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

2 Explanation

Let the matrix is A and b is the vector.
So, Ax = b
Then we can calculate x = $A^{-1}.b$
$A = \begin{pmatrix}158 & -378\\ -378 & 152\end{pmatrix}$
$b = \begin{pmatrix}-74\\ -604\end{pmatrix}$

3 Solution

$$A = \begin{pmatrix}158 & -378\\ -378 & 152\end{pmatrix}$$
$$b = \begin{pmatrix}-74\\ -604\end{pmatrix}$$

Augmented Matrix is : Ax = b

Assuming $R = \begin{pmatrix}0 & -1\\ 1 & 0\end{pmatrix}$
Now,multiply R on both sides, we get :
RAx = Rb

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

After multiplication of matrix:
$$\begin{pmatrix}378 & -152\\ -158 & -378\end{pmatrix} x = \begin{pmatrix}604\\ -74\end{pmatrix}$$

Now, multiply the matrix A on both sides,we get:
ARAx = ARb

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

Now, after multiplication of above matrices:
$$\begin{pmatrix}0 & 118,868\\ -118,868 & 0\end{pmatrix} x = \begin{pmatrix}123404\\ -239560\end{pmatrix}$$

Now, both the rows is row/118,868:

$$\begin{pmatrix}0 & 1\\ -1 & 0\end{pmatrix} x = \begin{pmatrix}30851/29717\\ -59890/29717\end{pmatrix}$$

As we know $EE^{-1} = I$,

Now inverse of the $\begin{pmatrix}0 & 1\\ -1 & 0\end{pmatrix}$ is $\begin{pmatrix}0 & -1\\ 1 & 0\end{pmatrix}$

Now multiply with the inverse of the Matrix in order to get the identity Matrix :
$$\begin{pmatrix}0 & -1\\ 1 & 0\end{pmatrix}\begin{pmatrix}0 & 1\\ -1 & 0\end{pmatrix} x = \begin{pmatrix}0 & -1\\ 1 & 0\end{pmatrix}\begin{pmatrix}30851/29717\\ -59890/29717\end{pmatrix}$$

So, final matrix is after matrix multiplication:
$$\begin{pmatrix}1 & 0\\ 0 & 1\end{pmatrix} x = \begin{pmatrix}59890/29717\\ 30851/29717\end{pmatrix}$$

So, final result is :
$$x = \begin{pmatrix}59890/29717 & 30851/29717\end{pmatrix}$$