Pair of Linear Equations in Two Variables

Question 1. Solve the following systems of equations: i) x - 2y = 0; 3x + 4y = 20

Answer:

- i) x 2y = 0;
- -2y = -x
- $y = \frac{x}{2}$

$$3x + 4y = 20$$

 $4y = 20 - 3x$
 $y = \frac{20 - 3x}{4}$

20

	$\mathbf{x} - 2\mathbf{y} = 0$				
x	$y = \frac{x}{2}$	x, y			
0	0	(0, 0)		3x + 4y = 20	
2	$\frac{2}{2}=1$	(2, 1)	x	$y = \frac{20 - 3x}{4}$	x, y
4	$\frac{4}{2}=2$	(4, 2)	0	$\frac{20-3\cdot 0}{4}=5$	(0, 5)
- 6	$\frac{-6}{2} = -3$	(- 6, - 3)	4	$\frac{20-3\cdot 4}{4}$	
- 8	$\frac{-8}{2} = -4$	(- 8, - 4)][$=\frac{20-12}{4}=\frac{8}{4}$	= 2 (4, 2)



The two lines meet at (4, 2). The solution set is {(4, 2)}

ii) x + y = 2 2x + 2y = 4 **Answer:** x + y = 2

2x + 2y = 4

a	x + y =	2	2x + 2y = 4		
x	у	(x, y)	x	у	(x, y)
0	2	(0, 2)	0	2	(0, 2)
1	1 0	(1, 1)	1	1	(1, 1)
2	0	(2, 0)	2	0	(2, 0)
3	- 1	(3, - 1)	3	- 1	(3, -1)



These two are coincident lines.

 \therefore There are infinitely many solutions.

iii) 2x - y = 44x - 2y = 6**Answer:**

2x - y = 4 $\Rightarrow y = 2x - 4$

4x - 2y = 6			
$\Rightarrow 2y = 4x -$	$6 \Rightarrow y =$	2x –	3

$2\mathbf{x} - \mathbf{y} = 4$						
x	y = 2x - 4	(x, y)				
0	- 4	(0, - 4)				
2	0	(2, 0)				
1	- 2	(1, - 2)				
1	-6	(-1, -6)				

$4\mathbf{x} - 2\mathbf{y} = 6$					
x	y = 2x - 3	(x, y)			
0	- 3	(0, -3)			
2	1	(2, 1)			
1	- 1	(1, -1)			
3	3	(3, 3)			



These two are parallel lines.

 \therefore The pair of linear equations has no solution.

Question 2. Two rails of a railway track are represented by the equations. x + 2y - 4 = 0 and 2x + 4y - 12 = 0. Represent this situation graphically. (Page No. 79)

Answer:

$$x + 2y - 4 = 0$$

$$2y = 4 - x$$

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

$$x + 2y - 4 = 0$$

x	$y = \frac{4-x}{2}$	(x, y)
0	2	(0, 2)
4	0	(4, 0)
2	1	(2, 1)
6	-1	(6, -1)

$$2x + 4y - 12 = 0$$

$$4y = 12 - 2x \text{ (or) } 4y = 2 (6 - x)$$

$$y = \frac{6-x}{2}$$

$$2x + 4y - 12 = 0$$

x	$y = \frac{6 - x}{2}$	(x, y)
0	3	(0, 3)
2	2	(2, 2)
6	0	(6, 0)



These lines are parallel and hence no solution.

Question 3. Check each of the given systems of equations to see if it has a unique solution, infinitely many solutions or no solution. Solve them graphically. (Page No. 83)

i) 2x + 3y = 1

3x - y = 7 **Answer:** Let $a_1x + b_1y - c_1 = 0 \approx 2x + 3y - 1 = 0$ $a_2x + b_2y + c_2 = 0 \approx 3x - y - 7 = 0$ Now comparing their coefficients i.e., $\frac{a_1}{a_2}$ and $\frac{b_1}{b_2}$

 $\Rightarrow \frac{2}{3} \neq \frac{3}{-1}$

The given lines are intersecting lines.

$$2x + 3y = 1$$

$$3y = 1 - 2x$$

$$y = \frac{1 - 2x}{3}$$

$$3x - y = 7$$

$$y - 3x = 7$$

(0)	2x + 3y =	:1 (3x - y - 7 =	= 0
x	$y = \frac{1 - 2x}{3}$	(x, y)	x	y = 3x - 7	(x, y)
5	- 3	(5, - 3)	0	- 7	(0, - 7)
- 1	1	(-1, 1)	3	2	(3, 2)



The system of equations has a unique solution (2, – 1).

ii) x + 2y = 62x + 4y = 12**Answer:** From the given pair of equations,

$$\begin{array}{rcl} \frac{a_1}{a_2} &=& \frac{1}{2} \\ \frac{b_1}{b_2} &=& \frac{2}{4} \\ \frac{c_1}{c_2} &=& \frac{6}{12} \\ \vdots \\ \frac{a_1}{a_2} &=& \frac{b_1}{b_2} \\ \end{array} = \begin{array}{r} \frac{c_1}{c_2} \\ \frac{c_1}{c_2}$$

\therefore The lines are dependent and have infinitely many solutions.

x + 2y = 6	2x + 4y = 12
2y = 6 - x	4y = 12 - 2x (or) $4y = 2(6 - x)$
$y = \frac{6-x}{2}$	$y = \frac{12 - 2x}{4}$ or $y = \frac{6 - x}{2}$

$\mathbf{x} + 2\mathbf{y} = 6$			2x + 4y = 12			
x	$y = \frac{6-x}{2}$	(x, y)	×	$y = \frac{12 - 2x}{4}$	(x, y)	
0	3	(0, 3)	0	3	(0, 3)	
6	0	(6, 0)	6	0	(6, 0)	



iii) 3x + 2y = 66x + 4y = 18**Answer:** From the given pair of equations,

$$\frac{a_1}{a_2} = \frac{3}{6} = \frac{1}{2};$$

$$\frac{b_1}{b_2} = \frac{2}{4} = \frac{1}{2};$$

$$\frac{c_1}{c_2} = \frac{6}{18} = \frac{1}{3};$$

$$\therefore \frac{a_1}{a_2} = \frac{b_1}{b_2}$$

 \div The lines are parallel and hence no solution.

$$3x + 2y = 6
2y = 6 - 3x
y = \frac{6 - 3x}{2}$$

$$6x + 4y = 18
4y = 18 - 6x
y = \frac{18 - 6x}{4}$$

	3x + 2y = 6			6x + 4y = 18		
x	$y = \frac{6 - 3x}{2}$	(x, y)	x	$y = \frac{18 - 6x}{4}$	(x, y)	
0	3	(0, 3)	3	0	(3, 0)	
2	0	(2, 0)	-1	6	(- 1, 6)	



Question 4. Mark the correct option in the following **Question**s: Which of the following equations is not a linear equation?

a) 5 + 4x = y + 3
b) x + 2y = y - x
c) 3 - x = y² + 4
d) x + y = 0
Answer: [c]

Question 5. Which of the following is a linear equation in one variable?

a) 2x + 1 = y - 3
b) 2t - 1 = 2t + 5
c) 2x - 1 = x²
d) x² - x + 1 = 0
Answer: [b]