



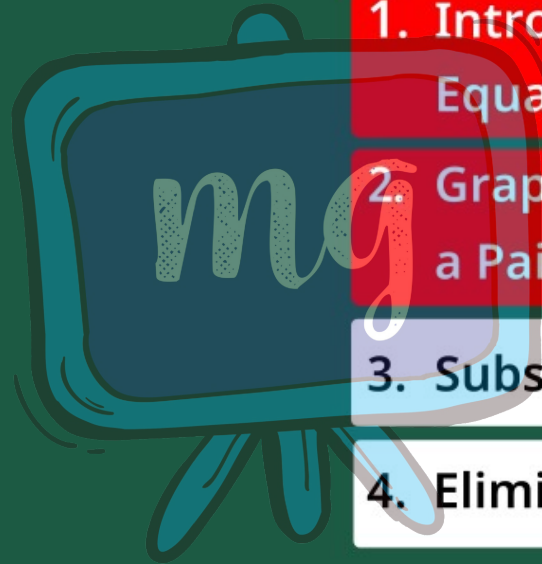
CLASS – 10 MATHEMATICS

CH-3 : Pair of Linear Equations in Two Variables

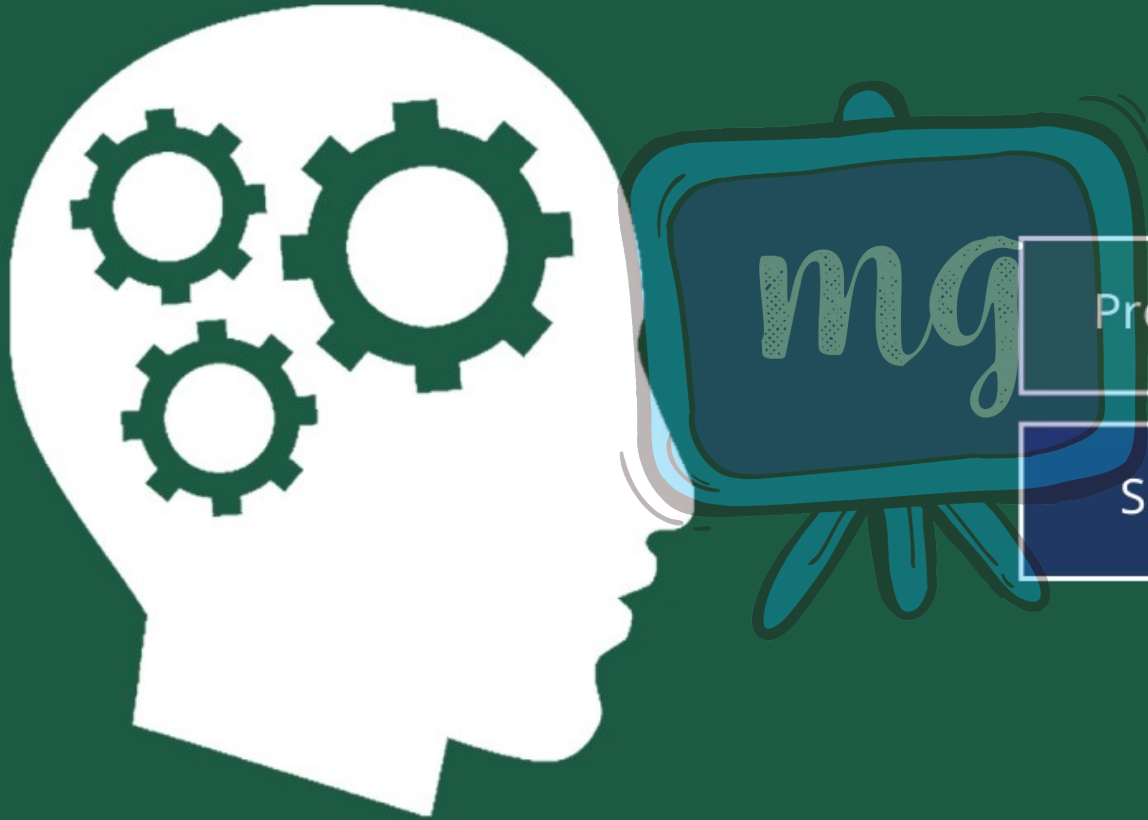
Part – 1

Introduction to Pair of Linear
Equation in Two Variables

Shubham Tiwari



1. Introduction to Pair of Linear Equation in Two Variables
2. Graphical Method of Solution of a Pair of Linear Equations
3. Substitution Method
4. Elimination Method



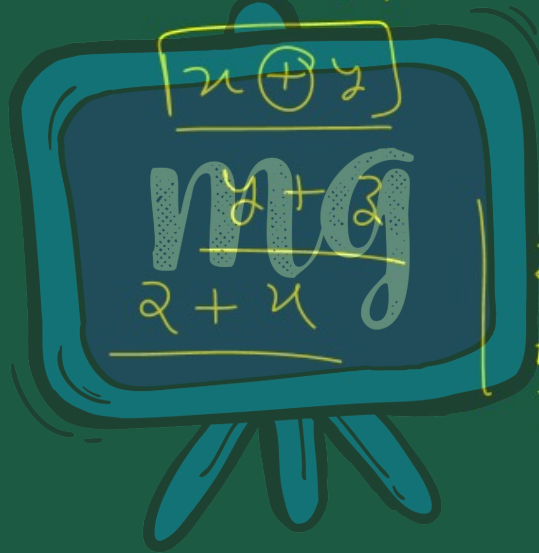
Properties of Linear Equation

Solution of Linear Equation

Linear eq.

x, y, z

$+, -, \times, \div$



$$\underline{x + y}$$

$$\underline{y + z}$$

$$\underline{z + x}$$

mg

$$2 \times x = \underline{2x}$$

$$\underline{5x - 3y}$$

eg.

LHS $\left\{ \begin{array}{l} 2x + 3y \end{array} \right. \stackrel{RHS}{=} 0$

$2x + 3y = x$ ✓

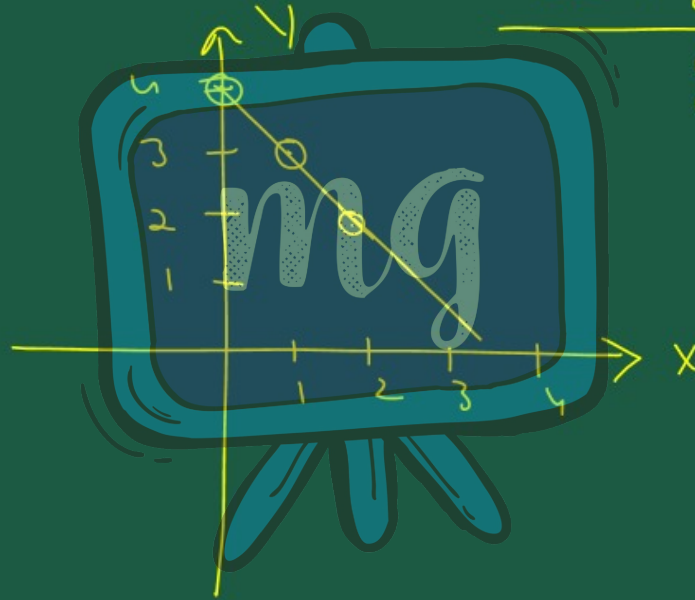
$2x + 3y = 7$ ✓

$2x + 4y = 7x + 9y$ ✓

$$\underline{2x + 3y = 4}$$

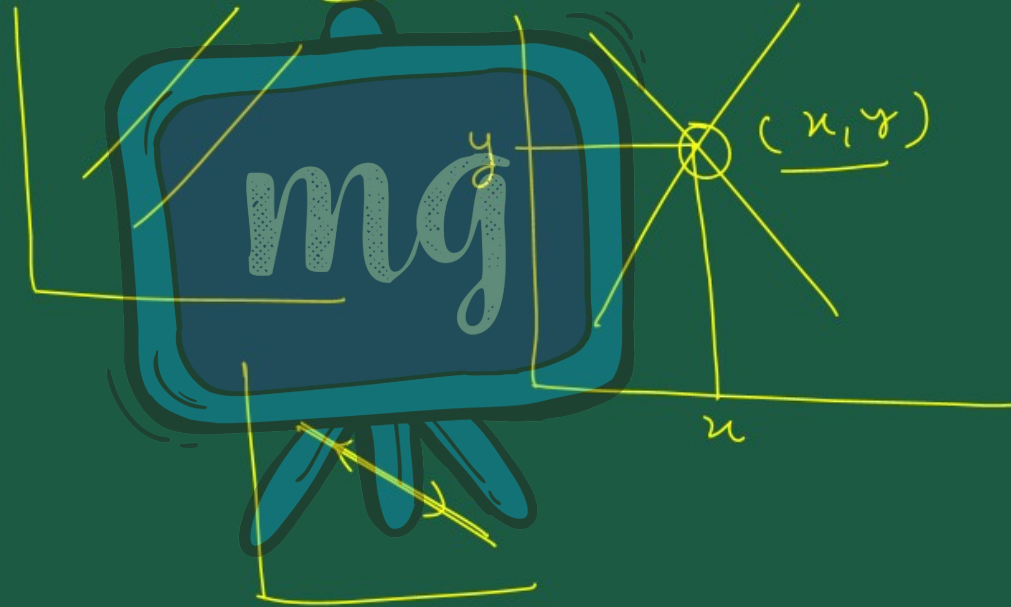
$$\underline{x + y = 4}$$

$$y = 4 - x$$



x	0	1	2
y	4	3	2

$$\left\{ \begin{array}{l} x + y = 4 \\ 2x + y = 5 \end{array} \right\} \text{solus}$$



ALGEBRAIC EXPRESSION

A combination of constant and variable; connected by four fundamental arithmetic operation of $+$, $-$, \times , \div is called algebraic expression.

Example :

$$\underline{x + 2y = 1}$$

$$\underline{3 - 7x}, \underline{8 + 9y^2} \text{ etc.}$$

EQUATION

Handwritten mathematical examples of equations. At the top, an equals sign (=) is circled in yellow. Below it, the equation $2x + y = 5$ is written in yellow, with a yellow arrow pointing from the equals sign to the right. Below that, the equation $2x + y - 5 = 0$ is written in yellow, with a yellow arrow pointing from the equals sign to the right. A yellow line is drawn under the second equation.

An algebraic expression is equated to some constant, variable or other algebraic expression. Then that relation is known as equation.

Example :

$3x + 7 = 10$, $x^2 - 7x + 10 = 0$ etc.

LINEAR EQUATION

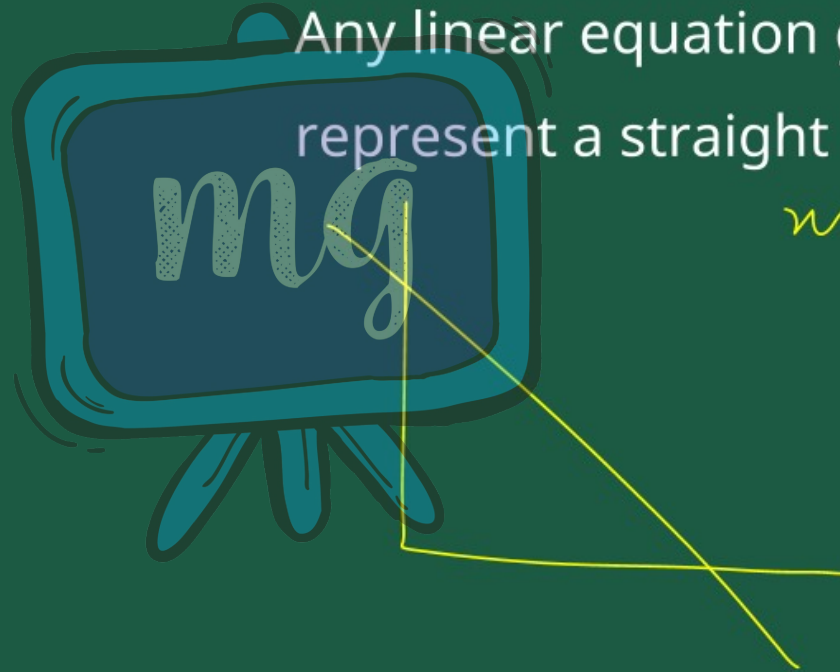
If the greatest exponent of the variable in an equation is one, called linear equation.

Example :

