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

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

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

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

augmented vector is

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

Area of triangle $\Delta ABC is given by$

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

Area Of $\Delta ABC is$ det (ΔABC) =

$$\frac{1}{2} \times \begin{vmatrix}1 & 1 & 1\\1 & 3 & x\\2 & 6 & y\end{vmatrix} = 0 \tag{2.0.4}$$

since A,B,C are collinear

$$1\begin{vmatrix}3 & x\\6 & y\end{vmatrix} - 1\begin{vmatrix}1 & x\\2 & y\end{vmatrix} + 1\begin{vmatrix}1 & 3\\2 & 6\end{vmatrix} = 0 \tag{2.0.5}$$

$$1 \times (3y - 6x) - 1 \times (y - 2x) + 1 \times (6 - 6) = 0 \tag{2.0.6}$$

$$3y - 6x - y + 2x = 0 \tag{2.0.7}$$

$$y - 2x = 0 \tag{2.0.8}$$

$$\begin{pmatrix}-2 & 1\end{pmatrix}\mathbf{x} = 0 \tag{2.0.9}$$

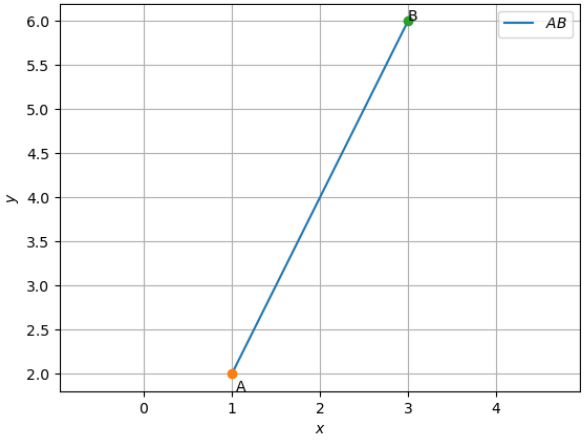

Fig. 0: line formed with points(1,2) and (3,6) using Python

from Equations(2.0.1) and (2.0.2)

$$\mathbf{A}^T \times \mathbf{n} = 1 \tag{2.0.10}$$

$$\mathbf{B}^T \times \mathbf{n} = 1 \tag{2.0.11}$$

so, from Equation (2.0.10) and (2.0.11) the resultant Matrix is

$$\begin{pmatrix}\mathbf{A}^T\\\mathbf{B}^T\end{pmatrix} \times n = \begin{pmatrix}1\\1\end{pmatrix} \tag{2.0.12}$$

$$\mathbf{n} = \begin{pmatrix}\mathbf{A}^T\\\mathbf{B}^T\end{pmatrix}^{-1} \times \begin{pmatrix}1\\1\end{pmatrix} \tag{2.0.13}$$

For any Matrix X

$$\mathbf{X}^{-1} = \frac{adj\mathbf{X}}{\det \mathbf{X}} \tag{2.0.14}$$

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

$$\det\begin{pmatrix}\mathbf{A}^T\\ \mathbf{B}^T\end{pmatrix} = \begin{vmatrix}1 & 2\\ 3 & 6\end{vmatrix} = 6 - 6 = 0 \qquad (2.0.15)$$

Here Determinant is Zero so we can not find Invese of that equations(2.0.1)and (2.0.2) have same slope or have infinite solutions