ASSIGNMENT 1 - EE5600

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***Abstract*—This paper contains solution to problem no 17 of Lines and Planes section. Links to Python codes are available below.**

Download python codes using

https://github.com/rsgirishkumar/Assignment1/codes/

1 Problem

Find m if

$$\begin{pmatrix}2 & 3\end{pmatrix}\mathbf{x} = 11$$
$$\begin{pmatrix}2 & -4\end{pmatrix}\mathbf{x} = -24 \tag{1.0.1}$$
$$\begin{pmatrix}m & -1\end{pmatrix}\mathbf{x} = -3$$

2 Solution

Step1: To Find the solution using

$$\begin{pmatrix}2 & 3\end{pmatrix}\mathbf{x} = 11$$
$$\begin{pmatrix}2 & -4\end{pmatrix}\mathbf{x} = -24$$

To find the solution, check the consistency of equations by using the rank of matrix.

$$N = \begin{pmatrix}2 & 3\\ 2 & -4\end{pmatrix}$$
$$M = \begin{pmatrix}2 & 3 & 11\\ 2 & -4 & -24\end{pmatrix}$$

since rank of matrix N =2 and M =2, there exists a unique solution which is intersection point of two line equations.

To Find the solution,use ratio of determinants methods for x and y and form a 2x2 matrix from above equations to get into Ax=B format.

$$\begin{pmatrix}2 & 3\\ 2 & -4\end{pmatrix}\begin{pmatrix}x\\ y\end{pmatrix} = \begin{pmatrix}11\\ -24\end{pmatrix}$$

As per ratio of determinants,

$$\mathbf{x} = \frac{\begin{vmatrix}11 & 3\\ -24 & -4\end{vmatrix}}{\begin{vmatrix}2 & 3\\ 2 & -4\end{vmatrix}} = \frac{-44+72}{-8-6} = \frac{28}{-14} = -2$$

$$\mathbf{y} = \frac{\begin{vmatrix}2 & 11\\ 2 & -24\end{vmatrix}}{\begin{vmatrix}2 & 3\\ 2 & -4\end{vmatrix}} = \frac{-48-22}{-8-6} = \frac{70}{14} = 5$$

$$\begin{pmatrix}x\\ y\end{pmatrix} = \begin{pmatrix}-2\\ 5\end{pmatrix}$$

On back-substituting the values in 3rd equation i.e.

$$\begin{pmatrix}m & -1\end{pmatrix}\mathbf{x} = -3 \tag{2.0.1}$$

The equation can be re-written as

$$\begin{pmatrix}m & -1\end{pmatrix}\begin{pmatrix}-2\\ 5\end{pmatrix} = -3$$

$$\Rightarrow m = -1 \tag{2.0.2}$$

The solution of all the three equations i.e.

$$\begin{pmatrix}x\\ y\end{pmatrix} = \begin{pmatrix}-2\\ 5\end{pmatrix}$$

can be verified from the plot of vectors as below The vectors of equations are plotted on 2D axes by taking intersecting points on x and y axes respectively.Intersecting points are given in code

https://github.com/rsgirishkumar/Assignment1/codes/assignment1_solution.py

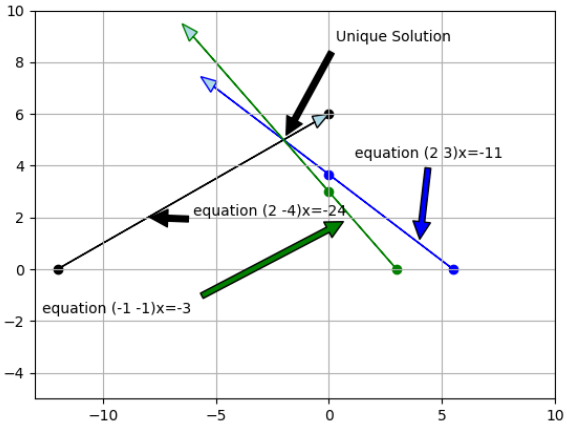

Fig. 0: Three lines intersecting at a point.

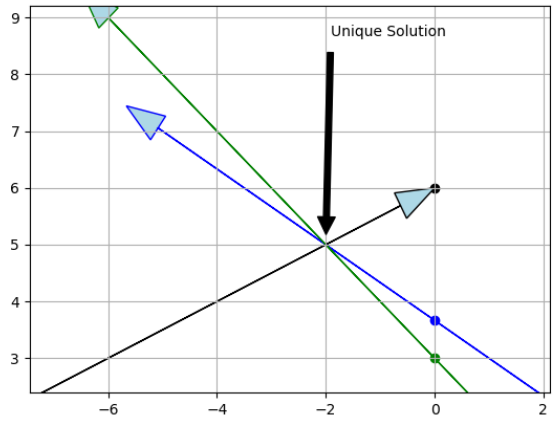

Fig. 0: A Clear view.