$$3x + 11 = 0, 9y - 7 = 12$$

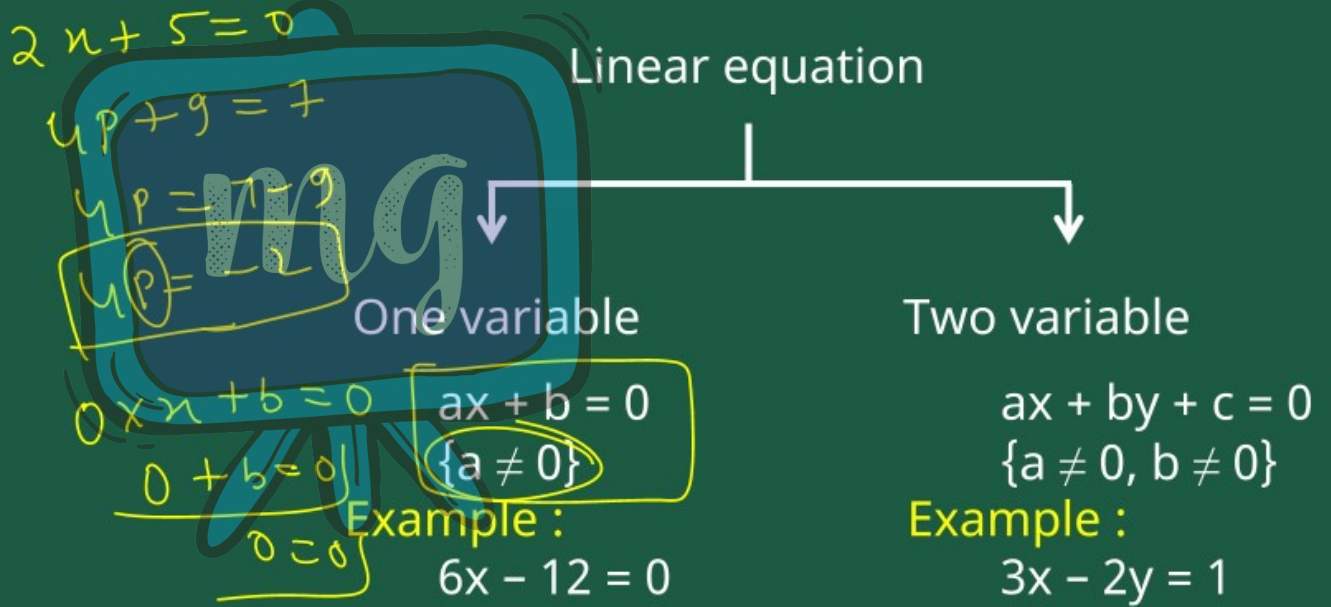


Any linear equation geometrically represent a straight line.



$$m \rightarrow y = 4$$

TYPES OF LINEAR EQUATION



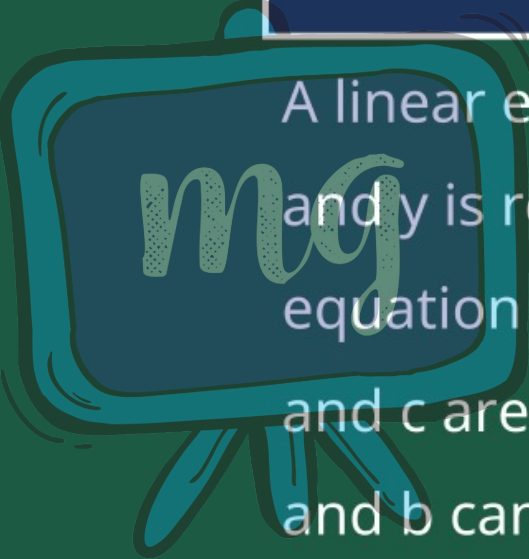
$$x + y = 4$$

$$x = 4 - y$$



x	4	3	0
y	0	1	4

LINEAR EQUATION IN TWO VARIABLES



A linear equation in two variables x and y is represented by the equation $ax + by + c = 0$ where a , b , and c are real number and both a and b can not be zero.

Examples :

$$4x + 5y = 3$$

- ▮ $3p + 2q = 0$ is a linear equation in two variables p and q .



DEPENDENT AND INDEPENDENT VARIABLE



→ Expressed x in terms of y

$$x = \frac{-by - c}{a}$$

x = dependent, y = independent

→ Expressed y in terms of x

$$y = \frac{-ax - c}{b}$$

x = independent, y = dependent

SOLUTION OF LINEAR EQUATION IN TWO VARIABLE

The solutions of a linear equation in two variables are the values of x & y which satisfy the linear equation in two variables.

Examples :

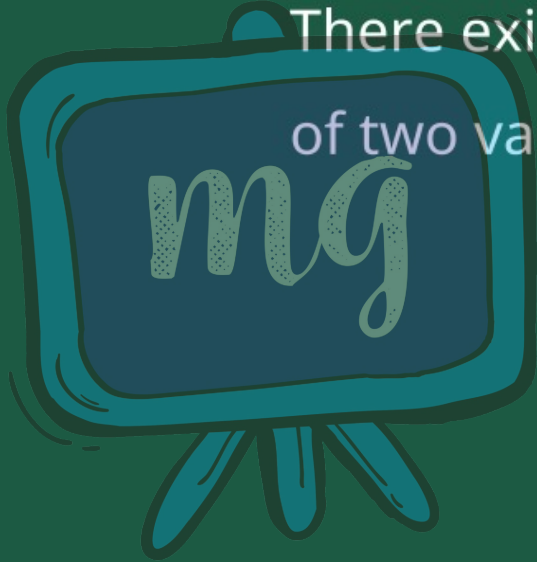
Ordered Pair
 (x, y)

$4x + 5y = 3$ is a linear equation whose solutions are $(-13, 11), (-3, 3)$ etc.

$$\begin{aligned} 2x + 5 &= 0 \\ x &= -\frac{5}{2} \\ 4x + 5y &= 3 \\ 4(-13) + 5(11) &= 3 \\ -52 + 55 &= 3 \end{aligned}$$



Note



There exist infinitely many solutions
of two variable linear equations.

$$\begin{cases} a_1x + b_1y + c_1 = 0 \\ a_2x + b_2y + c_2 = 0 \end{cases}$$

SYSTEM OF SIMULTANEOUS LINEAR EQUATION

Set of two linear equation in two variables written in the form.

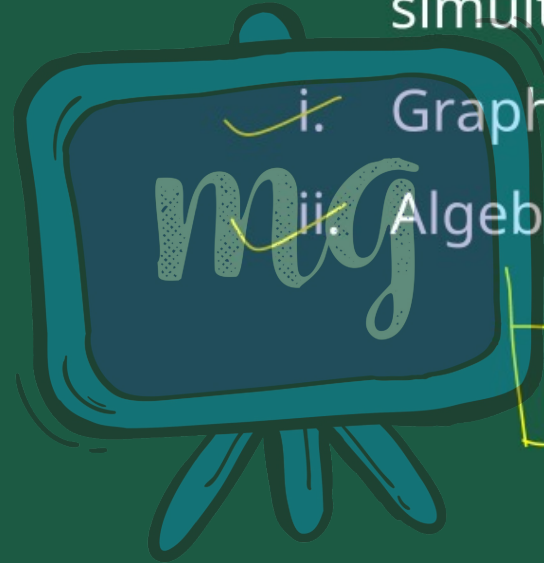
$$\begin{cases} a_1x + b_1y + c_1 = 0 \\ a_2x + b_2y + c_2 = 0 \end{cases} \begin{cases} a_1 \neq 0, b_1 \neq 0 \\ a_2 \neq 0, b_2 \neq 0 \end{cases}$$

Called system of simultaneous linear equation.

