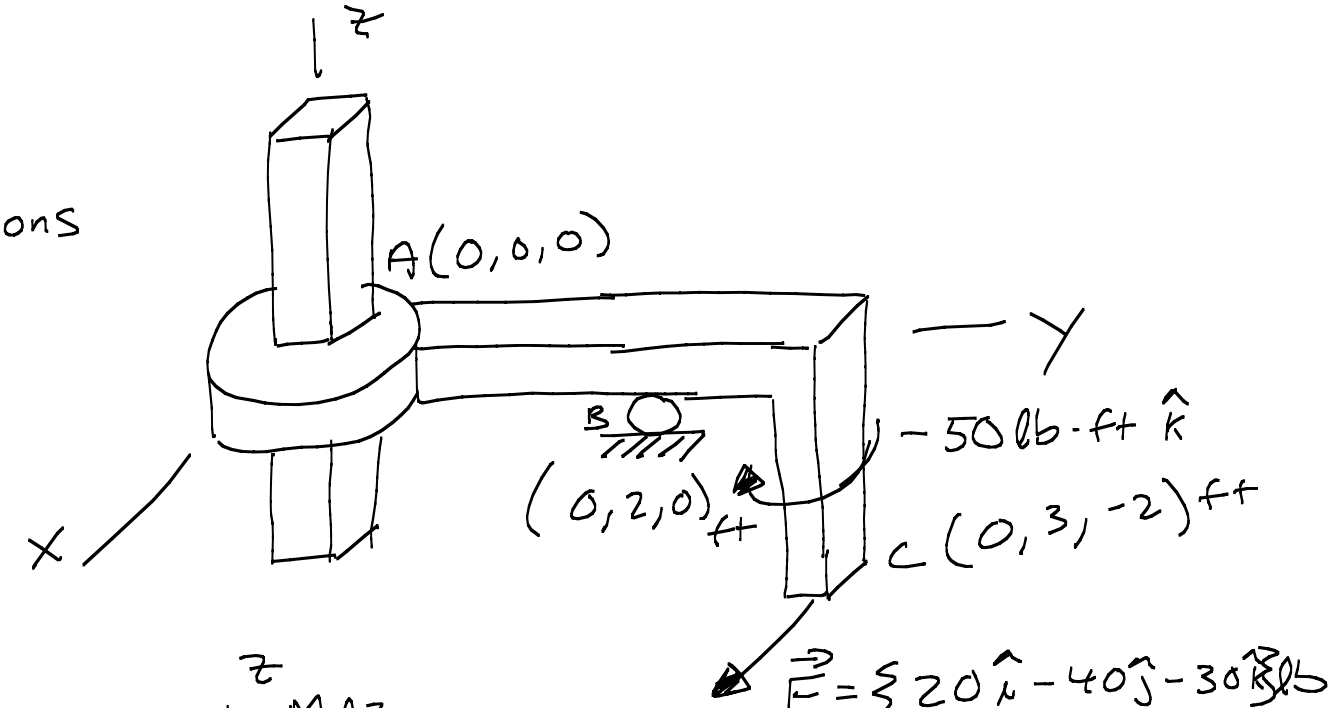
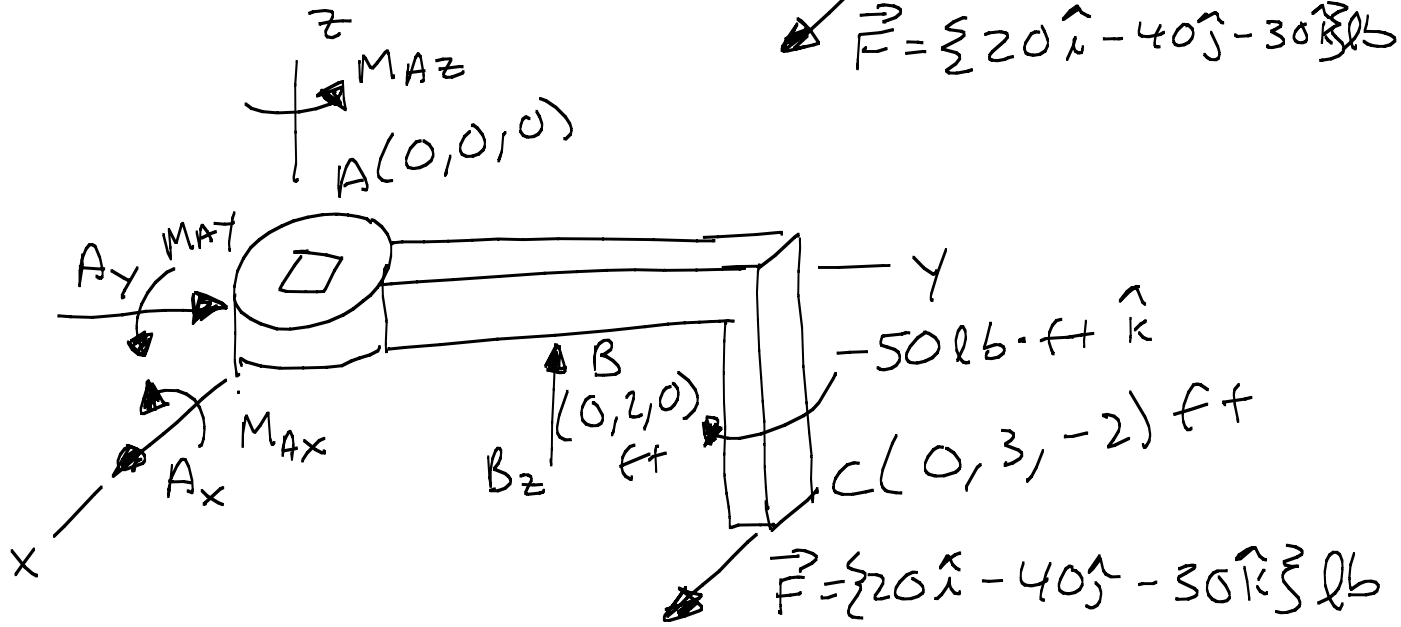
Example

