

# Assignment - 1

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## PROBLEM

$$\|\mathbf{A} - \mathbf{B}\| = \|\mathbf{B} - \mathbf{C}\| \neq \|\mathbf{C} - \mathbf{A}\|$$

**Show that the following triad of points form an equilateral triangle**

**$(a,0)$ ,  $(0,2a)$ ,  $(2a,a)$ , axes being inclined at an angle of  $60^\circ$**

So the given triad of points does not form an equilateral triangle.

Answer: A triangle is said to be equilateral if length of all sides are equal.

The given points are:

$$\mathbf{A} = \begin{pmatrix} a \\ 0 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 0 \\ 2a \end{pmatrix}, \mathbf{C} = \begin{pmatrix} 2a \\ a \end{pmatrix}$$

The distance between points A and B,

$$\begin{aligned} \|\mathbf{A} - \mathbf{B}\| &= \begin{pmatrix} a \\ 0 \end{pmatrix} - \begin{pmatrix} 0 \\ 2a \end{pmatrix} = \begin{pmatrix} a \\ -2a \end{pmatrix} \\ &= \sqrt{(a)^2 + (-2a)^2} \end{aligned}$$

$$\|\mathbf{A} - \mathbf{B}\| = \sqrt{5}a$$

Similarly,

$$\begin{aligned} \|\mathbf{B} - \mathbf{C}\| &= \begin{pmatrix} 0 \\ 2a \end{pmatrix} - \begin{pmatrix} 2a \\ a \end{pmatrix} = \begin{pmatrix} -2a \\ a \end{pmatrix} \\ &= \sqrt{(-2a)^2 + (a)^2} \end{aligned}$$

$$\|\mathbf{B} - \mathbf{C}\| = \sqrt{5}a$$

$$\begin{aligned} \|\mathbf{C} - \mathbf{A}\| &= \begin{pmatrix} 2a \\ a \end{pmatrix} - \begin{pmatrix} a \\ 0 \end{pmatrix} = \begin{pmatrix} a \\ a \end{pmatrix} \\ &= \sqrt{(a)^2 + (a)^2} \end{aligned}$$

$$\|\mathbf{C} - \mathbf{A}\| = \sqrt{2}a$$