☛ We have two methods to solve simultaneous linear equations.

i. Graphical method

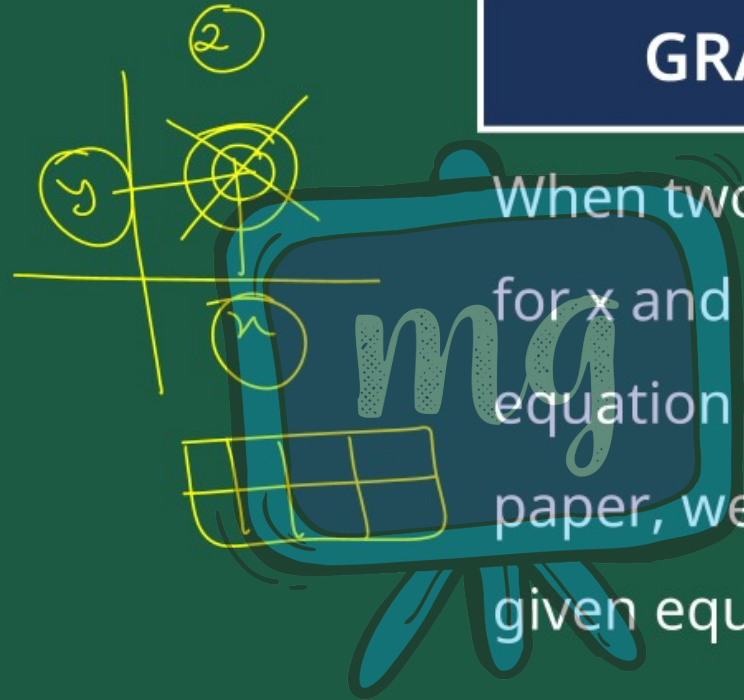
ii. Algebraic method



→ Substitution Method

→ Elimination Method

GRAPHICAL METHOD



When two or more pairs of values for x and y satisfy the given equation are joined on the graph paper, we find the graph of the given equation.

GENERAL EQUATION IN LINEAR EQUATION IN TWO VARIABLE

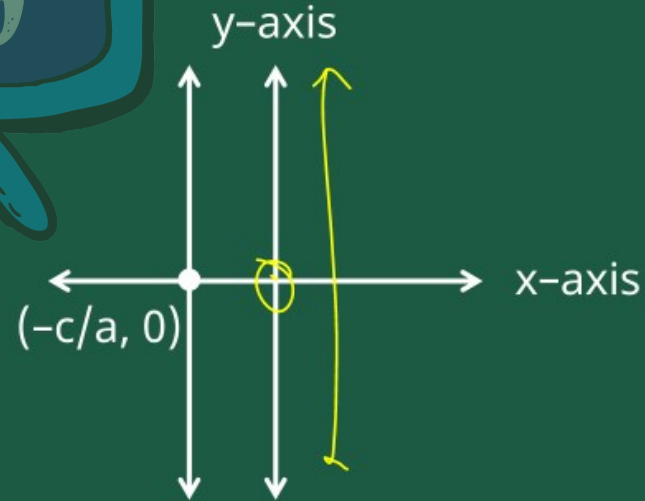
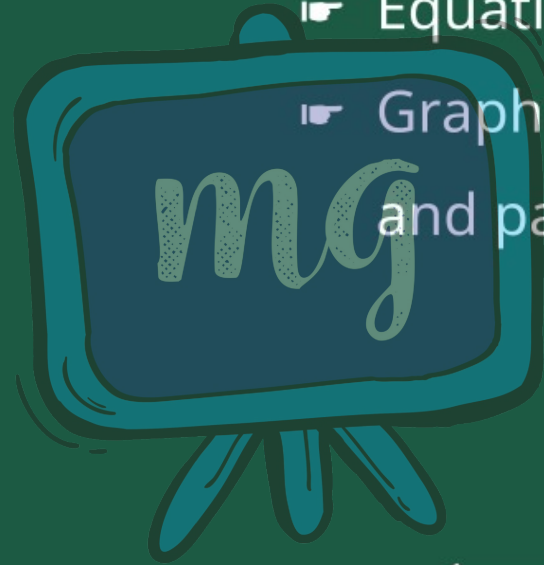
$$ax + by + c = 0 \quad \{ \underline{a \neq 0}, \underline{b \neq 0} \}$$

mg

When $a \neq 0$, $b = 0$ and $c \neq 0$

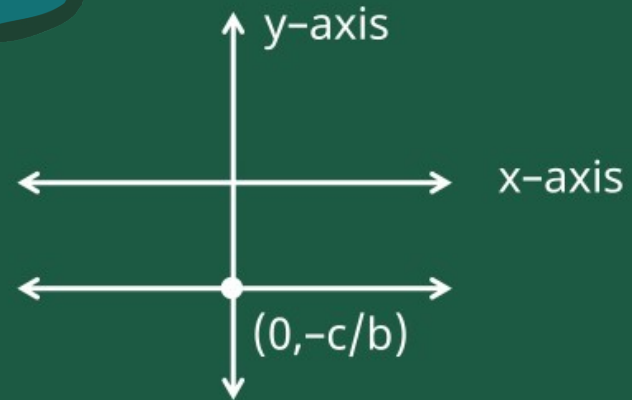
Equation : $ax + c = 0$, $x = -c/a$

Graph is straight line || y axis
and passing through $(-c/a, 0)$



When $a = 0$, $b \neq 0$ and $c \neq 0$

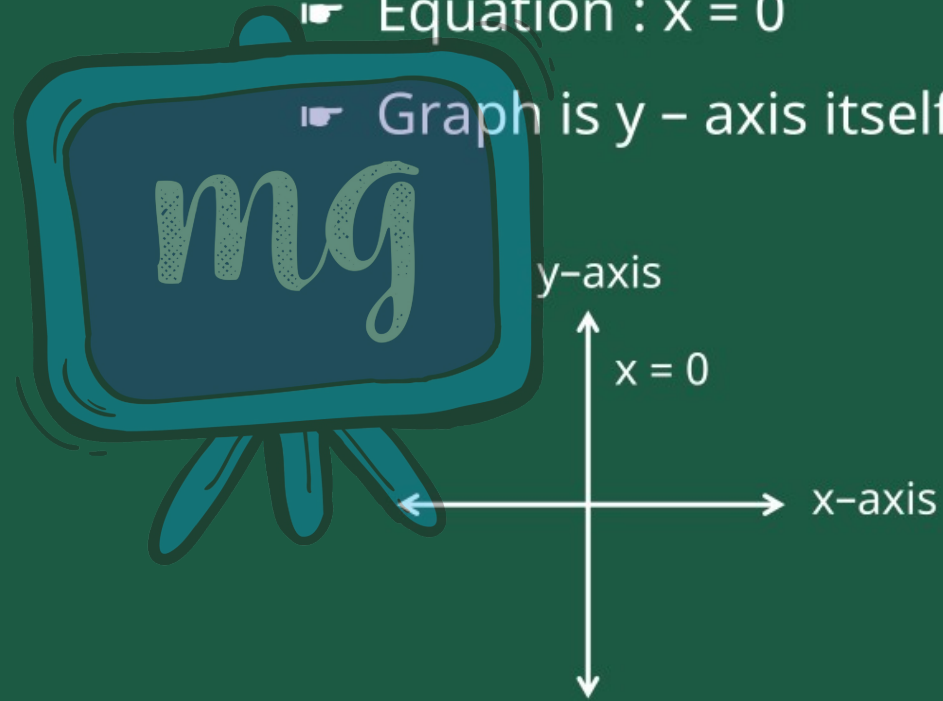
- Equation : $by + c = 0$, $y = -c/b$
- Graph is straight line passing from $(0, -c/b)$, parallel to x-axis.