Determine the support reactions





$$\Sigma \vec{F} = 0$$

$$\Sigma F_x = 0 \Rightarrow A_x + 20\,lb = 0 \qquad \boxed{A_x = -20\,lb}$$

$$\Sigma F_y = 0 \Rightarrow A_y - 40\,lb = 0 \qquad \boxed{A_y = 40\,lb}$$

$$\Sigma F_z = 0 \Rightarrow B_z - 30\,lb = 0 \qquad \boxed{B_z = 30\,lb}$$

$$\Sigma \vec{M}_A = 0 \Rightarrow M_{Ax}\hat{\imath} + M_{Ay}\hat{\jmath} + M_{Az}\hat{k} + (\vec{r}_{AB} \times \vec{B}_z) + (\vec{r}_{AC} \times \vec{F}) - 50\,lb\cdot ft\,\hat{k}$$

$$(\vec{r}_{AC} \times \vec{F}) = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ 0 & 3 & -2 \\ 20 & -40 & -30 \end{vmatrix} = [(3)(-30) - (-2)(-40)]\hat{\imath} - [0 - (-2)(20)]\hat{\jmath} + [0 - (3)(20)]\hat{k}$$

$$= \{-170\hat{\imath} - 40\hat{\jmath} - 60\hat{k}\}\,lb\cdot ft$$

$$(\vec{r}_{AB} \times \vec{B}_z) = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ 0 & 2 & 0 \\ 0 & 0 & 30 \end{vmatrix} = [(2)(30) - 0]\hat{\imath} + 0\hat{\jmath} + 0\hat{k}$$

$$= 60\hat{\imath}\ lb\cdot ft$$

$$(\Sigma M_A)_x = M_{Ax} - 170 + 60 = 0$$

$$M_{Ax} = 110 \text{ lb} \cdot \text{ft}$$

$$(\Sigma M_A)_y = 0 \Rightarrow M_{Ay} - 40 = 0$$

$$M_{Ay} = 40 \text{ lb} \cdot \text{ft}$$

$$(\Sigma M_A)_z = 0 \Rightarrow M_{Az} - 60 - 50 \text{ lb} \cdot \text{ft} = M_{Az} = 110 \text{ lb} \cdot \text{ft}$$