VECTOR USING PYTHON

SRIKANTH REDDY SURAM

ssrikanthreddy03@gmail.com

FWC220107   IITH Future Wireless Communication (FWC)   ASSIGN-1

Contents

1 Construction

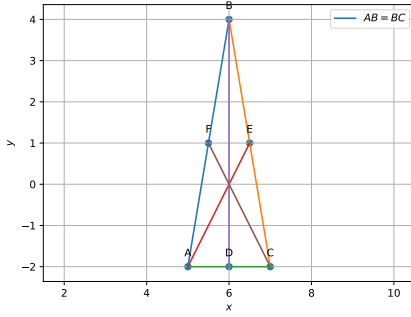
Figure of construction

2 Problem

Check whether $(5, -2), (6, 4)$ and $(7, -2)$ are the vertices of an isosceles triangle.

Show that the points $\begin{pmatrix} 5, -2 \end{pmatrix}$, $\begin{pmatrix} 6, 4 \end{pmatrix}$ and $\begin{pmatrix} 7, -2 \end{pmatrix}$ and vertices of an isosceles triangle.

3 solution

3.1 method 1

Let the given points be $\mathbf{A}, \mathbf{B}, \mathbf{C}$ respectively. Then, the direction vectors of AB, BC and CA are

$$\tag{1}$$

$$\mathbf{A} - \mathbf{B} = \begin{pmatrix} 5 \\ -2 \end{pmatrix} - \begin{pmatrix} 6 \\ 4 \end{pmatrix} = \begin{pmatrix} -1 \\ -6 \end{pmatrix} \tag{2}$$

$$\mathbf{B} - \mathbf{C} = -\begin{pmatrix} 6 \\ 4 \end{pmatrix} - \begin{pmatrix} 7 \\ -2 \end{pmatrix} = \begin{pmatrix} -1 \\ 6 \end{pmatrix} \tag{3}$$

$$\mathbf{C} - \mathbf{A} = \begin{pmatrix} 7 \\ -2 \end{pmatrix} - \begin{pmatrix} 5 \\ -2 \end{pmatrix} = \begin{pmatrix} 2 \\ 0 \end{pmatrix} \tag{4}$$

$$From the above, we find that of EFD \tag{5}$$

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

$$= 37 \tag{7}$$

$$(\mathbf{B} - \mathbf{C})^{\top} (\mathbf{C} - \mathbf{A}) = \begin{pmatrix} -1 & 6 \end{pmatrix} \begin{pmatrix} 2 \\ 0 \end{pmatrix} \tag{8}$$

$$= -2 \tag{9}$$

$$(\mathbf{C} - \mathbf{A})^{\top} (\mathbf{A} - \mathbf{B}) = \begin{pmatrix} 2 & 0 \end{pmatrix} \begin{pmatrix} -1 \\ -6 \end{pmatrix} \tag{10}$$

Thus, the triangle is isosceles triangle.

3.2 method 2

Let the given points be $\mathbf{E}, \mathbf{F}, \mathbf{D}$ respectively. Then, the direction vectors of BD, CF, AE are

From the above, we find that midpoints

$$\mathbf{B} - \mathbf{C} = \begin{pmatrix} 6 \\ 4 \end{pmatrix} - \begin{pmatrix} 7 \\ -2 \end{pmatrix} = \begin{pmatrix} 13/2 \\ 1 \end{pmatrix} \quad (16)$$

$$\mathbf{C} - \mathbf{A} = \begin{pmatrix} 7 \\ -2 \end{pmatrix} - \begin{pmatrix} 5 \\ -2 \end{pmatrix} = \begin{pmatrix} 6 \\ -2 \end{pmatrix} \quad (17)$$

$$\mathbf{A} - \mathbf{B} = \begin{pmatrix} 5 \\ -2 \end{pmatrix} - \begin{pmatrix} 6 \\ 4 \end{pmatrix} = \begin{pmatrix} 11/2 \\ 1 \end{pmatrix} \quad (18)$$

$$(\mathbf{E} - \mathbf{A})^\top (\mathbf{C} - \mathbf{B}) = \begin{pmatrix} 3/2 & 3 \end{pmatrix} \begin{pmatrix} -1 \\ -6 \end{pmatrix} \quad (19)$$

$$\neq 0 \quad (20)$$

$$(\mathbf{F} - \mathbf{C})^\top (\mathbf{B} - \mathbf{A}) = \begin{pmatrix} 3/2 & 3 \end{pmatrix} \begin{pmatrix} 1 \\ 6 \end{pmatrix} \quad (21)$$

$$\neq 0 \quad (22)$$

$$(\mathbf{D} - \mathbf{B})^\top (\mathbf{C} - \mathbf{A}) = \begin{pmatrix} 0 & -6 \end{pmatrix} \begin{pmatrix} 2 \\ 0 \end{pmatrix} \quad (23)$$

$$= 0 \quad (24)$$

$$(\mathbf{B} - \mathbf{D}) \perp (\mathbf{A} - \mathbf{C}) \quad (25)$$

$$\angle BCA = \angle CAB \quad (26)$$

Thus, the triangle is isosceles triangle.