Chapter 5 Problem 22 [†]

Given
$\vec{F}_1 = \frac{75.0}{\sqrt{2}}(\hat{i} - \hat{j})\ N$
$\vec{F}_2 = \frac{150.0}{\sqrt{2}}(\hat{i} - \hat{j})\ N$

Solution
Find the third force that is needed to balance the first two forces.

The sum of all three forces should add up to zero.

$$\vec{F}_1 + \vec{F}_2 + \vec{F}_3 = 0$$

Solving for the third force gives

$$\vec{F}_3 = -\vec{F}_1 - \vec{F}_2$$

Substituting in the provided values gives

$$\vec{F}_3 = -\left(\frac{75.0}{\sqrt{2}}(\hat{i} - \hat{j})\right)\ N - \left(\frac{150.0}{\sqrt{2}}(\hat{i} - \hat{j})\right)\ N$$

$$\vec{F}_3 = \left\{-\frac{75.0}{\sqrt{2}}\hat{i} + \frac{75.0}{\sqrt{2}}\hat{j} - \frac{150.0}{\sqrt{2}}\hat{i} + \frac{150.0}{\sqrt{2}}\hat{j}\right\}\ N$$

$$\vec{F}_3 = \left\{-\frac{225.0}{\sqrt{2}}\hat{i} + \frac{225.0}{\sqrt{2}}\hat{j}\right\}\ N$$

$$\vec{F}_3 = \{-159\hat{i} + 159\hat{j}\}\ N$$

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