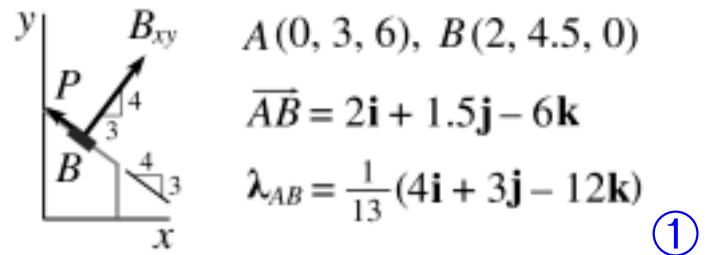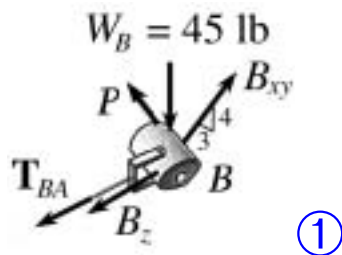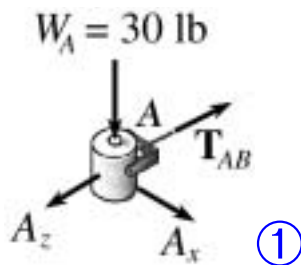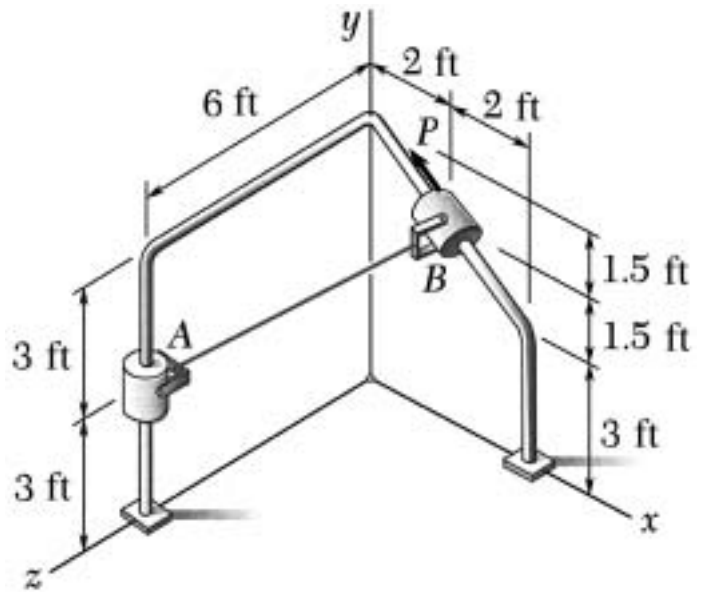# Quiz #3

The weights of collars A and B are $W_A = 30$ lb and $W_B = 45$ lb. If friction is negligible and equilibrium exists, determine (a) the reaction $\mathbf{A}$ exerted on the collar A by the rod, (b) the reaction $\mathbf{B}$ exerted on the collar B by the rod.

$A(0, 3, 6),\ B(2, 4.5, 0)$

$\overrightarrow{AB} = 2\mathbf{i} + 1.5\mathbf{j} - 6\mathbf{k}$

$\lambda_{AB} = \frac{1}{13}(4\mathbf{i} + 3\mathbf{j} - 12\mathbf{k})$ ①

Collar A: $\mathbf{T}_{AB} + \mathbf{A} + \mathbf{W}_A = \mathbf{0}$

$\mathbf{T}_{AB} = \frac{T_{AB}}{13}(4\mathbf{i} + 3\mathbf{j} - 12\mathbf{k})$ $\mathbf{A} = A_x\mathbf{i} + A_z\mathbf{k}$ $\mathbf{W}_A = -30\mathbf{j}$

$\mathbf{i}: \frac{4}{13}T_{AB} + A_x = 0$ $\mathbf{j}: \frac{3}{13}T_{AB} - 30 = 0$ $\mathbf{k}: -\frac{12}{13}T_{AB} + A_z = 0$

We get $T_{AB} = 130$, $A_x = -40$, $A_z = 120$.

$$\therefore \quad \boxed{\mathbf{A} = -40\mathbf{i} + 120\mathbf{k} \text{ lb}} \qquad ③$$

Collar B: $\mathbf{T}_{BA} + \mathbf{B} + \mathbf{W}_B + \mathbf{P} = \mathbf{0}$

$\mathbf{T}_{BA} = -\mathbf{T}_{AB} = \frac{T_{AB}}{13}(-4\mathbf{i} - 3\mathbf{j} + 12\mathbf{k}) = -40\mathbf{i} - 30\mathbf{j} + 120\mathbf{k}$

$\mathbf{B} = \frac{B_{xy}}{5}(3\mathbf{i} + 4\mathbf{j}) + B_z\mathbf{k}$ $\mathbf{W}_B = -45\mathbf{j}$ $\mathbf{P} = \frac{P}{5}(-4\mathbf{i} + 3\mathbf{j})$

$\mathbf{i}: -40 + \frac{3}{5}B_{xy} - \frac{4}{5}P = 0$ $\mathbf{j}: -30 + \frac{4}{5}B_{xy} - 45 + \frac{3}{5}P = 0$ $\mathbf{k}: 120 + B_z = 0$

We get $B_{xy} = 84$, $B_z = 120$, $P = 13$.

$$\therefore \quad \boxed{\mathbf{B} = 50.4\mathbf{i} + 67.2\mathbf{j} - 120\mathbf{k} \text{ lb}} \qquad ④$$