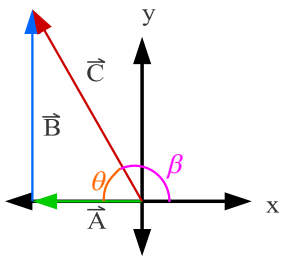
Chapter 2 Problem 38 [†]



Solution
Find the displacement from the starting point.

The first part of the walk is.

$$\vec{A} = -18.0\hat{i}\ m$$

The second part of the walk is.

$$\vec{B} = 25.0\hat{j}\ m$$

The displacement is the vector sum

$$\vec{C} = \vec{A} + \vec{B} = -18.0\hat{i}\ m + \vec{B} = 25.0\hat{j}\ m$$

The magnitude of this vector is.

$$C = \sqrt{C_x^2 + C_y^2} = \sqrt{(-18.0)^2 + (25.0)^2} = \sqrt{949} = 30.8\ m$$

Since the initial values are good to three significant digits, this answer is also good to three significant digits.
The direction of the displacement is obtained by doing trigonometry.

$$\beta = \tan^{-1}\left(\frac{25.0\ m}{-18.0\ m}\right) = -54.3^\circ$$

Since the x-component is negative and the y-component is positive, the answer should be in the 2nd quadrant. The answer given by the calculator implies it is in the 4th quadrant. Therefore, 180° must be added to move the answer into the 2nd quadrant.

$$\beta = -54.3^\circ + 180^\circ = 126^\circ$$

An equally acceptable answer and one that communicates the direction better is to calculate the angle while ignoring the signs on the components.

$$\theta = \tan^{-1}\left(\frac{25.0\ m}{18.0\ m}\right) = 54.3^\circ$$

We have already determined that the vector is in the 2nd quadrant. Since tangent is the ratio of opposite over adjacent sides, the angle θ goes between the negative x-axis and the vector C. The negative x-axis is west and the positive y-axis is north; therefore, the direction is 54.3° north of west.

[†]Problem from University Physics by Ling, Sanny and Moebs (OpenStax)