Assignment 5

Mirha Sidheek

Download all python codes from

https://github.com/mirhasidheek7213/InternshipIITH/tree/main/Assignment−5/Codes

and latex-tikz codes from

https://github.com/mirhasidheek7213/InternshipIITH/blob/main/Assignment−5/Assignment5.tex

1 Question No. 1.77 - Matrices

If the area of the triangle is 35 sq.units with vertices $\begin{pmatrix}2 & -6\end{pmatrix}, \begin{pmatrix}5 & 4\end{pmatrix}, \begin{pmatrix}k & 4\end{pmatrix}$, then k is,

2 Solution

Given the vertices of triangle,

$$\mathbf{A} = \begin{pmatrix}2\\-6\end{pmatrix}, \mathbf{B} = \begin{pmatrix}5\\4\end{pmatrix}, \mathbf{C} = \begin{pmatrix}k\\4\end{pmatrix} \tag{2.0.1}$$

Area of the triangle = 35 sq.units

Area matrix is,

$$\begin{pmatrix}1 & 1 & 1\\ \mathbf{A} & \mathbf{B} & \mathbf{C}\end{pmatrix} \tag{2.0.2}$$

$$= \begin{pmatrix}1 & 1 & 1\\2 & 5 & k\\-6 & 4 & 4\end{pmatrix} \tag{2.0.3}$$

Area of Triangle = $\frac{1}{2} \times \left|AreaMatrix\right|$

$$\implies \frac{1}{2} \times \begin{vmatrix}1 & 1 & 1\\ \mathbf{A} & \mathbf{B} & \mathbf{C}\end{vmatrix} \tag{2.0.4}$$

$$= \frac{1}{2} \times \begin{vmatrix}1 & 1 & 1\\2 & 5 & k\\-6 & 4 & 4\end{vmatrix} \tag{2.0.5}$$

By using coloumn operation,

$$\begin{vmatrix}1 & 1 & 1\\2 & 5 & k\\-6 & 4 & 4\end{vmatrix} \xleftrightarrow[C_2-C_3\to C_2]{C_1-C_3\to C_1} \tag{2.0.6}$$

$$\begin{vmatrix}0 & 0 & 1\\2-k & 5-k & k\\10 & 0 & 4\end{vmatrix} \tag{2.0.7}$$

From cofactor,

$$\begin{vmatrix}2-k & 5-k\\10 & 0\end{vmatrix} \tag{2.0.8}$$

$$Determinant = 10(5-k) \tag{2.0.9}$$

Since area of triangle is half of the determinant of area matrix,

$$\frac{1}{2}10(5-k) = 35 \tag{2.0.10}$$

$$\implies 50 - 10k = 70 \tag{2.0.11}$$

$$\implies k = -2 \tag{2.0.12}$$

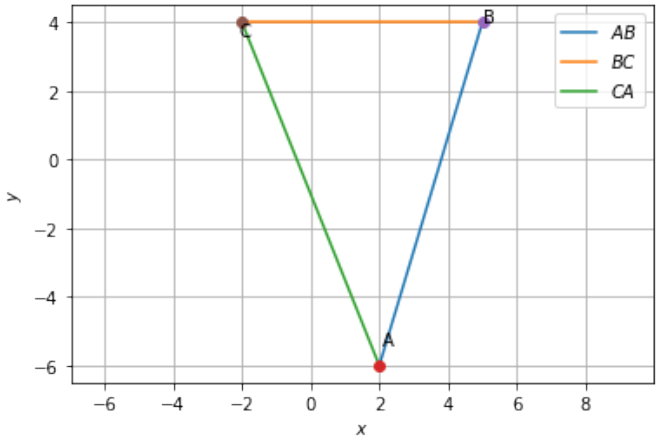

Fig. 0: Plot of the triangle