Pair of linear equation in two variables

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Class 10^{th} Maths - Chapter 3

1. On comparing $\frac{a_1}{a_2}$, $\frac{b_1}{b_2}$ $\frac{c_1}{c_2}$ Find out whether the following pair of linear equation are consistent, or inconsistent.

$$5x - 3y = 11; \tag{1}$$
$$-10x + 6y = 22 \tag{2}$$

Solution:
equations can be written as:

$$\begin{pmatrix} 5 & -3 \\ -10 & 6 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 11 \\ 22 \end{pmatrix} \tag{3}$$

$$\tag{4}$$

The values of x and y are:

$$x = \frac{\begin{vmatrix} \mathbf{b} & \mathbf{a_2} \end{vmatrix}}{\begin{vmatrix} \mathbf{a_1} & \mathbf{a_2} \end{vmatrix}} = \frac{\begin{vmatrix} 11 & 22 \\ -3 & 6 \end{vmatrix}}{\begin{vmatrix} 5 & -10 \\ -3 & 6 \end{vmatrix}} = \frac{\begin{vmatrix} 11 \times -3 \end{vmatrix} - \begin{vmatrix} 22 \times 6 \end{vmatrix}}{\begin{vmatrix} 5 \times 6 \end{vmatrix} - \begin{vmatrix} -10 \times -3 \end{vmatrix}} = \frac{66 - 66}{30 - 30} = \frac{0}{0} \tag{5}$$

$$y = \frac{\begin{vmatrix} \mathbf{a_1} & \mathbf{b} \end{vmatrix}}{\begin{vmatrix} \mathbf{a_1} & \mathbf{a_2} \end{vmatrix}} = \frac{\begin{vmatrix} 5 & -10 \\ 11 & 22 \end{vmatrix}}{\begin{vmatrix} 5 & -10 \\ -3 & 6 \end{vmatrix}} = \frac{\begin{vmatrix} 5 \times 22 \end{vmatrix} - \begin{vmatrix} -10 \times 11 \end{vmatrix}}{\begin{vmatrix} 6 \times 5 \end{vmatrix} - \begin{vmatrix} -10 \times -3 \end{vmatrix}} = \frac{-10 + 10}{30 - 30} = \frac{0}{0} \tag{6}$$

The solution derived has infinite solutions as x and y values are zero.