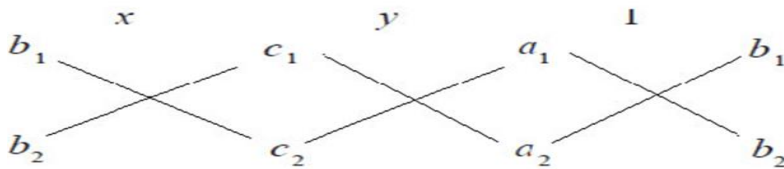## *Linear Equations in two variables*

Cross Multiplication Method

1. Consider that $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ are two equations that need to be solved. By the **method** of **cross-multiplication**, we would find the values of the **x** and y variables

$$a_1x + b_1y + c_1 = 0$$
$$a_2x + b_2y + c_2 = 0$$

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

$$x = \frac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1} \quad \text{and} \quad y = \frac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}$$

Example 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

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{y}{a_2c_1 - a_1c_2} = \frac{1}{a_1b_2 - a_2b_1}$$

Here,

$a_1 = 2, b_1 = 3$, and $c_1 = 8$

$a_2 = 4, b_2 = \ 5$ and $c_2 = 14$

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

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

$$\frac{x}{2} = \frac{y}{16} = \frac{1}{-4}$$

$$\frac{x}{2} = \frac{1}{-4}, \quad \frac{y}{16} = \frac{1}{-4}$$

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

We can verify the solution.