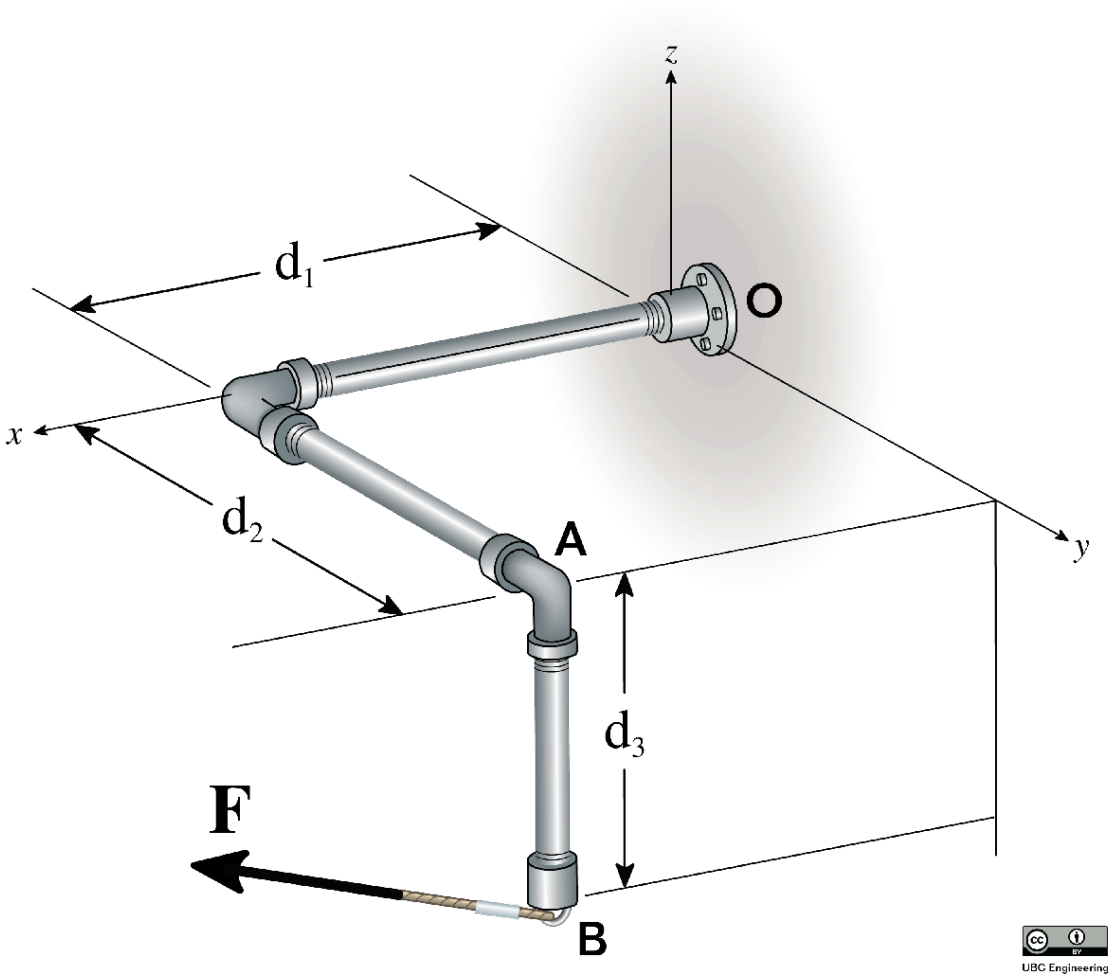

A cable attached to the end of the bent rod OB exerts a force $\vec{F} = F_x\hat{i} + F_y\hat{j} + F_z\hat{k}$. Determine the magnitude of the moment created about the OA axis.

Find the unit vector $\hat{u}_{OA}$.

$$\vec{r}_{OA} = d_1\hat{i} + d_2\hat{j}$$

$$r_{OA} = \sqrt{d_1^2 + d_2^2}$$

$$\hat{u}_{OA} = \frac{\vec{r}_{OA}}{r_{OA}} = \frac{1}{\sqrt{d_1^2 + d_2^2}} \cdot (d_1\hat{i} + d_2\hat{j})$$

Find the magnitude of the moment created about the OA axis.

First, draw a line $\vec{r}$ from any point on the OA axis to any point on the line of action of the force $\vec{F}$.

Ex: Start from A and end at B.

$$\vec{r} = -d_3\hat{k}$$

Next, find the moment the force creates about the origin of $\vec{r}$.

$$\overrightarrow{M_A} = \vec{r} \times \vec{F} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & -d_3 \\ F_x & F_y & F_z \end{vmatrix}$$

$$\Rightarrow \overrightarrow{M_A} = d_3F_y\hat{i} - d_3F_x\hat{j}$$

Lastly, find the scalar projection of this moment on the desired axis.

$$M_{OA} = \hat{u}_{OA} \cdot (\vec{r} \times \vec{F}) = \hat{u}_{OA} \cdot \overrightarrow{M_A}$$

$$\Rightarrow M_{OA} = \frac{d_3}{\sqrt{d_1^2 + d_2^2}} \cdot (d_1F_y - d_2F_x)$$