

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

and latex-tikz codes from

https://github.com/priya6971/matrix_theory_EE5609/tree/master/school/tree/master/training/design

1 PROBLEM

Solve the following pair of linear equation

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

2 EXPLANATION

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

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

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

3 SOLUTION

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

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

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

$$RARAx = RARb \quad (3.0.4)$$

$$RARA = kI \quad (3.0.5)$$

I is the Identity Matrix and k is the constant which is equal to 118868 which is shown below

$$kIx = RARb \quad (3.0.6)$$

$$kx = RARb \quad (3.0.7)$$

Finally divide the LHS and RHS by constant k in order to get the value of x. Now as we know

$$Ax = b \quad (3.0.8)$$

$$x = A^{-1} \cdot b \quad (3.0.9)$$

$$A^{-1} = RAR \quad (3.0.10)$$

So, by putting the values of R, A and b in equation 3.0.4 we can easily find out the value of x as follows:

Matrix Multiplication of RA is :

$$\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} 158 & -378 \\ -378 & -152 \end{pmatrix} = \begin{pmatrix} 378 & -152 \\ 158 & -378 \end{pmatrix} \quad (3.0.11)$$

Now, using above resultant matrix RA we can evaluate an equation 3.0.4

$$\begin{pmatrix} 378 & -152 \\ 158 & -378 \end{pmatrix} \begin{pmatrix} 378 & -152 \\ 158 & -378 \end{pmatrix} x = \begin{pmatrix} 378 & -152 \\ 158 & -378 \end{pmatrix} \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} -74 \\ -604 \end{pmatrix} \quad (3.0.12)$$

After doing matrix multiplication in LHS and RHS,

$$\begin{pmatrix} 118868 & 0 \\ 0 & 118868 \end{pmatrix} x = \begin{pmatrix} 239560 \\ 123404 \end{pmatrix} \quad (3.0.13)$$

Now, divide both the rows by 118868:

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} x = \begin{pmatrix} 239560/118868 \\ 123404/118868 \end{pmatrix} \quad (3.0.14)$$

After further calculations in the fractional result:

$$x = \begin{pmatrix} 59890/29717 & 30851/29717 \end{pmatrix} \quad (3.0.15)$$