

# Matrix theory Assignment 1

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**Abstract**—This document explains the equation of the line passing through the point of intersection of the lines that has equal intercepts on the axes

Download all python codes from

<https://github.com/pavanmanesh/EE5609/tree/master/codes>

and latex-tikz codes from

<https://github.com/pavanmanesh/EE5609>

## 1 PROBLEM

Find the equation of the line passing through the point of intersection of the lines

$$(4 \ 7)\mathbf{x} = 3$$

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

that has equal intercepts on the axes

## 2 SOLUTION

Constructing the augmented matrix

$$\begin{pmatrix} 4 & 7 & 3 \\ 2 & -3 & -1 \end{pmatrix}$$

Transforming the matrix into row-echelon form

$$\begin{aligned} &\begin{pmatrix} 4 & 7 & 3 \\ 2 & -3 & -1 \end{pmatrix} \xrightarrow{R2 \leftarrow 2R2 - R1} \\ &\begin{pmatrix} 4 & 7 & 3 \\ 0 & -13 & -5 \end{pmatrix} \xrightarrow{R2 \leftarrow -R2/13, R1 \leftarrow R1/4} \\ &\begin{pmatrix} 1 & 7/4 & 3/4 \\ 0 & 1 & 5/13 \end{pmatrix} \xrightarrow{R1 \leftarrow R1 - 7/4 R2/13} \\ &\begin{pmatrix} 1 & 0 & 2/26 \\ 0 & 1 & 5/13 \end{pmatrix} \quad (2.0.1) \end{aligned}$$

Thus, The point of intersection is at point  $(2/26, 5/13)$  i.e.  $(0.07, 0.38)$

As the required line passes through the point of intersection  $(0.07, 0.38)$  and the intercepts are equal, the intercepts can be written as:

$$\begin{pmatrix} 0.45 \\ 0 \\ 0 \end{pmatrix} \text{ and } \begin{pmatrix} 0 \\ 0.45 \\ 0 \end{pmatrix}$$

we know that the standard equation for the line with intercepts in vector form is ,

$$\mathbf{r} = \mathbf{a} + b\mathbf{t}$$

Based on the intercept details, The line equation in vector form is

$$\mathbf{r} = \begin{pmatrix} 0.45 \\ 0 \\ 0 \end{pmatrix} + t \begin{pmatrix} 0.45 \\ -0.45 \\ 0 \end{pmatrix}$$

Plot of the two lines:

