PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

CROSS MULTIPLICATION METHOD

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Step–I: Obtain the two equation:

 $a_1x + b_1y + c_1 = 0;$

$$a_2x + b_2y + c_2 = 0$$

Step-II:



The down arrows (>>>) shows the term with a plus sign and up arrows (>>>) shows the term with a negative sign.

Then the solution is given by

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{y}{c_1a_2 - c_2a_1} = \frac{1}{a_1b_2 - a_2b_1}$$

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{-y}{a_1c_2 - c_1a_2} = \frac{1}{a_1b_2 - a_2b_1}$$

Ex.1 Solve the following system of equations by cross-multiplication method.

$$2x + 3y + 8 = 0$$

$$4x + 5y + 14 = 0$$

Sol. The given system of equations is

$$2x + 3y + 8 = 0$$

$$4x + 5y + 14 = 0$$

By cross-multiplication, we get

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$$\frac{x}{3} \frac{x}{\sqrt{14}} = \frac{-y}{4} \frac{-y}{\sqrt{14}} = \frac{1}{2} \frac{1}{\sqrt{35}}$$

$$\Rightarrow \frac{x}{3 \times 14 - 5 \times 8} = \frac{-y}{2 \times 14 - 4 \times 8} = \frac{1}{2 \times 5 - 4 \times 3}$$

$$\Rightarrow \frac{x}{42 - 40} = \frac{-y}{28 - 32} = \frac{1}{10 - 12}$$

$$\Rightarrow \frac{x}{2} = \frac{-y}{-4} = \frac{1}{-2}$$

$$\Rightarrow \frac{x}{2} = -\frac{1}{2}$$

$$\Rightarrow x = -1$$
and $\frac{-y}{-4} = -\frac{1}{2} \Rightarrow y = -2$.
Hence, the solution is $x = -1$, $y = -2$

We can verify the solution.

Ex.2 Solve the follownig system of equations by the method of cross-multiplication.

2x - 6y + 10 = 03x - 7y + 13 = 0

Sol. The given system of equations is

$$2x - 6y + 10 = 0 \qquad \dots (1)$$

$$3x - 7y + 13 = 0 \qquad \dots (2)$$

By cross-multiplication, we have

$$\frac{x}{_{-7}^{-6} \times \frac{10}{13}} = \frac{-y}{_{2}^{2} \times \frac{10}{13}} = \frac{1}{_{2}^{2} \times \frac{-6}{_{-7}}}$$

$$\Rightarrow \frac{x}{_{-6 \times 13 - (-7) \times 10}} = \frac{-y}{_{2 \times 13 - 3 \times 10}}$$

$$= \frac{1}{_{2 \times (-7) - 3 \times (-6)}}$$

$$\Rightarrow \frac{x}{_{-78 + 70}} = \frac{-y}{_{26 - 30}} = \frac{1}{_{-14 + 18}}$$

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 $\Rightarrow \frac{x}{-8} = \frac{-y}{-4} = \frac{1}{4}$ $\Rightarrow \frac{x}{-8} = \frac{1}{4}$ $\Rightarrow x = -2$ $\Rightarrow \frac{-y}{-4} = \frac{1}{4}$ $\Rightarrow y = 1$

Hence, the solution is x = -2, y = 1

Ex.3 Solve the following system of equations by the method of cross-multiplication.

11x + 15y = -23; 7x - 2y = 20

Sol. The given system of equations is

11x + 15y + 23 = 07x - 2y - 20 = 0

Now, by cross-multiplication method, we have

$$\frac{x}{15} \frac{-y}{23} = \frac{-y}{11} \frac{1}{1} \frac{1}{1} \frac{1}{7} \frac{15}{7-2}$$

$$\Rightarrow \frac{x}{15 \times (-20) - (-2) \times 23} = \frac{-y}{11 \times (-20) - 7 \times 23}$$

$$= \frac{1}{11 \times (-2) - 7 \times 15}$$

$$\Rightarrow \frac{x}{-300 \cdot 46} = \frac{-y}{-220 \cdot 161} = \frac{1}{-22 - 105}$$

$$\Rightarrow \frac{x}{-254} = \frac{-y}{-381} = \frac{1}{-127}$$

$$\Rightarrow \frac{x}{-254} = \frac{1}{-127} \Rightarrow x = 2$$
and $\frac{-y}{-381} = \frac{1}{-127} \Rightarrow y = -3$

Ex.4 Solve 3x + 2y + 25 = 0(i)

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So, solution is x = 5 and y = -20