Assignment-1

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Abstract—This assignment finds the equation of the line parallel to the Y-axis drawn through the point of intersection of the lines.

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1 PROBLEM STATEMENT

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

$$\begin{pmatrix} 1 & -7 \end{pmatrix} \mathbf{x} = -5 \tag{1.0.1}$$

$$\begin{pmatrix} 3 & 1 \end{pmatrix} \mathbf{x} = 0 \tag{1.0.2}$$

2 THEORY

consider the equation of the system of lines

$$x - 7y = -5 \tag{2.0.1}$$

$$3x + y = 0 \tag{2.0.2}$$

consider the augmented matrix

$$\begin{pmatrix} 1 & -7 & -5 \\ 3 & 1 & 0 \end{pmatrix} \tag{2.0.3}$$

By applying row reduction reduction technique

$$\begin{pmatrix} 4 & -7 & -5 \\ 3 & 1 & 0 \end{pmatrix} \tag{2.0.4}$$

$$\xrightarrow[R_2 \leftarrow R_2/22]{R_2 \leftarrow R_2 - 3R_1} \begin{pmatrix} 1 & -7 & -5 \\ 0 & 1 & \frac{15}{22} \end{pmatrix} \tag{2.0.5}$$

$$\xrightarrow{R_1 \leftarrow R_1 + 7R_2} \begin{pmatrix} 1 & 0 & \frac{-5}{22} \\ 0 & 1 & \frac{15}{22} \end{pmatrix} \tag{2.0.6}$$

The value of **A** is the point of intersection.

$$\mathbf{A} = \begin{pmatrix} \frac{-5}{22} \\ \frac{15}{22} \end{pmatrix} \tag{2.0.7}$$

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

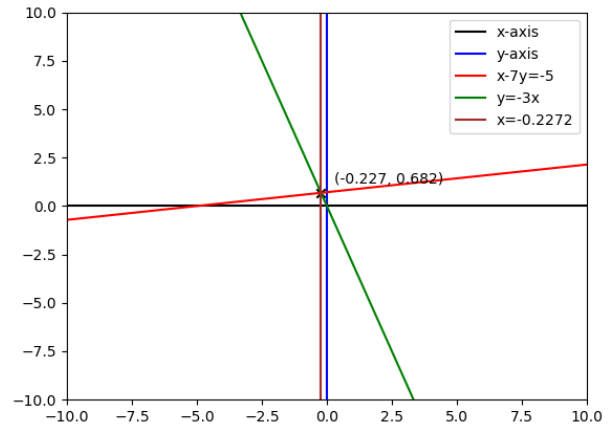$$\mathbf{n}^T (\mathbf{x} - \mathbf{A}) = 0 \tag{2.0.8}$$

Fig. 0: graphical representation of systems of lines
Shown in figure 0 is the equation of the line parallel to the Y-axis drawn through the point of intersection of the lines.

where **n** is the vector normal to the Y - axis and **A** is the point of intersection

$$\mathbf{n}^T \mathbf{x} = \mathbf{n}^T \mathbf{A} \text{ where } \mathbf{n}^T = \begin{pmatrix} 1 & 0 \end{pmatrix} \tag{2.0.9}$$

$$\begin{pmatrix} 1 & 0 \end{pmatrix} \mathbf{x} = \begin{pmatrix} 1 & 0 \end{pmatrix} \begin{pmatrix} \frac{-5}{22} \\ \frac{15}{22} \end{pmatrix} \tag{2.0.10}$$

$$\begin{pmatrix} 1 & 0 \end{pmatrix} \mathbf{x} = -\frac{5}{22} \tag{2.0.11}$$