

Chapter 3 Problem 46 †

Given

$$\vec{A} = 1.0 \text{ m } \angle -35^\circ$$

$$\vec{B} = 1.8 \text{ m } \angle \phi$$

Solution

Find the angle ϕ such that the sum only has a vertical component.

First break each vector into components.

$$\vec{A} = \{A \cos \theta \hat{i} + A \sin \theta \hat{j}\}$$

$$\vec{A} = \{1.0 \cos(-35) \hat{i} + 1.0 \sin(-35) \hat{j}\} \text{ m}$$

$$\vec{A} = \{0.819 \hat{i} - 0.574 \hat{j}\} \text{ m}$$

and

$$\vec{B} = \{B \cos \theta \hat{i} + B \sin \theta \hat{j}\}$$

$$\vec{B} = \{1.8 \cos \phi \hat{i} + 1.8 \sin \phi \hat{j}\} \text{ m}$$

$$\vec{C} = \vec{A} + \vec{B}$$

$$\vec{C} = \{0.819 \hat{i} - 0.574 \hat{j}\} \text{ m} + \{1.8 \cos \phi \hat{i} + 1.8 \sin \phi \hat{j}\} \text{ m}$$

$$\vec{C} = \{(0.819 + 1.8 \cos \phi) \hat{i} + (-0.574 + 1.8 \sin \phi) \hat{j}\} \text{ m}$$

$$\vec{C} = \{0 \hat{i} + C_y \hat{j}\} \text{ m}$$

Therefore,

$$0 = 0.819 + 1.8 \cos \phi$$

Solving for ϕ gives

$$\cos \phi = \frac{-0.819}{1.8}$$

$$\phi = \cos^{-1}\left(\frac{-0.819}{1.8}\right) = 117^\circ$$

†Problem from Essential University Physics, Wolfson