

Answer on Question #51349 – Math – Vector Calculus

A hiker travels 2.5km due North followed by 4.5km on a bearing 132° . Calculate the distance and bearing of the hiker's final position from his initial position.

Solution

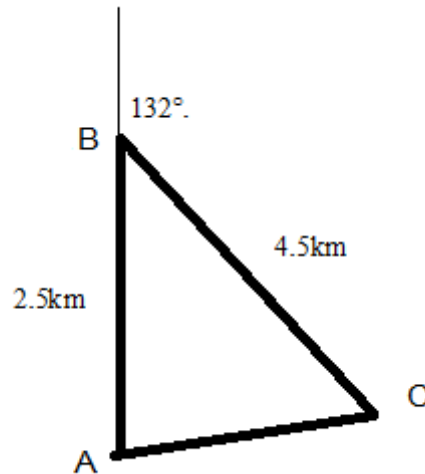


Fig.1

We need to find the angle $\angle BAC$ and distance between points B and C (see Fig.1).

From the figure 1 it is clear that angle $\angle ABC = 180^\circ - 132^\circ = 48^\circ$.

According to the law of cosines, $(AC) = \sqrt{(AB)^2 + (BC)^2 - 2(AB)(BC)\cos(\angle ABC)}$
 $= \sqrt{2.5^2 + 4.5^2 - 2 \cdot 2.5 \cdot 4.5 \cos 38^\circ} = 2.96 \text{ km} .$

According to the law of sines,

$$\frac{BC}{\sin(\angle BAC)} = \frac{AC}{\sin(\angle ABC)} \Rightarrow \sin(\angle BAC) = \frac{BC}{AC} \sin(\angle ABC) \Rightarrow \angle BAC = \arcsin\left(\frac{BC}{AC} \sin(\angle ABC)\right)$$

$\angle BAC = \arcsin\left(\frac{BC}{AC} \sin(\angle ABC)\right) = \arcsin\left(\frac{4.5}{2.96} \sin 38^\circ\right) \approx 69^\circ$, where $\arcsin(x)$ is the inverse of sine function $\sin(x)$.

Answer: the distance is 2.96km and bearing of the hiker's final position from his initial position is 69° .