

Vector Algebra

12th Maths - Chapter 10

This is Problem-3 from Exercise 10.4

1. A girl walks 4 km towards west, then she walk 3 km in a direction 30° east of north and stops. Determine the girl's displacement from her initial point of departure.

Solution: Let initial point, middle point, final point be **A**, **B** and **C** respectively,

$$\mathbf{A} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} -4 \\ 0 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} \cos 60^\circ \\ \sin 60^\circ \end{pmatrix} \quad (1)$$

Now, girl walks 4km towards west **A-B** then,

$$\mathbf{A-B} = \begin{pmatrix} -4 \\ 0 \end{pmatrix} \quad (2)$$

Then girl walks 3 km in the direction 30° east of north

$$\mathbf{B-C} = \begin{pmatrix} 3 \cos 60^\circ \\ 3 \sin 60^\circ \end{pmatrix} \quad (3)$$

$$= \begin{pmatrix} \frac{3}{2} \\ \frac{3\sqrt{3}}{2} \end{pmatrix} \quad (4)$$

By triangle law of vector addition, we have

$$\mathbf{A-C} = \mathbf{A-B} + \mathbf{B-C} \quad (5)$$

$$= \begin{pmatrix} -4 \\ 0 \end{pmatrix} + \begin{pmatrix} \frac{3}{2} \\ \frac{3\sqrt{3}}{2} \end{pmatrix} \quad (6)$$

$$= \begin{pmatrix} \frac{-5}{2} \\ \frac{3\sqrt{3}}{2} \end{pmatrix} \quad (7)$$

Hence, the girl's displacement from her initial point of departure is

$$\begin{pmatrix} \frac{-5}{2} \\ \frac{3\sqrt{3}}{2} \end{pmatrix} \quad (8)$$

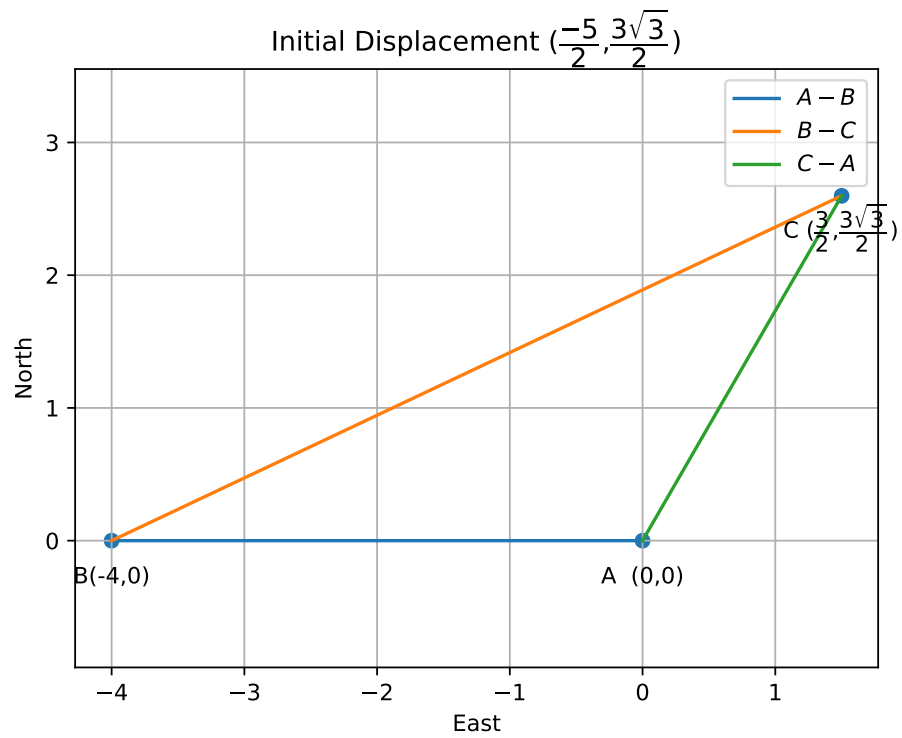


Figure 1