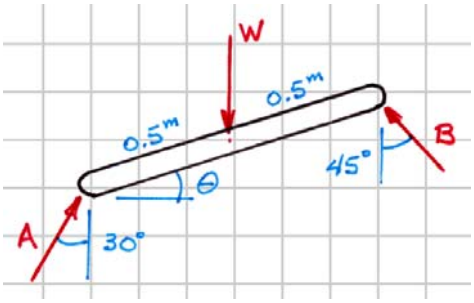
1-42*

The weight of the bar *AB* is

$$W = 25(9.81) = 245.25 \text{ N}$$



From a free-body diagram of the bar *AB*, the equations of equilibrium give

$$\rightarrow \Sigma F_x = 0: \qquad A\sin 30° - B\sin 45° = 0$$

$$\uparrow \Sigma F_y = 0: \qquad A\cos 30° + B\cos 45° - W = 0$$

$$\circlearrowleft \Sigma M_B = 0: \qquad (0.5\cos\theta)W - (1\cos\theta)(A\cos 30°) + (1\sin\theta)(A\sin 30°) = 0$$

Since $\sin 45° = \cos 45°$ adding the first two equations together gives

$$A(\sin 30° + \cos 30°) = W$$

Substituting this result into the third equation gives

$$A(\cos 30°\cos\theta - \sin 30°\sin\theta) = 0.5\cos\theta\left[A(\sin 30° + \cos 30°)\right]$$

Dividing by $A\cos\theta$ gives

$$2(\cos 30° - \sin 30°\tan\theta) = (\sin 30° + \cos 30°)$$

$$\tan\theta = \frac{2\cos 30° - (\sin 30° + \cos 30°)}{2\sin 30°}$$

$\theta = 20.10°$ ..... **Ans.**

(Actually, this result is independent of both the length and weight of the bar.)