When $a \neq 0, b = 0, c = 0$

Equation : $x = 0$

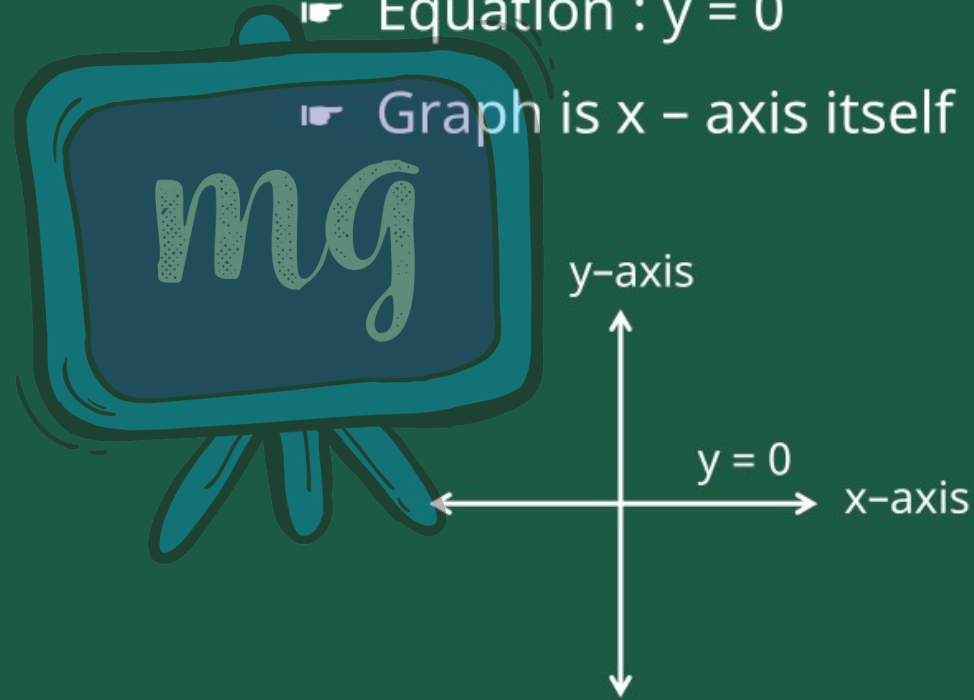
Graph is y - axis itself



When $a = 0, b \neq 0, c = 0$

Equation : $y = 0$

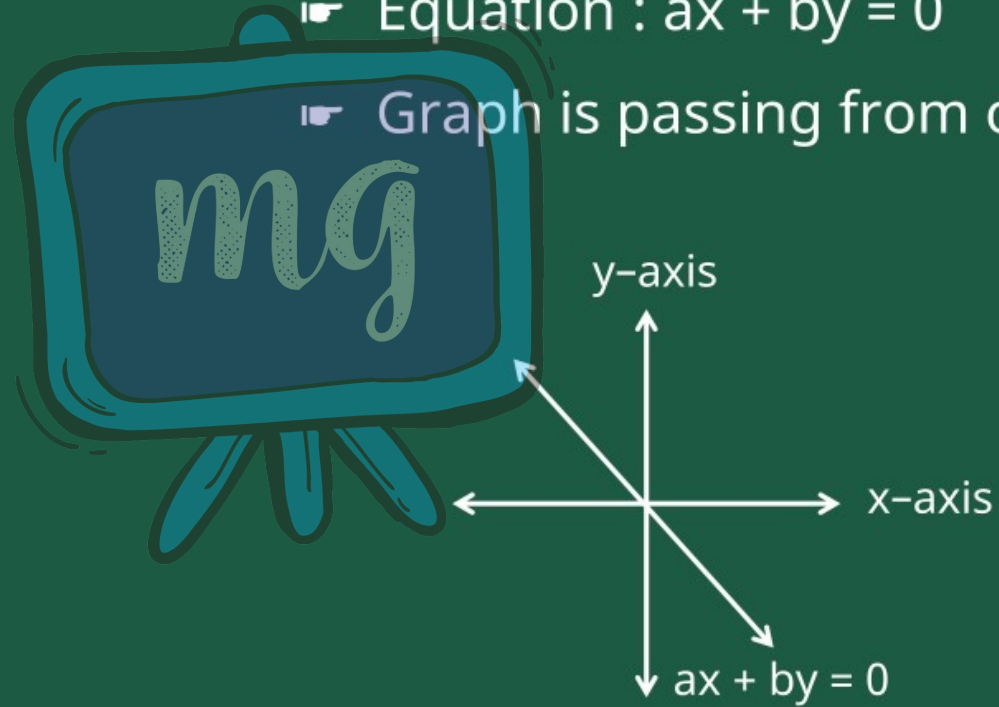
Graph is x - axis itself



When $c = 0, a \neq 0, b \neq 0$

Equation : $ax + by = 0$

Graph is passing from origin.



CONDITION OF CONSISTENCY

Graph of simultaneous linear
equation in two variable

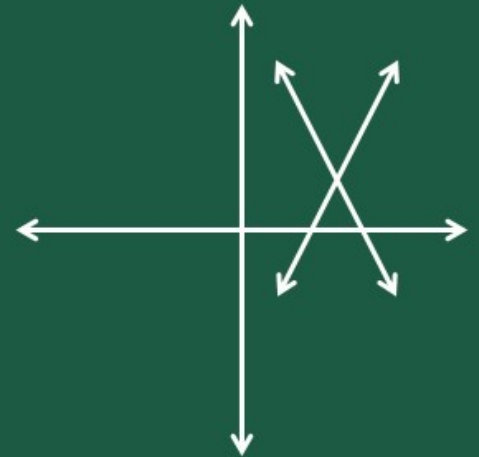
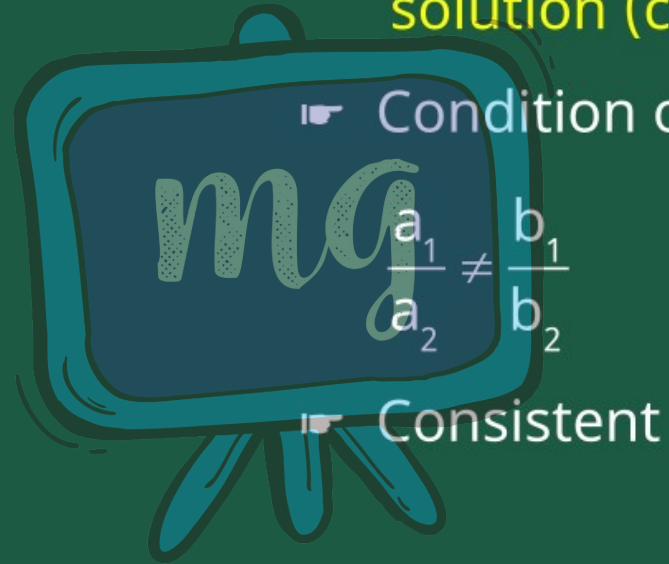


