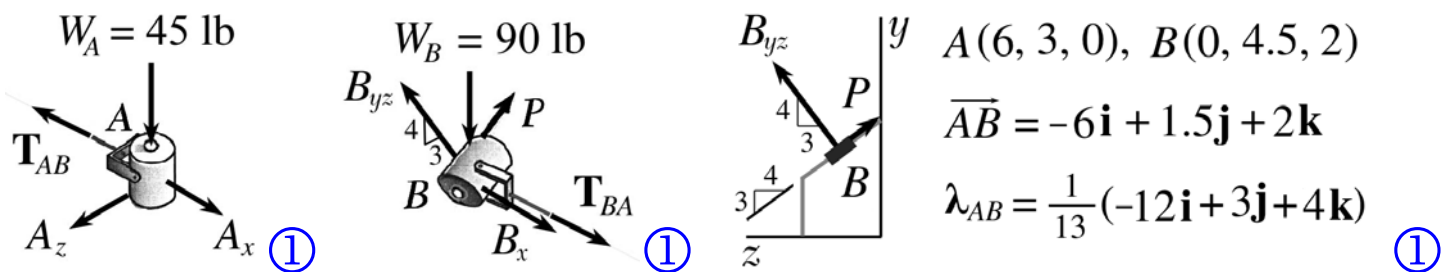
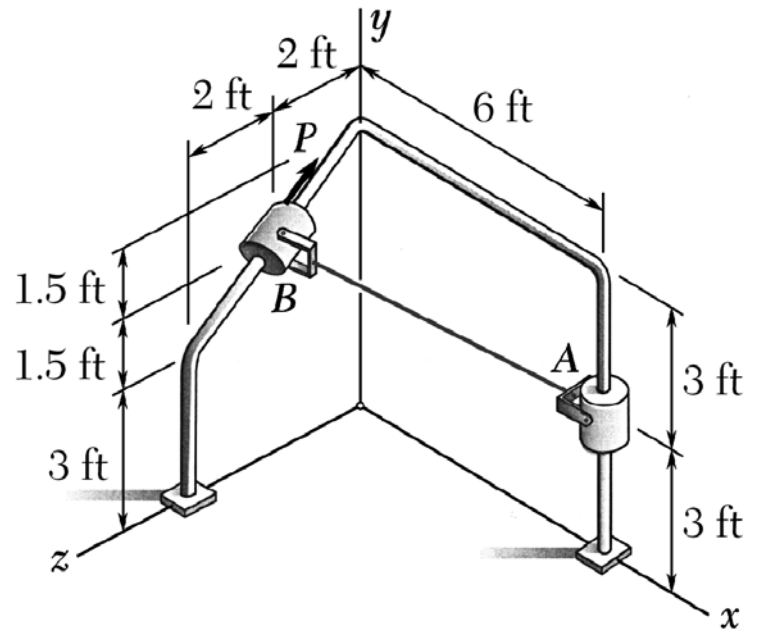


## Quiz #3

The weights of collars A and B are  $W_A = 45$  lb and  $W_B = 90$  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.



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

$$\mathbf{T}_{AB} = \frac{T_{AB}}{13}(-12\mathbf{i} + 3\mathbf{j} + 4\mathbf{k}) \quad \mathbf{A} = A_x\mathbf{i} + A_z\mathbf{k} \quad \mathbf{W}_A = -45\mathbf{j}$$

$$\mathbf{i}: -\frac{12}{13}T_{AB} + A_x = 0 \quad \mathbf{j}: \frac{3}{13}T_{AB} - 45 = 0 \quad \mathbf{k}: \frac{4}{13}T_{AB} + A_z = 0$$

We get  $T_{AB} = 195$ ,  $A_x = 180$ ,  $A_z = -60$ .

$$\therefore \mathbf{A} = 180\mathbf{i} - 60\mathbf{k} \text{ lb} \quad (3)$$

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

$$\mathbf{T}_{BA} = -\mathbf{T}_{AB} = \frac{T_{AB}}{13}(12\mathbf{i} - 3\mathbf{j} - 4\mathbf{k}) = 180\mathbf{i} - 45\mathbf{j} - 60\mathbf{k}$$

$$\mathbf{B} = B_x\mathbf{i} + \frac{B_{yz}}{5}(4\mathbf{j} + 3\mathbf{k}) \quad \mathbf{W}_B = -90\mathbf{j} \quad \mathbf{P} = \frac{P}{5}(3\mathbf{j} - 4\mathbf{k})$$

$$\mathbf{i}: 180 + B_x = 0 \quad \mathbf{j}: -45 + \frac{4}{5}B_{yz} - 90 + \frac{3}{5}P = 0 \quad \mathbf{k}: -60 + \frac{3}{5}B_{yz} - \frac{4}{5}P = 0$$

We get  $B_x = -180$ ,  $B_{yz} = 144$ ,  $P = 33$ .

$$\therefore \mathbf{B} = -180\mathbf{i} + 115.2\mathbf{j} + 86.4\mathbf{k} \text{ lb} \quad (4)$$