

Assignment 1

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1) In the following figure for the triangle ABC, which of the following is not true:

- (A) $\vec{AB} + \vec{BC} + \vec{CA} = \vec{0}$
 (B) $\vec{AB} + \vec{BC} - \vec{AC} = \vec{0}$
 (C) $\vec{AB} + \vec{BC} + \vec{AC} = \vec{0}$
 (D) $\vec{AB} - \vec{CB} + \vec{CA} = \vec{0}$

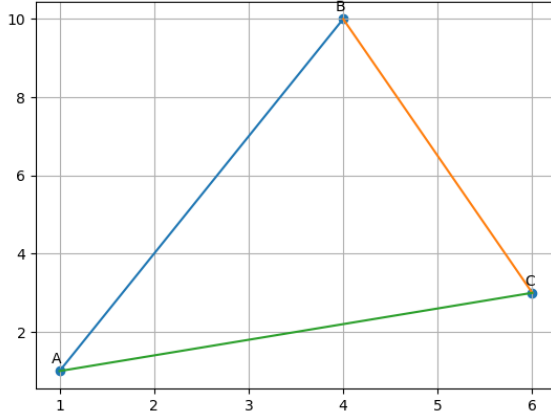


Fig. 1

Solution: We know that,

$$\vec{AB} = \mathbf{B} - \mathbf{A} \quad (0.0.1)$$

$$\vec{BC} = \mathbf{C} - \mathbf{B} \quad (0.0.2)$$

$$\vec{CA} = \mathbf{A} - \mathbf{C} \quad (0.0.3)$$

By using this we verify each of the given option

a)

$$\vec{AB} + \vec{BC} + \vec{CA} = \mathbf{B} - \mathbf{A} + \mathbf{C} - \mathbf{B} + \mathbf{A} - \mathbf{C} \quad (0.0.4)$$

$$= \mathbf{0} \quad (0.0.5)$$

Option A is correct.

b)

$$\vec{AB} + \vec{BC} - \vec{AC} = \mathbf{B} - \mathbf{A} + \mathbf{C} - \mathbf{B} - (\mathbf{C} - \mathbf{A}) \quad (0.0.6)$$

$$= \mathbf{0} \quad (0.0.7)$$

Option B is correct.

c)

$$\vec{AB} + \vec{BC} + \vec{AC} = \mathbf{B} - \mathbf{A} + \mathbf{C} - \mathbf{B} + \mathbf{C} - \mathbf{A} \quad (0.0.8)$$

$$= 2(\mathbf{C} - \mathbf{A}) \quad (0.0.9)$$

Option C is incorrect.

d)

$$\vec{AB} - \vec{CB} + \vec{CA} = \mathbf{B} - \mathbf{A} - (\mathbf{B} - \mathbf{C}) + \mathbf{A} - \mathbf{C} \quad (0.0.10)$$

$$= \mathbf{0} \quad (0.0.11)$$

Option D is correct.

The options A, B, D are correct and the option C is incorrect.

Verification: Let us take an example to verify

$$\mathbf{A} = \begin{pmatrix} 1 \\ 1 \end{pmatrix} \quad (0.0.12)$$

$$\mathbf{B} = \begin{pmatrix} 3 \\ 1 \end{pmatrix} \quad (0.0.13)$$

$$\mathbf{C} = \begin{pmatrix} 6 \\ 6 \end{pmatrix} \quad (0.0.14)$$

$$\vec{AB} = \mathbf{B} - \mathbf{A} = \begin{pmatrix} 2 \\ 0 \end{pmatrix} \quad (0.0.15)$$

$$\vec{BC} = \mathbf{C} - \mathbf{B} = \begin{pmatrix} 3 \\ 5 \end{pmatrix} \quad (0.0.16)$$

$$\vec{CA} = \mathbf{A} - \mathbf{C} = \begin{pmatrix} -5 \\ -5 \end{pmatrix} \quad (0.0.17)$$

$$\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CA} = \begin{pmatrix} 2 + 3 + (-5) \\ 0 + 5 + (-5) \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

(0.0.18)

Similarly other options can be verified.