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$$a_1x + b_1y + c_1 = 0$$

$$a_2x + b_2y + c_2 = 0$$

i. Intersecting lines gives unique solution (common solution)

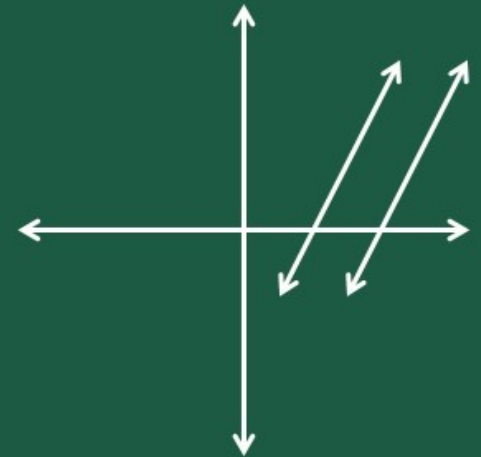
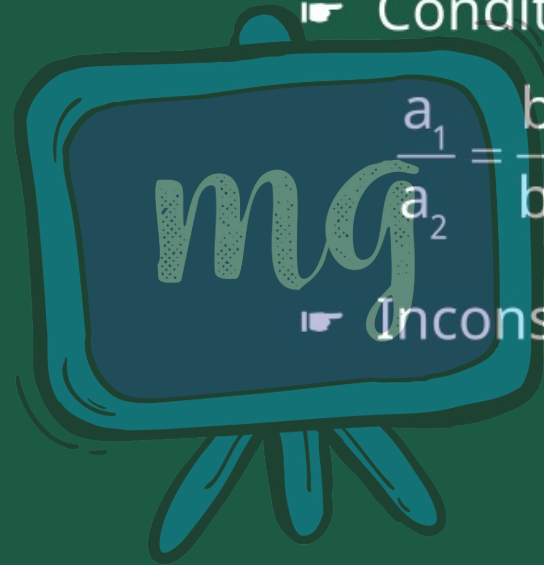


ii. Parallel lines gives no solution

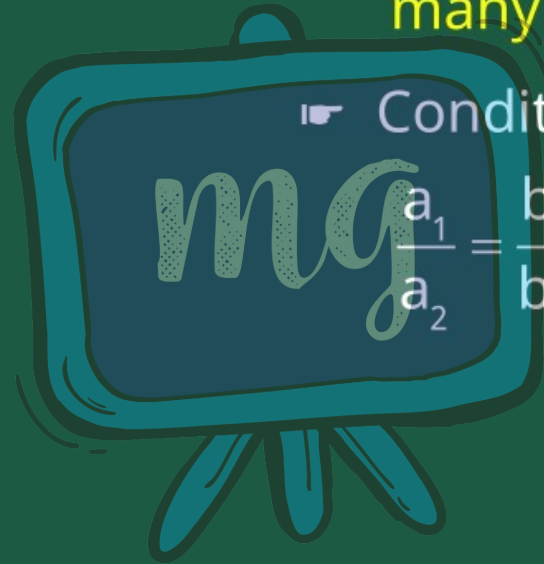
☛ Condition of consistency

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$$

☛ Inconsistent

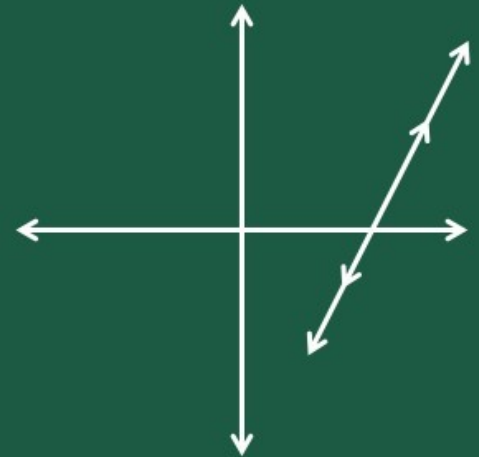


iii. Coincident lines gives infinite many solution



Condition of consistency

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$



- ▮ Consistent
- ▮ Also called dependent pair of equation.



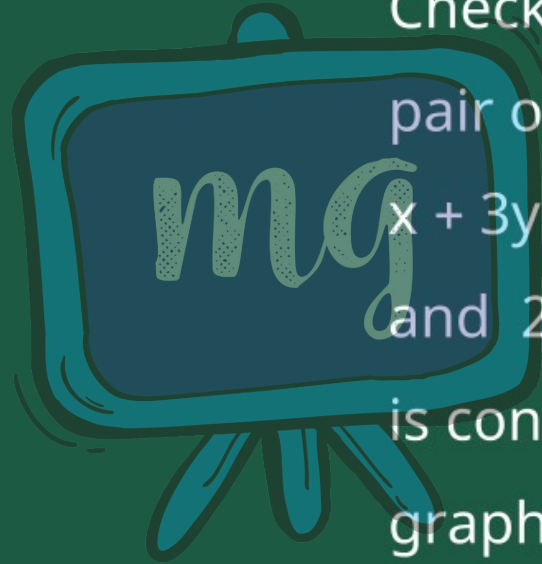
Example : 1

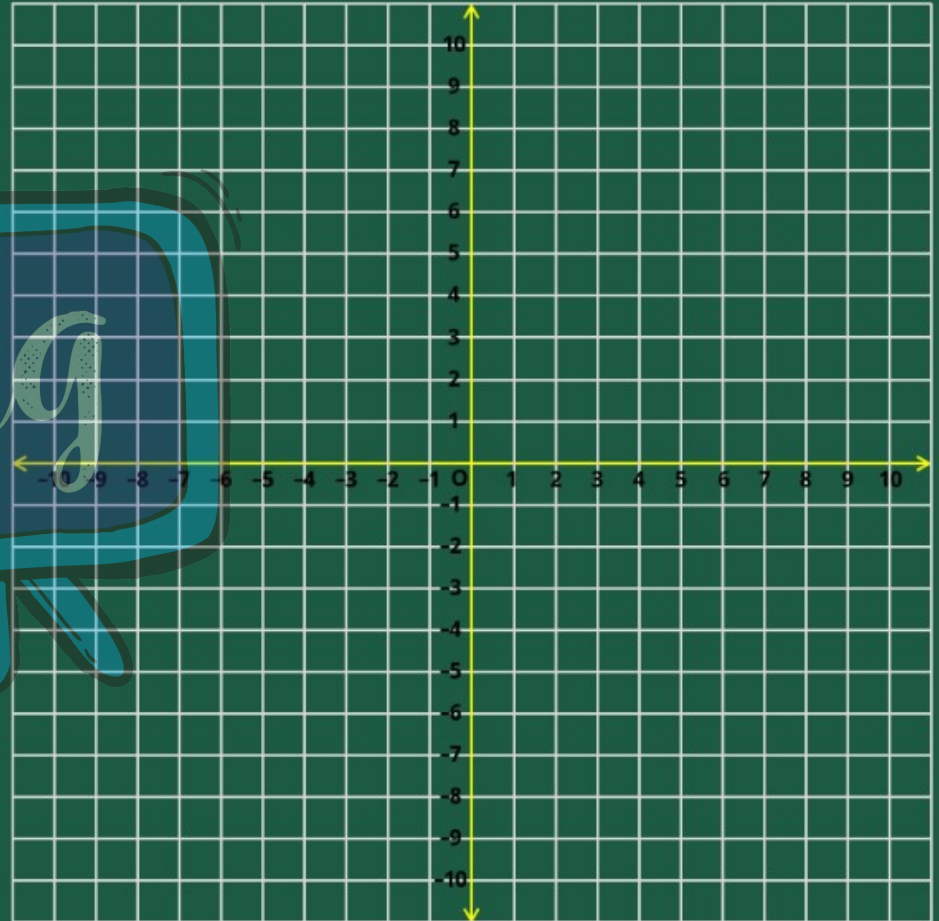
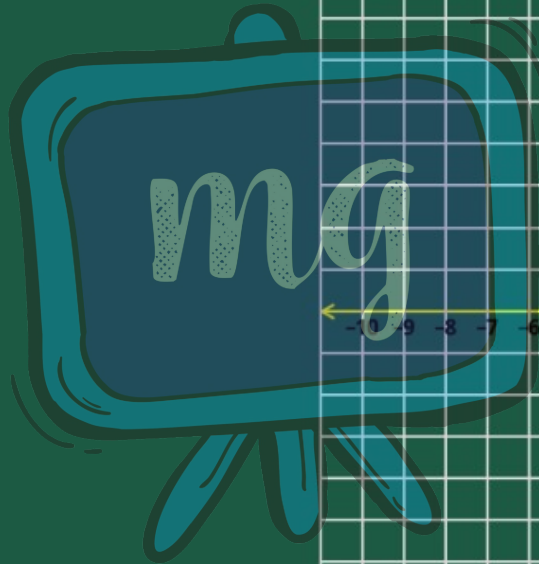
Check graphically whether the pair of equations

