# 1 Problem Statement

Find the equation of the line parallel to the Y-axis drawn through the point of intersection of the lines

$$\begin{pmatrix}1 & -7\end{pmatrix} x = -5 \tag{1}$$
$$\begin{pmatrix}3 & 1\end{pmatrix} x = 0 \tag{2}$$

# 2 Theory

consider the equation of the system of lines

$$x - 7y = -5 \tag{3}$$
$$3x + y = 0 \tag{4}$$

consider the augmented matrix

$$\begin{pmatrix}1 & -7 & -5\\ 3 & 1 & 0\end{pmatrix} \tag{5}$$

By applying row reduction reduction technique

$$\begin{pmatrix}4 & -7 & -5\\ 3 & 1 & 0\end{pmatrix} \xleftrightarrow[R_2 \to R_2/22]{R_2 \to R_2 - 3R_1} \begin{pmatrix}1 & -7 & -5\\ 0 & 1 & \frac{15}{22}\end{pmatrix} \xrightarrow{R_1 \to R_1 + 7R_2} \begin{pmatrix}1 & 0 & \frac{-5}{22}\\ 0 & 1 & \frac{15}{22}\end{pmatrix} \tag{6}$$

$$The value of A = \begin{pmatrix}\frac{-5}{22}\\ \frac{15}{22}\end{pmatrix}; A is the point of intersection. \tag{7}$$

Now the equation of line parallel to y-axis through the point of intersection

$$n^T(x - A) = 0 \tag{8}$$

$$where \vec{n} is the vector normal to the Y - axis and A is the point of intersection.$$

$$n^T x = n^T A; where\ n^T = \begin{pmatrix}1 & 0\end{pmatrix}$$

$$\begin{pmatrix}1 & 0\end{pmatrix} x = \begin{pmatrix}1 & 0\end{pmatrix} \begin{pmatrix}\frac{-5}{22}\\ \frac{15}{22}\end{pmatrix} \tag{9}$$
$$x = \begin{pmatrix}\frac{-5}{22}\end{pmatrix} \tag{10}$$

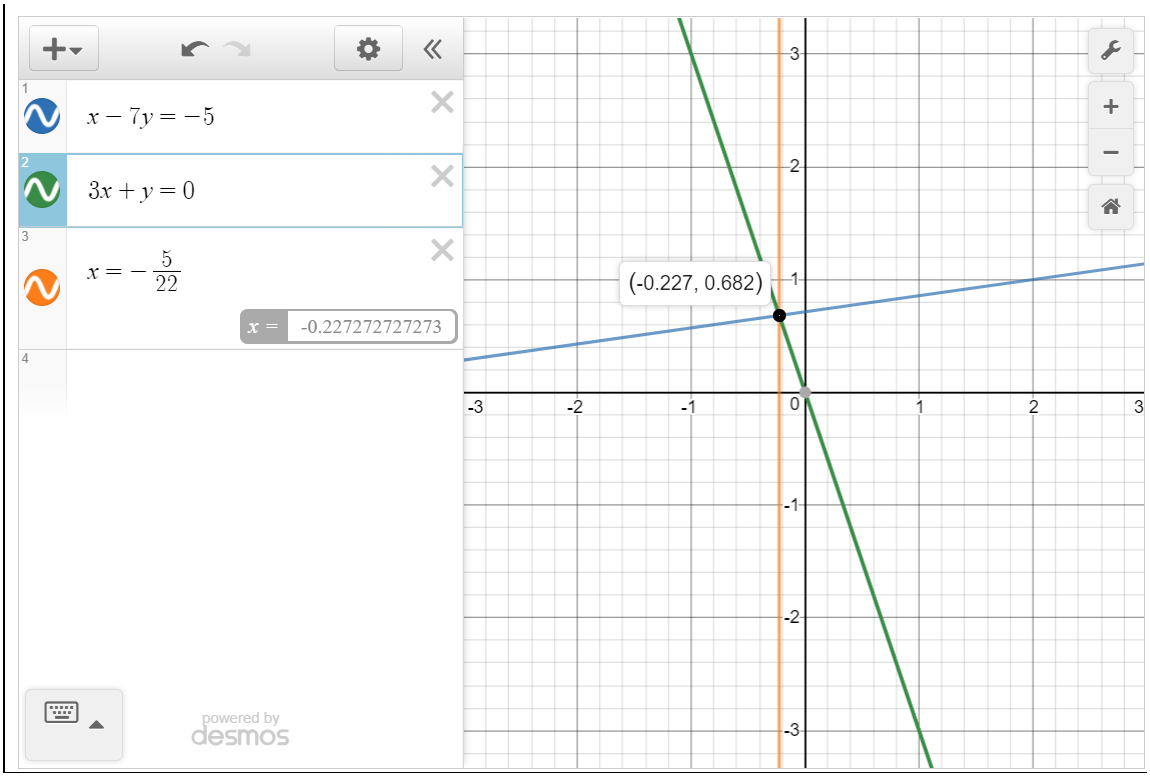


Figure 1: graphical representation of systems of lines