MATHS ACTIVITY

LINEAR EQUATION

STD X

ACTIVITY

Theme

Conditions for Consistency and Inconsistency of a System of Linear Equations in two Variables by Graphical Method.

Objective

To obtain the conditions for consistency of a system of linear equations in two variables by graphical method.

Background Knowledge

1. Should know the concept of a linear equation and drawing the graph on graph paper.
2. Linear equation of two variables of the form $a_1x + b_1y = c_1$; $a_2x + b_2y = c_2$
   Where a_1, a_2, b_1, b_2 and c_1, c_2 are non-zero real numbers.
3. Coordinate system
4. Plotting of points on a graph paper
5. Solution of a given equation
6. Parallel lines, intersecting lines and coincident lines.

Materials Required

1. Graph papers
2. White sheets of paper
3. Geometry box

PROCEDURE

Steps to Follow

1. Consider three pairs of linear equations in two variables.

   (i) $x + y = 4$
   $2x + 3y = 6$

   (ii) $2x + 3y = 6$
   $4x + 6y = 12$

   (iii) $2x + 3y = 6$
   $4x + 6y = 24$

2. First of all, take first pair (i) of linear equations and prepare a table of ordered pair (x, y) for each of the two equations.

Table for $x + y = 4$.

x	4	6	0
y	0	–2	4
x, y	(4, 0)	6,–2	0,4

Table for $2x + 3y = 6$.

