"5-16. Determine the tension in the cable and the horizontal and vertical components of reaction of the pin A. The pulley at D is frictionless and the cylinder weighs 80 lb.

\[ \sum F_y = 0; \quad A_y + \frac{2}{\sqrt{5}}T + T - 80 = 0 \]  
\[ \sum F_x = 0; \quad A_x - \frac{1}{\sqrt{5}}T = 0 \]  
\[ \sum M_A = 0; \quad 5T + 10\left(\frac{2}{\sqrt{5}}T\right) - 13(80) = 0 \]  
\[ \Rightarrow T = 74.58 \text{ N} \]

By (2)  
\[ A_x = \frac{1}{\sqrt{5}} \left(74.58\right) = 33.35 \text{ N} \]

By (1)  
\[ A_y = 80 - \frac{2}{\sqrt{5}} \left(74.58\right) - 74.58 = -61.29 \text{ lb} \]

*Ay is in opposite direction than what is specified in FBD

\[ T = 74.58 \text{ lb} \]  
\[ A_x = 33.35 \text{ lb} \]  
\[ A_y = -61.29 \text{ lb} \]
5-21. The uniform rod $AB$ has a mass of 40 kg. Determine the force in the cable when the rod is in the position shown. There is a smooth collar at $A$.

\[ \Sigma M_B = 0; \quad 1.5 \cos 60 \cdot (40)(0.81) = 3 \sin 60 \quad (A_x) = 0 \]
\[ A_x = 113.28 \text{ N} \]

\[ \rightarrow \Sigma F_x = 0; \quad -T + A_x = 0 \]
\[ T = A_x = 113.28 \text{ N} \]
5–59. The rod supports a weight of 200 lb and is pinned at its end A. If it is also subjected to a couple moment of 100 lb \cdot ft, determine the angle \( \theta \) for equilibrium. The spring has an unstretched length of 2 ft and a stiffness of \( k = 50 \text{ lb/ft} \).

\[
\begin{align*}
\text{Ax} & \quad 100 \text{ lb} \\
\text{200 lb} & \quad 3' \\
\text{3 ft} & \quad \theta
\end{align*}
\]

\[
\begin{align*}
\Sigma M_A &= 0; -100 - 3 \cos \theta (200) + 6 \cos \theta F_{spr} = 0 \\
-100 - 600 \cos \theta + 1800 \cos \theta \sin \theta &= 0 \\
\theta_1 &= 22.3^\circ \quad \text{Graphed} \\
\theta_2 &= 88.20^\circ \quad E_i \text{ found zeros}
\end{align*}
\]