

Assignment1

PARIMISETTY HARINADHA (CS19RESCH11004)

Abstract—This document explains the concept of collinear and whether the triangle formed by given 3 points is right angled triangle or not.

Download all python codes from
<https://github.com/cs19resch11004/5600/hari>
 Download all Latex-tikz codes from
<https://github.com/cs19resch11004/5600/hari>

I. PROBLEM

Without using the Pythagoras theorem, show that $\begin{pmatrix} 4 \\ 4 \end{pmatrix}$, $\begin{pmatrix} 3 \\ 5 \end{pmatrix}$ and $\begin{pmatrix} -1 \\ -1 \end{pmatrix}$ are the vertices of a right angled triangle?

II. SOLUTION

The direction vectors of $\vec{A}-\vec{B}$, $\vec{A}-\vec{C}$ and $\vec{B}-\vec{C}$ are

$$\vec{A}-\vec{B} = \begin{pmatrix} -1 \\ 1 \end{pmatrix} \quad (1)$$

$$\vec{A}-\vec{C} = \begin{pmatrix} -5 \\ -5 \end{pmatrix} \quad (2)$$

$$\vec{B}-\vec{C} = \begin{pmatrix} -4 \\ -6 \end{pmatrix} \quad (3)$$

1)

$$(\vec{A}-\vec{B})^T(\vec{B}-\vec{C}) = \begin{pmatrix} -1 \\ 1 \end{pmatrix} \begin{pmatrix} -4 \\ -6 \end{pmatrix} = -2 \quad (4)$$

$$(\vec{A}-\vec{B})^T(\vec{B}-\vec{C}) = -2 \neq 0$$

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

2)

$$(\vec{A}-\vec{C})^T(\vec{B}-\vec{C}) = \begin{pmatrix} -5 \\ -5 \end{pmatrix} \begin{pmatrix} -4 \\ -6 \end{pmatrix} = 50 \quad (5)$$

$$(\vec{A}-\vec{C})^T(\vec{B}-\vec{C}) = 50 \neq 0$$

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

3)

$$(\vec{A}-\vec{B})^T(\vec{A}-\vec{C}) = \begin{pmatrix} -1 \\ 1 \end{pmatrix} \begin{pmatrix} -5 \\ -5 \end{pmatrix} = 0 \quad (6)$$

$$(\vec{A}-\vec{B})^T(\vec{A}-\vec{C}) = 0$$

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

