ASSIGNMENT 1

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and latex-tikz codes from

1 Vectors 2.3

Show that the vectors $\begin{pmatrix} 2 \\ -1 \\ 1 \end{pmatrix}, \begin{pmatrix} 1 \\ -3 \\ -5 \end{pmatrix}, \begin{pmatrix} 3 \\ -4 \\ -4 \end{pmatrix}$ form the vertices of a right angled triangle.

2 Solution

Let

$$\mathbf{A} = \begin{pmatrix} 2 \\ -1 \\ 1 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 1 \\ -3 \\ -5 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} 3 \\ -4 \\ -4 \end{pmatrix} \quad (2.0.1)$$

$$(\mathbf{B} - \mathbf{A})^\top (\mathbf{C} - \mathbf{A}) = \begin{pmatrix} -1 & -2 & -6 \end{pmatrix} \begin{pmatrix} 1 \\ -3 \\ -5 \end{pmatrix} \quad (2.0.2)$$

$$= 35 \neq 0 \quad (2.0.3)$$

$$(\mathbf{A} - \mathbf{B})^\top (\mathbf{C} - \mathbf{B}) = \begin{pmatrix} 1 & 2 & 6 \end{pmatrix} \begin{pmatrix} 2 \\ -1 \\ 1 \end{pmatrix} \quad (2.0.4)$$

$$= 6 \neq 0 \quad (2.0.5)$$

$$(\mathbf{A} - \mathbf{C})^\top (\mathbf{B} - \mathbf{C}) = \begin{pmatrix} -1 & 3 & 5 \end{pmatrix} \begin{pmatrix} -2 \\ 1 \\ -1 \end{pmatrix} \quad (2.0.6)$$
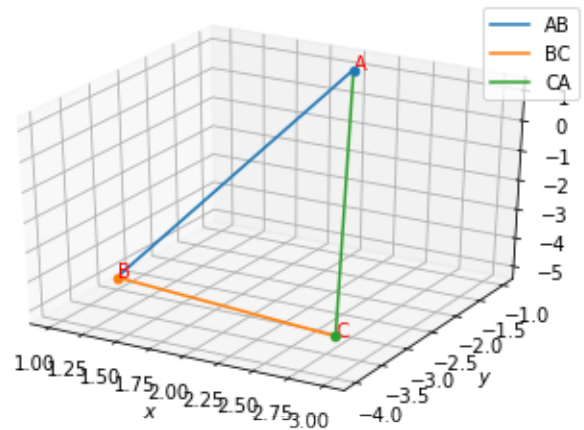
$$= 0 \quad (2.0.7)$$

Hence, $\triangle ABC$ is right angled at C.

Fig. 0: Plot of the triangle