

## 1 Problem Statement

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

$$(1 \quad -7) \mathbf{x} = -5 \quad (1)$$

$$(3 \quad 1) \mathbf{x} = 0 \quad (2)$$

## 2 Theory

consider the equation of the system of lines

$$x - 7y = -5 \quad (3)$$

$$3x + y = 0 \quad (4)$$

consider the augmented matrix

$$\begin{pmatrix} 1 & -7 & -5 \\ 3 & 1 & 0 \end{pmatrix} \quad (5)$$

By applying row reduction technique

$$\begin{pmatrix} 4 & -7 & -5 \\ 3 & 1 & 0 \end{pmatrix} \xrightarrow[R_2 \rightarrow R_2/22]{R_2 \rightarrow R_2 - 3R_1} \begin{pmatrix} 1 & -7 & -5 \\ 0 & 1 & \frac{15}{22} \end{pmatrix} \xrightarrow{R_1 \rightarrow R_1 + 7R_2} \begin{pmatrix} 1 & 0 & \frac{-5}{22} \\ 0 & 1 & \frac{15}{22} \end{pmatrix} \quad (6)$$

The value of  $\mathbf{A}$  is the point of intersection.

$$\mathbf{A} = \begin{pmatrix} \frac{-5}{22} \\ \frac{15}{22} \end{pmatrix}; \quad (7)$$

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

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

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

$$\mathbf{n}^T \mathbf{x} = \mathbf{n}^T \mathbf{A}; \text{ where } \mathbf{n}^T = (1 \quad 0)$$

$$(1 \quad 0) \mathbf{x} = (1 \quad 0) \begin{pmatrix} \frac{-5}{22} \\ \frac{15}{22} \end{pmatrix} \quad (9)$$

$$\mathbf{x} = \begin{pmatrix} \frac{-5}{22} \\ 0 \end{pmatrix} \quad (10)$$

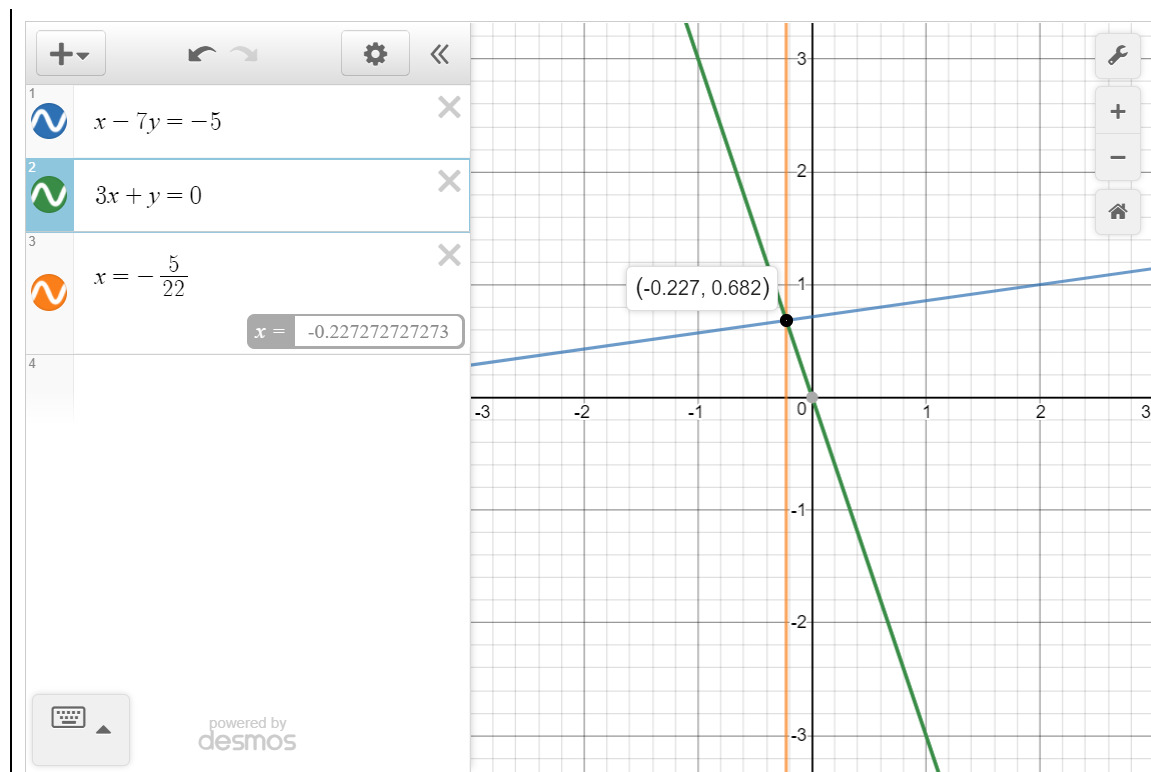


Figure 1: graphical representation of systems of lines  
Shown in figure 1 is the equation of the line parallel to the Y-axis drawn through the point of intersection of the lines