

VECTORE USING PYTHON

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IITH Future Wireless Communication (FWC)

ASSIGN-1

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1 Construction

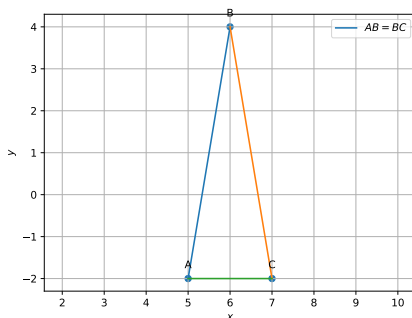


Figure of construction

2 Problem

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

Show that the points $(5, -2)$, $(6, 4)$ and $(7, -2)$ are vertices of an isosceles triangle.

3 solution

1 Let the given points be A, B, C respectively. Then, the direction vectors of AB, BC and CA are

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

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

$$\mathbf{C} - \mathbf{A} = \begin{pmatrix} 7 \\ -2 \end{pmatrix} - \begin{pmatrix} 5 \\ -2 \end{pmatrix} = \begin{pmatrix} 2 \\ 0 \end{pmatrix} \quad (3)$$

From the above, we find that

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

$$= 37 \quad (6)$$

$$(\mathbf{B} - \mathbf{C})^\top (\mathbf{C} - \mathbf{A}) = \begin{pmatrix} -1 & 6 \end{pmatrix} \begin{pmatrix} 2 \\ 0 \end{pmatrix} \quad (7)$$

$$= -2 \quad (8)$$

$$(\mathbf{C} - \mathbf{A})^\top (\mathbf{A} - \mathbf{B}) = \begin{pmatrix} 2 & 0 \end{pmatrix} \begin{pmatrix} -1 \\ -6 \end{pmatrix} \quad (9)$$

$$= -2 \quad (10)$$

From the above equations, (11)

$$(\mathbf{A} - \mathbf{B}) \perp (\mathbf{B} - \mathbf{C}) \quad (12)$$

$$\angle BCA = \angle CAB \quad (13)$$

Thus, the triangle is isosceles triangle.