x	0	3	6
y	2	0	–2
x, y	0, 2	3,0	6,–2

For $4x + 6y = 24$

x	0	6	−3
y	4	0	4

7. By plotting the points (ordered pairs) on graph paper draw the graph for each equation.

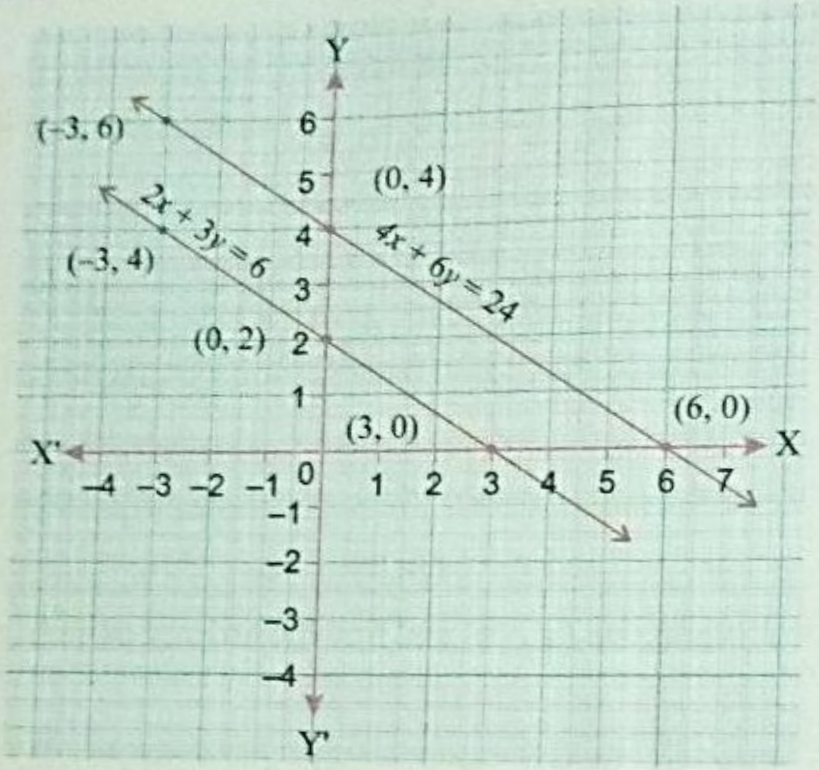

Fig. 3.3

3. By plotting the points (*i.e.*, ordered pairs) on graph paper draw the graph of two equations. (See Fig. 3.1)

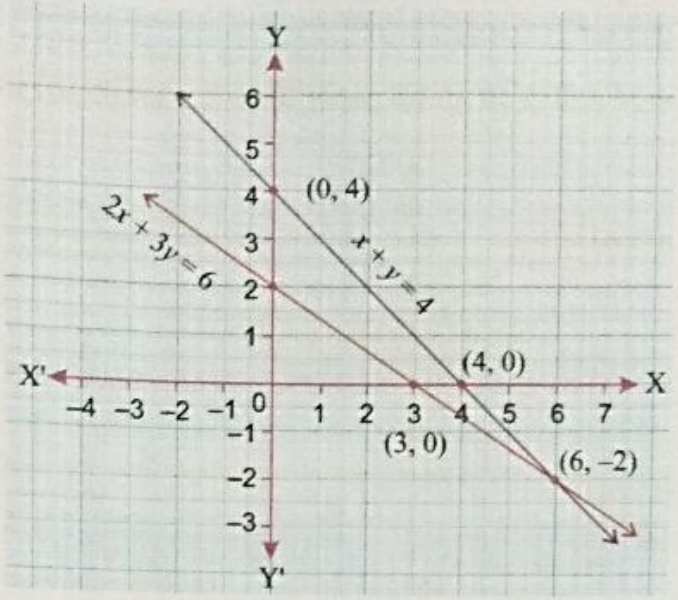

Fig. 3.1

4. Take the second pair of linear equations *i.e.*, (ii) and find the ordered pairs (x, y) for each of the two equations.

Table for $2x + 3y = 6$.

x	0	3	6
y	2	0	–2
(x, y)	(0,2)	(3,0)	(6,–2)

Table for $4x + 6y = 12$.

x	0	3	6
y	2	0	–2
(x, y)	0, 2	3,0	6,–2

5. By plotting the points (ordered pairs) on graph paper draw the graph of two equations.

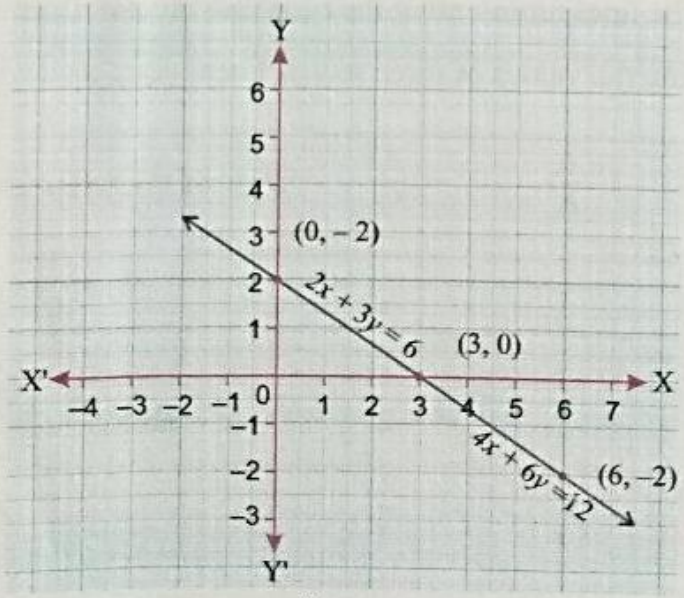

Fig. 3.2

6. Now, take third pair of (iii) linear equations and make a table of ordered pairs (x, y) for each of the two equations.

For $2x + 3y = 6$

x	0	3	–3
y	2	0	4

OBSERVATIONS

Observations

1. From Fig. 3.1, we notice that the two lines representing the equations intersect at a point (6,–2) so the two equations have a unique solution, namely $x = 6, y = -2$.
2. From Fig. 3.2, we observe that the two lines representing the equations are same so the lines have many points common and have infinite number of solutions.
3. From Fig. 3.3, we see that the lines representing the equations are parallel and they have no common points.
4. Prepare a table by comparing the values of three sets of linear equations with $\frac{a_1}{a_2}, \frac{b_1}{b_2}$ and $\frac{c_1}{c_2}$.

S.No.	$\frac{a_1}{a_2}$	$\frac{b_1}{b_2}$	$\frac{c_1}{c_2}$	Pair of lines representing the equations are
1st set of equations	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{2}{3}$	Intersecting
2nd set of equations	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	Coincident
3rd set of equations	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{4}$	Parallel

CONCLUSION

Results

1. For intersecting lines $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$.
2. For coincident lines $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$.
3. For parallel lines $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$.

Thus, the condition for consistency of a system of linear equations in two variables is verified.