Assignment 8

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Download all python codes from

https://github.com/ooharapolu/ASSIGNMENT8/Assignment8.py

and latex-tikz codes from

https://github.com/ooharapolu/ASSIGNMENT8/main.tex

1 Question No.VECTORS-2.4

Show that the points $\mathbf{A} = \begin{pmatrix} 2 \\ -1 \\ 1 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 1 \\ -3 \\ -5 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} 3 \\ -4 \\ -4 \end{pmatrix}$ are the vertices of a right angle triangle

2 SOLUTION

The direction vectors of A-B,A-C and B-C are

$$\mathbf{A} - \mathbf{B} = \begin{pmatrix} 2 \\ -1 \\ 1 \end{pmatrix} - \begin{pmatrix} 1 \\ -3 \\ -5 \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \\ -4 \end{pmatrix} \tag{2.0.1}$$

$$\mathbf{A} - \mathbf{C} = \begin{pmatrix} 2 \\ -1 \\ 1 \end{pmatrix} - \begin{pmatrix} 3 \\ -4 \\ -4 \end{pmatrix} = \begin{pmatrix} -1 \\ 3 \\ 5 \end{pmatrix} \tag{2.0.2}$$

$$\mathbf{B} - \mathbf{C} = \begin{pmatrix} 1 \\ -3 \\ -5 \end{pmatrix} - \begin{pmatrix} 3 \\ -4 \\ -4 \end{pmatrix} = \begin{pmatrix} -2 \\ 1 \\ -1 \end{pmatrix} \tag{2.0.3}$$

1)

$$\left(\mathbf{A} - \mathbf{B}\right)^{\top} \left(\mathbf{B} - \mathbf{C}\right) = \begin{pmatrix} 1 \\ 2 \\ -4 \end{pmatrix}^{\top} \begin{pmatrix} -2 \\ 1 \\ -1 \end{pmatrix} \tag{2.0.4}$$

$$= 4 \tag{2.0.5}$$

$$\left(\mathbf{A} - \mathbf{B}\right)^{\top} \left(\mathbf{B} - \mathbf{C}\right) = 4 \neq 0 \tag{2.0.6}$$

Sides $\mathbf{A} - \mathbf{B}$ and $\mathbf{B} - \mathbf{C}$ of triangle are not perpendicular.

2)

$$\left(\mathbf{A} - \mathbf{B}\right)^{\top} \left(\mathbf{A} - \mathbf{C}\right) = \begin{pmatrix} 1 \\ 2 \\ -4 \end{pmatrix}^{\top} \begin{pmatrix} -1 \\ 3 \\ 5 \end{pmatrix} \tag{2.0.7}$$

$$= -15 \tag{2.0.8}$$

$$\left(\mathbf{A} - \mathbf{B}\right)^{\top} \left(\mathbf{A} - \mathbf{C}\right) = -15 \neq 0 \tag{2.0.9}$$

Sides $\mathbf{A} - \mathbf{B}$ and $\mathbf{A} - \mathbf{C}$ of triangle are not perpendicular.

3)

$$\left(\mathbf{A} - \mathbf{C}\right)^{\top} \left(\mathbf{B} - \mathbf{C}\right) = \begin{pmatrix} -1 \\ 3 \\ 5 \end{pmatrix}^{\top} \begin{pmatrix} -2 \\ 1 \\ -1 \end{pmatrix} \tag{2.0.10}$$

$$= 0 \tag{2.0.11}$$

$$\left(\mathbf{A} - \mathbf{C}\right)^{\top} \left(\mathbf{B} - \mathbf{C}\right) = 0 \tag{2.0.12}$$

Sides $\mathbf{A} - \mathbf{C}$ and $\mathbf{B} - \mathbf{C}$ of triangle are perpendicular to each other and the right angle at vertex $\begin{pmatrix} 3 \\ -4 \\ -4 \end{pmatrix}$ and the following figure represents the triangle formed by given points A,B and C PLOT OF GIVEN -

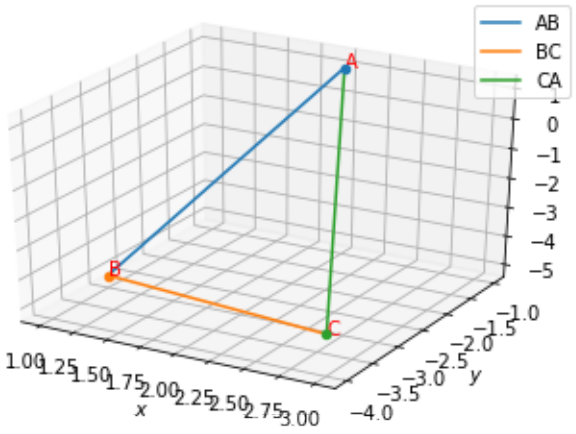

Fig. 3: The right angle triangle