Assignment No.1

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Download all python codes from

https://github.com/Sekharjala/Assignments/blob/main/code

and pdf from

https://github.com/Sekharjala/Assignments/blob/main/Assignment1.pdf

1 Question No.Matrices 1.76.1

Question : Find equation of line joining (1,2) and (3,6) using determinants.

2 Solution

To construct a line joining $\mathbf{A} = \begin{pmatrix}1\\2\end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix}3\\6\end{pmatrix}$ consider a point C= $\begin{pmatrix}x\\y\end{pmatrix}$ in vector form and $\mathbf{n}$ be the normal vector then

$$\mathbf{n^T A} = 1 \tag{2.0.1}$$

$$\mathbf{n^T B} = 1 \tag{2.0.2}$$

$$\mathbf{n^T C} = 1$$

augmented vector is

$$\begin{pmatrix}1 & 2 & 1\\ 3 & 6 & 1\\ x & y & 1\end{pmatrix}$$

Area of triangle $\Delta ABC is given by$

$$\frac{1}{2}\begin{vmatrix}1 & 1 & 1\\ A & B & C\end{vmatrix}$$

Area Of $\Delta ABC is \det(\Delta ABC) = \frac{1}{2}\begin{vmatrix}1 & 1 & 1\\ 1 & 3 & x\\ 2 & 6 & y\end{vmatrix} = 0$

since A,B,C are collinear

$$1\begin{vmatrix}3 & x\\ 6 & y\end{vmatrix} - 1\begin{vmatrix}1 & x\\ 2 & y\end{vmatrix} + 1\begin{vmatrix}1 & 3\\ 2 & 6\end{vmatrix} = 0$$

1 (3y-6x) -1 (y-2x)+ 1 (6-6)=0 3y-6x-y+2x=0

y-2x=0 $\begin{pmatrix}-2 & 1\end{pmatrix}$ x= 0

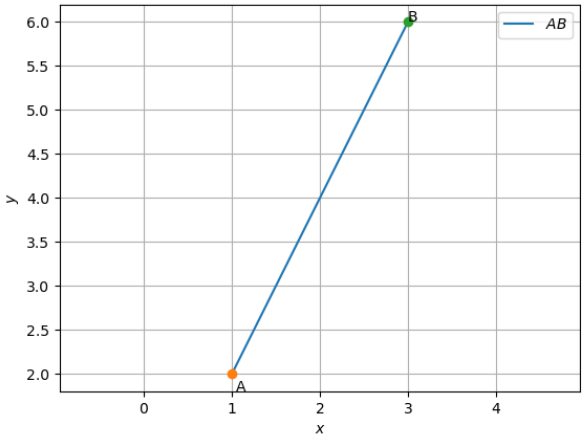

Fig. 0: line formed with points(1,2) and (3,6) using Python

from Equations(2.0.1) and (2.0.2)

$$\mathbf{A}^T\mathbf{n} = 1 \tag{2.0.3}$$

$$\mathbf{B}^T\mathbf{n} = 1 \tag{2.0.4}$$

$$\begin{pmatrix}\mathbf{A}^T\\ \mathbf{B}^T\end{pmatrix} n = \begin{pmatrix}1\\1\end{pmatrix} \tag{2.0.5}$$

$$\mathbf{n} = \begin{pmatrix}\mathbf{A}^T\\ \mathbf{B}^T\end{pmatrix}^{-1}\begin{pmatrix}1\\1\end{pmatrix} \tag{2.0.6}$$

For any Square Matrix X

$$\mathbf{X}^{-1} = \frac{adj\mathbf{X}}{\det\mathbf{X}} \tag{2.0.7}$$

To calculate inverse of matrix the determinant of a matrix should not be zero then unique solution exits

$$\det\begin{pmatrix}\mathbf{A}^T\\ \mathbf{B}^T\end{pmatrix} = \begin{vmatrix}1 & 2\\ 3 & 6\end{vmatrix} = 6 - 6 = 0 \tag{2.0.8}$$

Invese of Matrix dose not exist.

Hence The lines formed with equations(2.0.1)and (2.0.2) have same slope and have infinite solutions