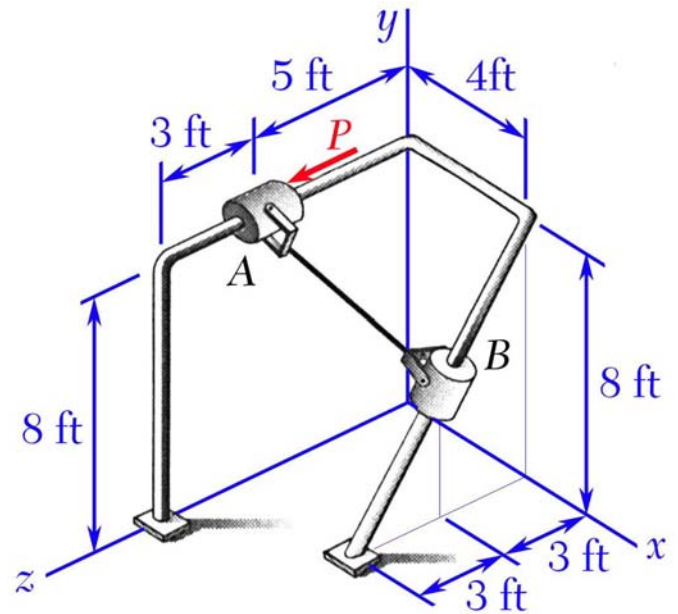


Quiz #3

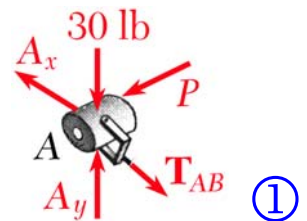
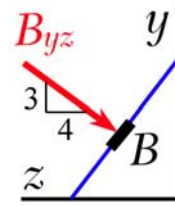
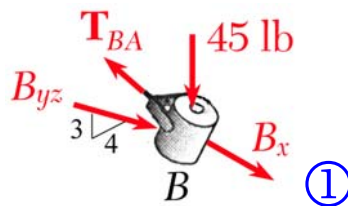
The weights of collars A and B are $W_A = 30$ lb and $W_B = 45$ lb. If friction is negligible and equilibrium exists, determine (a) the reaction **A** exerted on collar A by the rod, (b) the reaction **B** exerted on collar B by the rod.



$$A(0,8,5), B(4,4,3)$$

$$\vec{BA} = \langle -4, 4, 2 \rangle$$

$$\lambda_{BA} = \frac{1}{3} \langle -2, 2, 1 \rangle \quad (1)$$



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

$$\mathbf{T}_{BA} = \frac{T_{BA}}{3}(-2\mathbf{i} + 2\mathbf{j} + \mathbf{k}) \quad \mathbf{B} = B_x\mathbf{i} + \frac{B_{yz}}{5}(-3\mathbf{j} - 4\mathbf{k}) \quad \mathbf{W}_B = -45\mathbf{j}$$

$$\mathbf{i}: -\frac{2}{3}T_{BA} + B_x = 0 \quad \mathbf{j}: \frac{2}{3}T_{BA} - \frac{3}{5}B_{yz} - 45 = 0 \quad \mathbf{k}: \frac{1}{3}T_{BA} - \frac{4}{5}B_{yz} = 0$$

We get $T_{BA} = 108$, $B_x = 72$, $B_{yz} = 45$.

$$\therefore \mathbf{B} = 72\mathbf{i} - 27\mathbf{j} - 36\mathbf{k} \text{ lb} \quad (3)$$

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

$$\mathbf{T}_{AB} = -\mathbf{T}_{BA} = \frac{T_{BA}}{3}(2\mathbf{i} - 2\mathbf{j} - \mathbf{k}) = \frac{108}{3}(2\mathbf{i} - 2\mathbf{j} - \mathbf{k}) = 72\mathbf{i} - 72\mathbf{j} - 36\mathbf{k}$$

$$\mathbf{A} = -A_x\mathbf{i} + A_y\mathbf{j} \quad \mathbf{W}_A = -30\mathbf{j} \quad \mathbf{P} = P\mathbf{k}$$

$$\mathbf{i}: 72 - A_x = 0 \quad \mathbf{j}: -72 + A_y - 30 = 0 \quad \mathbf{k}: -36 + P = 0$$

We get $A_x = 72$, $A_y = 102$, $P = 36$.

$$\therefore \mathbf{A} = -72\mathbf{i} + 102\mathbf{j} \text{ lb} \quad (4)$$