

Assignment 1

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Abstract—This document solves a problem from Lines and Planes, where we solve the given pair of linear equations.

Download all python codes from

[https://github.com/priya6971/
matrix_theory_EE5609/tree/master/school/tree/
/master/training/design/codes](https://github.com/priya6971/matrix_theory_EE5609/tree/master/school/tree/master/training/design/codes)

and latex-tikz codes from

[https://github.com/priya6971/
matrix_theory_EE5609/tree/master/school/tree/
/master/training/design](https://github.com/priya6971/matrix_theory_EE5609/tree/master/school/tree/master/training/design)

1 PROBLEM

Solve the following pair of linear equation

$$\begin{pmatrix} 158 & -378 \\ -378 & 152 \end{pmatrix} \mathbf{x} = \begin{pmatrix} -74 \\ -604 \end{pmatrix} \quad (1.0.1)$$

2 EXPLANATION

Let the matrix is \mathbf{A} and \mathbf{b} is the vector. So, $\mathbf{Ax} = \mathbf{b}$. Then we can calculate $\mathbf{x} = \mathbf{A}^{-1} \cdot \mathbf{b}$

$$\mathbf{A} = \begin{pmatrix} 158 & -378 \\ -378 & 152 \end{pmatrix} \quad (2.0.1)$$

$$\mathbf{b} = \begin{pmatrix} -74 \\ -604 \end{pmatrix} \quad (2.0.2)$$

3 SOLUTION

$$\mathbf{A} = \begin{pmatrix} 158 & -378 \\ -378 & 152 \end{pmatrix} \quad (3.0.1)$$

$$\mathbf{b} = \begin{pmatrix} -74 \\ -604 \end{pmatrix} \quad (3.0.2)$$

$$\mathbf{R} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \quad (3.0.3)$$

$$\mathbf{RARAx} = \mathbf{RARb} \quad (3.0.4)$$

$$\mathbf{RARA} = k\mathbf{I} \quad (3.0.5)$$

\mathbf{I} is the Identity Matrix and k is the constant which is equal to 118868 which is shown below

$$k\mathbf{Ix} = \mathbf{RARb} \quad (3.0.6)$$

$$k\mathbf{x} = \mathbf{RARb} \quad (3.0.7)$$

Finally divide the LHS and RHS by constant k in order to get the value of \mathbf{x} . So, by putting the values of \mathbf{R} , \mathbf{A} and \mathbf{b} in equation 3.0.4 we can easily find out the value of \mathbf{x} as follows:

$$\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} 158 & -378 \\ -378 & -152 \end{pmatrix} \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} 158 & -378 \\ -378 & -152 \end{pmatrix} \mathbf{x} \\ = \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} 158 & -378 \\ -378 & -152 \end{pmatrix} \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} -74 \\ -604 \end{pmatrix} \quad (3.0.8)$$

After doing matrix multiplication in LHS and RHS,

$$\begin{pmatrix} 118868 & 0 \\ 0 & 118868 \end{pmatrix} \mathbf{x} = \begin{pmatrix} 239560 \\ 123404 \end{pmatrix} \quad (3.0.9)$$

Now, divide both the rows by 118868:

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \mathbf{x} = \begin{pmatrix} 239560/118868 \\ 123404/118868 \end{pmatrix} \quad (3.0.10)$$

After further calculations in the fractional result:

$$\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} 59890/29717 \\ 30851/29717 \end{pmatrix} \quad (3.0.11)$$