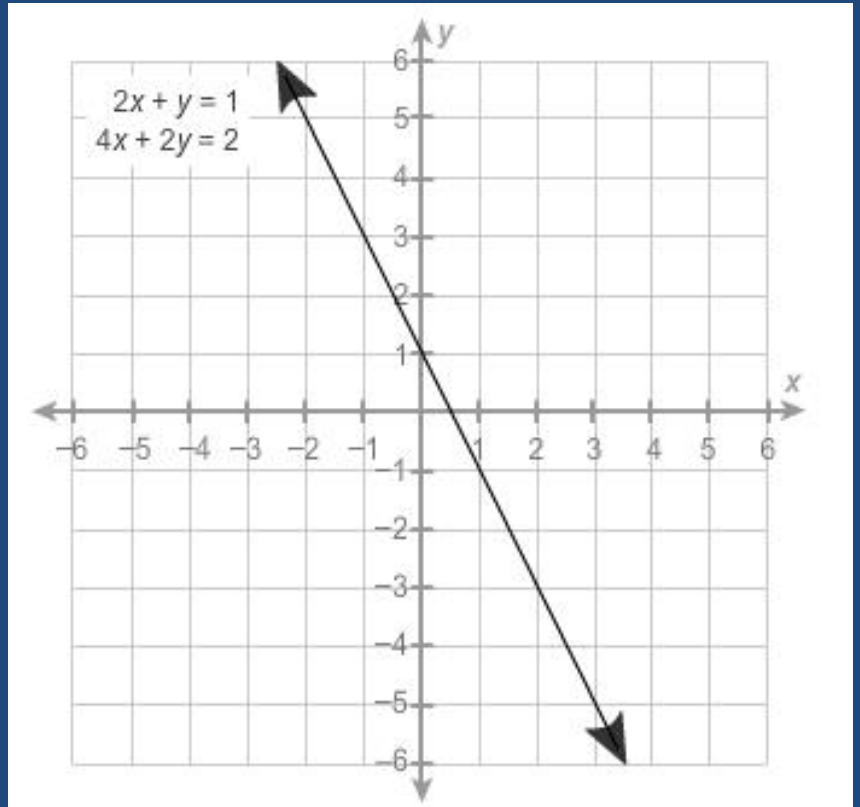
II) THEY ARE PARALLEL

- pair of linear equations which are parallel.



III) THEY ARE COINCIDENT

pair of linear
equations
which are
coincident.



Example 2 : Romila went to a stationery shop and purchased 2 pencils and 3 erasers for ₹ 9. Her friend Sonali saw the new variety of pencils and erasers with Romila, and she also bought 4 pencils and 6 erasers of the same kind for ₹ 18. Represent this situation algebraically and graphically.

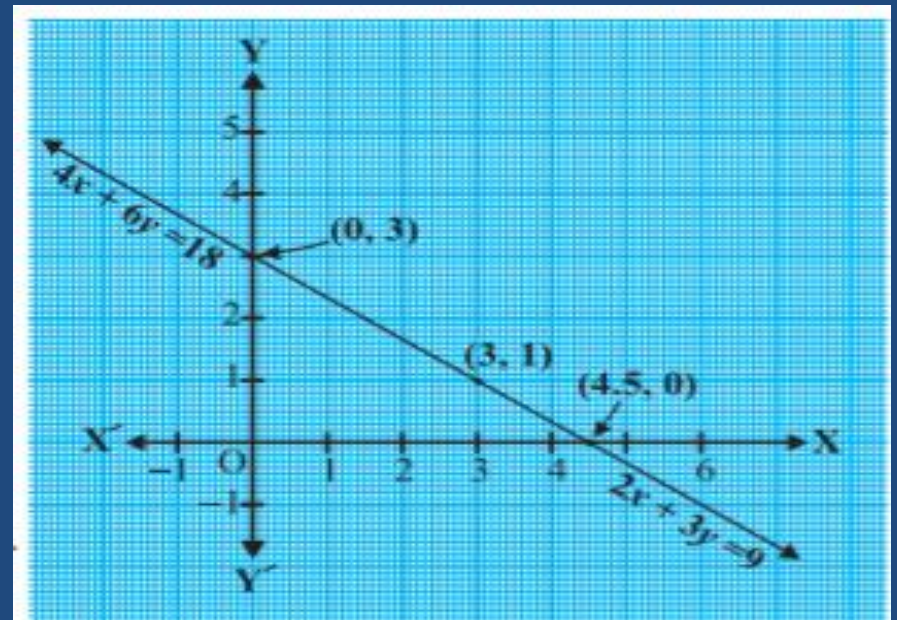
Solution : Let us denote the cost of 1 pencil by x and one eraser by y . Then the algebraic representation is given by the following equations:

$$2x + 3y = 9 \quad (1)$$

$$4x + 6y = 18 \quad (2)$$

x	0	4.5
$y = \frac{9 - 2x}{3}$	3	0

x	0	3
$y = \frac{18 - 4x}{6}$	3	1

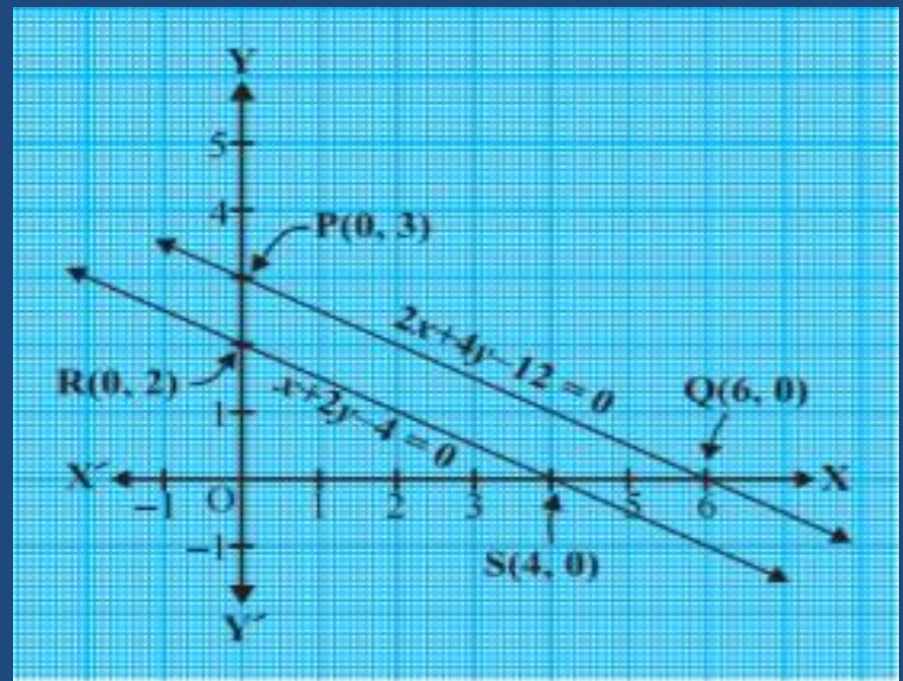


Example 3 : Two rails are represented by the equations $x + 2y - 4 = 0$ and $2x + 4y - 12 = 0$. Represent this situation geometrically

Solution : Two solutions of each of the equations
 $x + 2y - 4 = 0$; $2x + 4y - 12 = 0$

x	0	4
$y = \frac{4-x}{2}$	2	0

x	0	6
$y = \frac{12-2x}{4}$	3	0



EXERCISE 3.1

- 1. Aftab tells his daughter, “Seven years ago, I was seven times as old as you were then. Also, three years from now, I shall be three times as old as you will be.” (Isn’t this interesting?) Represent this situation algebraically and graphically.
- 2. The coach of a cricket team buys 3 bats and 6 balls for ₹ 3900. Later, she buys another bat and 3 more balls of the same kind for ₹ 1300. Represent this situation algebraically and geometrically.
- 3. The cost of 2 kg of apples and 1kg of grapes on a day was found to be ₹ 160. After a month, the cost of 4 kg of apples and 2 kg of grapes is ₹ 300. Represent the situation algebraically and geometrically.