Assignment1

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***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. Explanation

Initially we will test whether given 3 points are collinear or not. If they are non-collinear then we will check whether the triangle formed by given 3 points is right angled triangle or not by using one of the follwing 2 methods. 1. Direction vector based method 2. Slope method In this document we are going to use Direction vector based method. Let A, B and C are 3 non-collinear points, then we will test, whether any two of the following Direction vectors A-B and A-C or A-B and B-C or A-C and B-C are perpendicular to each other or not by using DOT PRODUCT.

III. Solution

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

$$A-B=\begin{pmatrix}-1\\1\end{pmatrix} \tag{1}$$

$$A-C=\begin{pmatrix}-5\\-5\end{pmatrix} \tag{2}$$

$$B-C=\begin{pmatrix}-4\\-6\end{pmatrix} \tag{3}$$

1) Testing of A-B and B-C are perpendicular to each other or not? DOT PRODUCT of A-B and B-C is,

$$\begin{pmatrix}-1 & 1\end{pmatrix}.\begin{pmatrix}-4\\-6\end{pmatrix}=-2 \tag{4}$$

A-B . B-C = -2 $\neq$ 0 Sides AB and BC of triangle are not perpendicular.

2) Testing of A-C and B-C are perpendicular to each other or not?
DOT PRODUCT of A-C and B-C is,

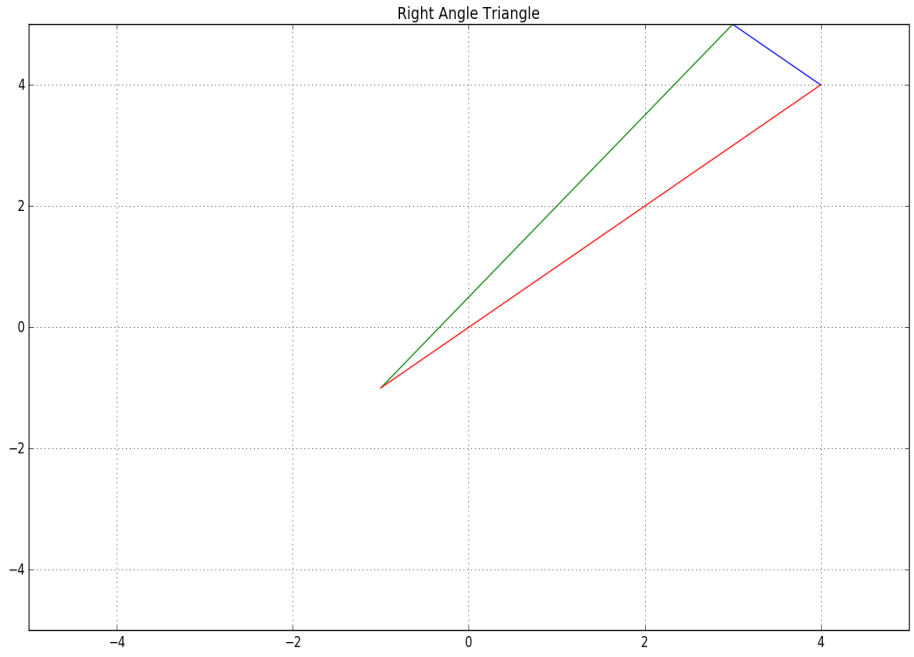
$$\begin{pmatrix}-5 & -5\end{pmatrix}.\begin{pmatrix}-4\\-6\end{pmatrix}=50 \tag{5}$$

A-C . B-C = 50 $\neq$ 0 Sides AC and BC of triangle are not perpendicular.

3) Testing of A-B and A-C are perpendicular to each other or not?
DOT PRODUCT of A-B and A-C is,

$$\begin{pmatrix}-1 & 1\end{pmatrix}.\begin{pmatrix}-5\\-5\end{pmatrix}=0 \tag{6}$$

A-B . A-C, which is 0 Sides AB and AC of triangle are perpendicular to each other. So Triangle ABC is right angled triangle and right angle at vertex $\begin{pmatrix}4\\4\end{pmatrix}$, and the following figure represents the triangle formed by given points A, B and C.


Right Angle Triangle
4
2
0
−2
−4
−4
−2
0
2
4