$$x + 3y = 6$$

$$\text{and } 2x - 3y = 12$$

is consistent. If so, solve them graphically.



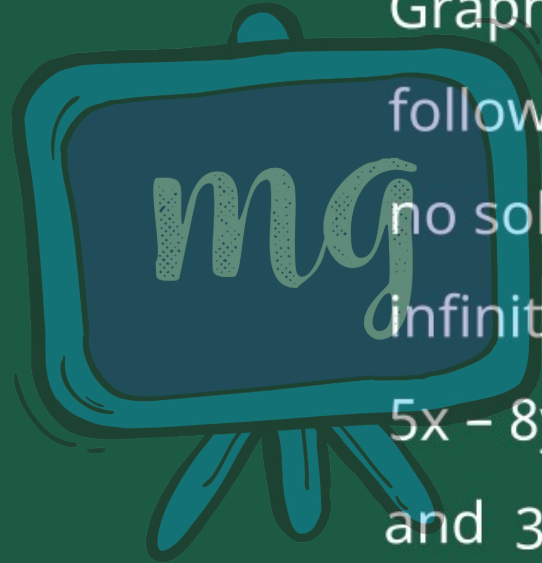


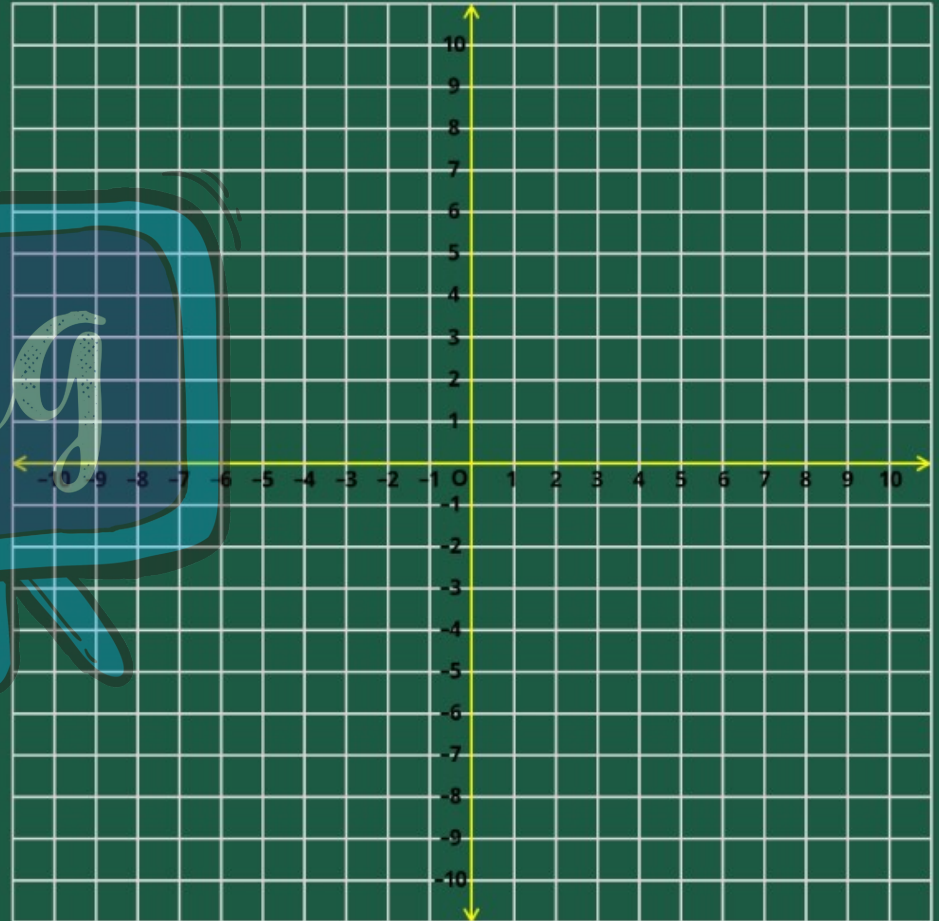
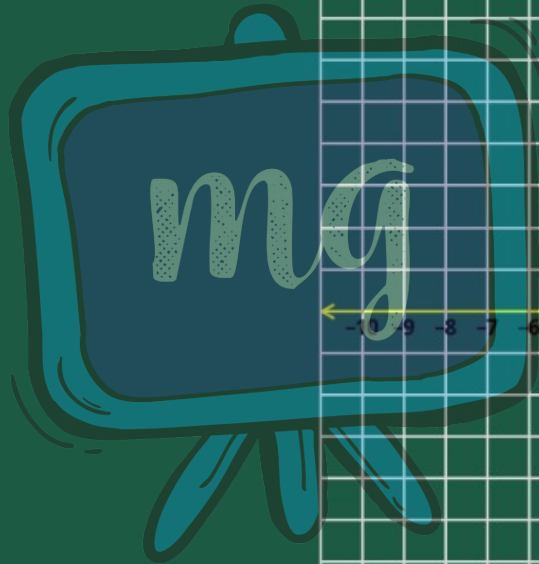
Example : 2

