

# 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

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

## 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

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

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

Augmented Matrix is :  $Ax = b$

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

$RARA x = RAR b$  where  $RARA = kI$ , where I is the Identity Matrix and k is the constant which is equal to 118868 which is shown below

Now as we know  $Ax = b$ ,

$RARA x = RAR b$  But as we know  $RARA = kI$ ,  $kIx = RAR b$  So,  $kx = RAR b$

Finally divide the LHS and RHS by k in order to get the value of x.

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

$RARA x = RAR b$

Matrix Multiplication of RA is :

$$\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} 158 & -378 \\ -378 & -152 \end{pmatrix} = \begin{pmatrix} 378 & -152 \\ 158 & -378 \end{pmatrix} \quad (3.0.4)$$

Now, using above resultant matrix RA we can evaluate  $RARA x = RAR b$

$$\begin{pmatrix} 378 & -152 \\ 158 & -378 \end{pmatrix} \begin{pmatrix} 378 & -152 \\ 158 & -378 \end{pmatrix} x = \begin{pmatrix} 378 & -152 \\ 158 & -378 \end{pmatrix} \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} -74 \\ -604 \end{pmatrix} \quad (3.0.5)$$

After doing matrix multiplication in LHS and RHS,

$$\begin{pmatrix} 118868 & 0 \\ 0 & 118868 \end{pmatrix} x = \begin{pmatrix} 239560 \\ 123404 \end{pmatrix} \quad (3.0.6)$$

Now, divide both the rows by 118868:

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} x = \begin{pmatrix} 239560/118868 \\ 123404/118868 \end{pmatrix} \quad (3.0.7)$$

After further calculations in the fractional result:

$$x = \begin{pmatrix} 59890/29717 \\ 30851/29717 \end{pmatrix} \quad (3.0.8)$$