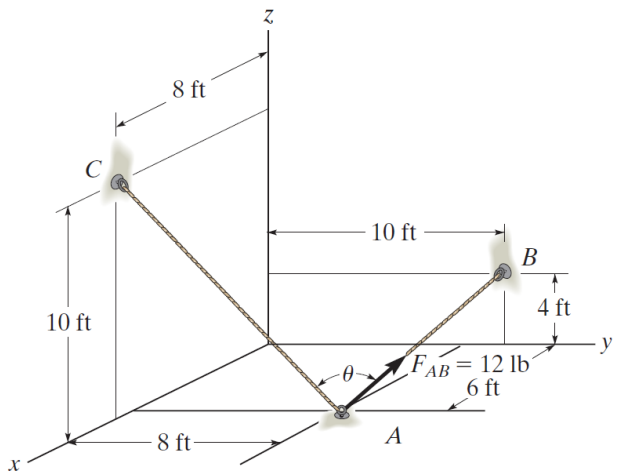
Problem 2-138

Determine the angle θ between the two cables.



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Solution

Write the position vectors to the points A, B, and C.

$$\mathbf{r}_A = \langle 6, 8, 0 \rangle \text{ ft}$$

$$\mathbf{r}_B = \langle 0, 10, 4 \rangle \text{ ft}$$

$$\mathbf{r}_C = \langle 8, 0, 10 \rangle \text{ ft}$$

The unit vector going from A to B is

$$\hat{\mathbf{u}}_{AB} = \frac{\mathbf{r}_B - \mathbf{r}_A}{|\mathbf{r}_B - \mathbf{r}_A|} = \frac{\langle -6, 2, 4 \rangle}{\sqrt{(-6)^2 + (2)^2 + (4)^2}},$$

and the unit vector going from A to C is

$$\hat{\mathbf{u}}_{AC} = \frac{\mathbf{r}_C - \mathbf{r}_A}{|\mathbf{r}_C - \mathbf{r}_A|} = \frac{\langle 2, -8, 10 \rangle}{\sqrt{(2)^2 + (-8)^2 + (10)^2}}.$$

Take the dot product of these unit vectors to find the angle between them.

$$\cos\theta = \hat{\mathbf{u}}_{AB} \cdot \hat{\mathbf{u}}_{AC} = \frac{\langle -6, 2, 4 \rangle}{\sqrt{(-6)^2 + (2)^2 + (4)^2}} \cdot \frac{\langle 2, -8, 10 \rangle}{\sqrt{(2)^2 + (-8)^2 + (10)^2}} = \frac{\sqrt{3}}{14}$$

$$\theta = \cos^{-1}\left(\frac{\sqrt{3}}{14}\right) \approx 82.9^\circ$$