Graphically, find whether the following pair of equations has no solution, unique solution or infinitely many solutions :

$$5x - 8y + 1 = 0$$

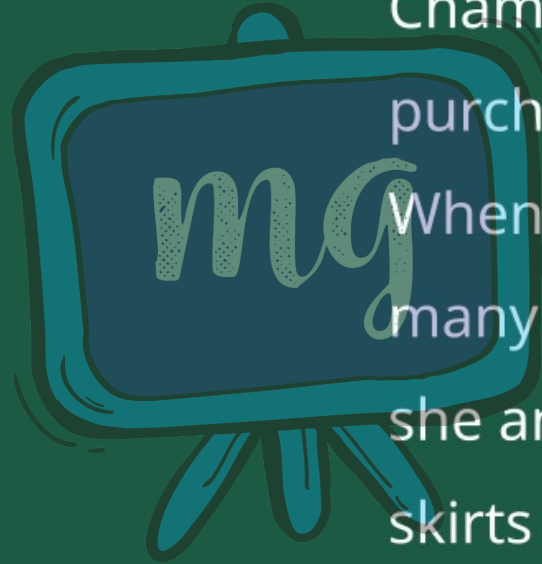
$$\text{and } 3x - \frac{24}{5}y + \frac{3}{5} = 0$$





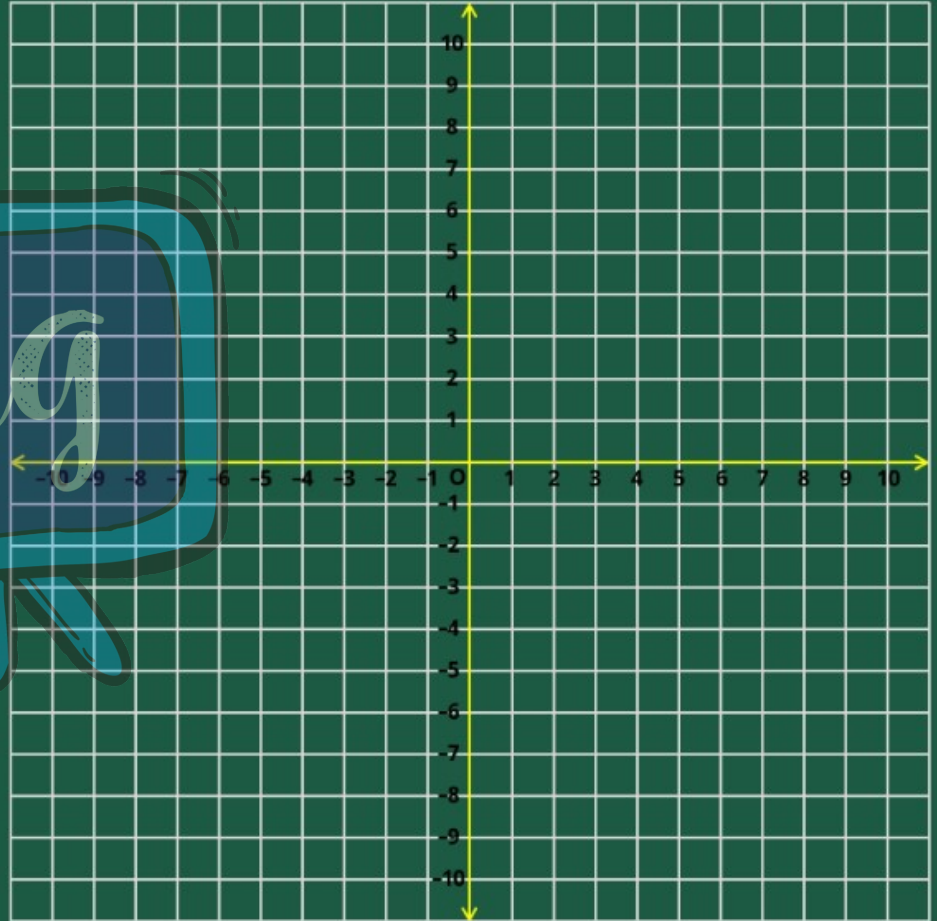
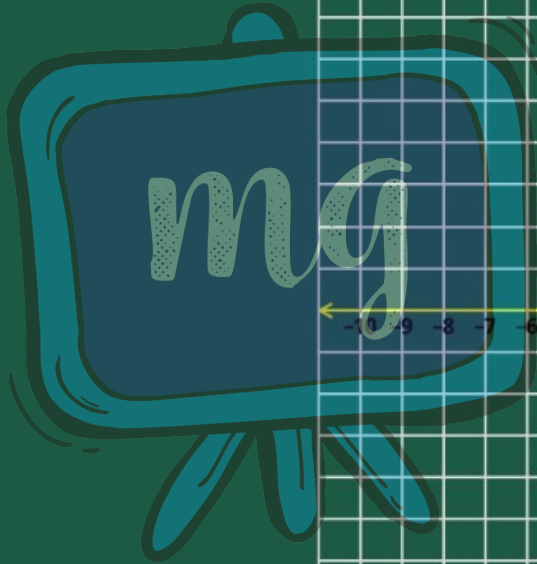
Example : 3

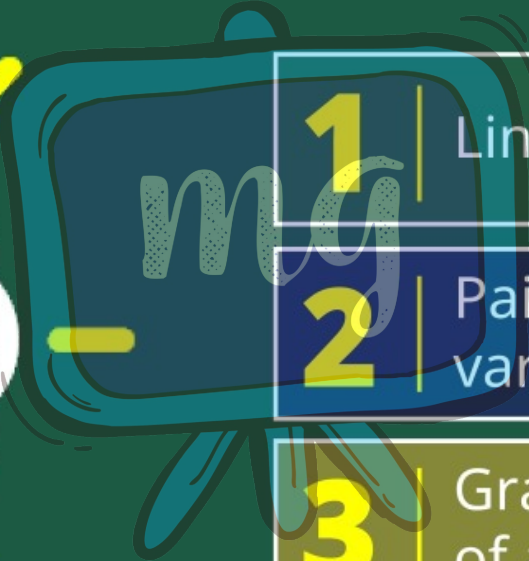
Champa went to a 'Sale' to purchase some pants and skirts. When her friends asked her how many of each she had bought, she answered, "The number of skirts is two less than twice the number of pants purchased."



Also, the number of skirts is four less than four times the number of pants purchased". Help her friends to find how many pants and skirts Champa bought.







1

Linear Equation

2

Pair of linear equation in two variables

3

Graphical method of solution of a pair of linear equations

1

The pairs of equations $x + 3y - 3 = 0$
and $2x + 6y - 6 = 0$ have :

- A Unique solution
- B Exactly two solution
- C Infinitely many solutions
- D No solution



2

If a pair of linear equations is consistent, then lines are :

- A Parallel
- B Always Coincident
- C Always Intersecting
- D Intersecting or Coincident



3

If the lines $4x + 2ky - 3 = 0$ and $2x + 3y - 5 = 0$ are parallel, then what is the value of k ?

A 6

B 3

C 4

D 2

