

## 2.5.34

AI25BTECH11001 - ABHISEK MOHAPATRA

**Question:** Show that the points  $(-2,3)$ ,  $(8,3)$  and  $(6,7)$  are the vertices of a right triangle.

**Solution:** Let

$$\mathbf{A} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 8 \\ 3 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} 6 \\ 7 \end{pmatrix} \quad (1)$$

Finding out the dot product of the vectors representing the sides,

$$(\mathbf{A} - \mathbf{B})^T (\mathbf{C} - \mathbf{B}) = \begin{pmatrix} -10 \\ 0 \end{pmatrix}^T \begin{pmatrix} -2 \\ 4 \end{pmatrix} = 20 + 0 = 20 \quad (2)$$

$$(\mathbf{A} - \mathbf{C})^T (\mathbf{B} - \mathbf{C}) = \begin{pmatrix} -8 \\ -4 \end{pmatrix}^T \begin{pmatrix} 2 \\ -4 \end{pmatrix} = -16 + 16 = 0 \quad (3)$$

$$(\mathbf{B} - \mathbf{A})^T (\mathbf{C} - \mathbf{A}) = \begin{pmatrix} 10 \\ 0 \end{pmatrix}^T \begin{pmatrix} 8 \\ 4 \end{pmatrix} = 80 + 0 = 80 \quad (4)$$

So, it is a right angle triangle with right angle at  $\mathbf{C}$  as the second statement is zero.  
Graph:

