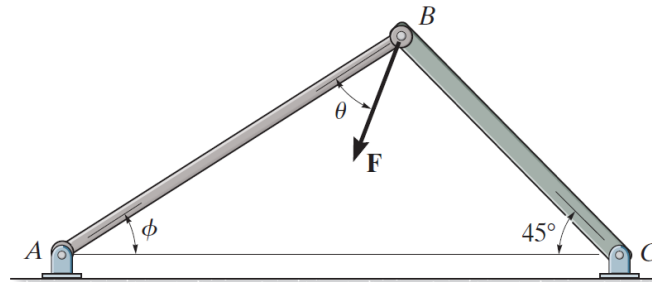


### Problem 2-16

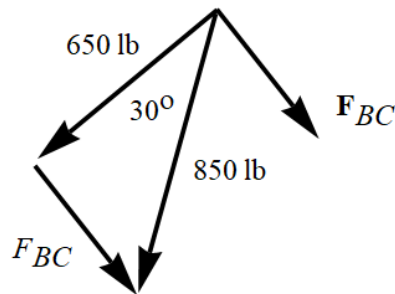
Force  $\mathbf{F}$  acts on the frame such that its component acting along member  $AB$  is 650 lb, directed from  $B$  towards  $A$ . Determine the required angle  $\phi$  ( $0^\circ \leq \phi \leq 45^\circ$ ) and the component acting along member  $BC$ . Set  $F = 850$  lb and  $\theta = 30^\circ$ .



Probs. 2–15/16

### Solution

Draw the triangle formed by the force and its components along members  $AB$  and  $AC$ .



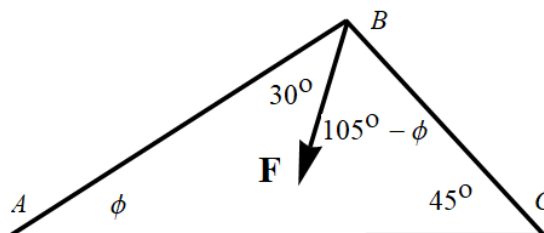
Use the law of cosines to determine the magnitude of the component along member  $BC$ .

$$F_{BC}^2 = 650^2 + 850^2 - 2(650)(850) \cos 30^\circ$$

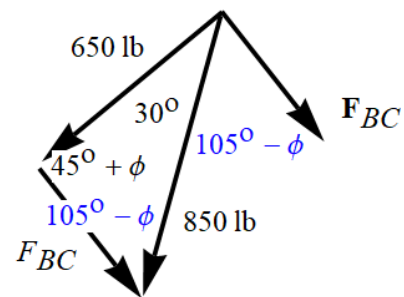
$$F_{BC} = \sqrt{650^2 + 850^2 - 2(650)(850) \cos 30^\circ}$$

$$\approx 434 \text{ lb}$$

The sum of a triangle's angles must be  $180^\circ$ . Use this fact to determine the missing angle.



Include these angles in the previous triangle.



Use the law of sines to determine  $\phi$ .

$$\frac{F_{BC}}{\sin 30^\circ} = \frac{850 \text{ lb}}{\sin(45^\circ + \phi)} \rightarrow \sin(45^\circ + \phi) = \frac{850 \text{ lb}}{F_{BC}} \sin 30^\circ$$

$$45^\circ + \phi \approx 78.5^\circ$$

$$\phi \approx 33.5^\circ$$