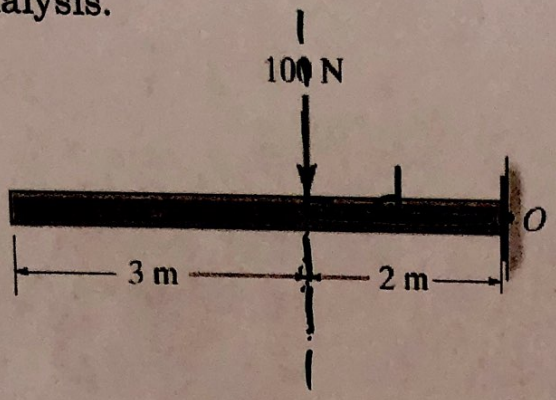
- **Example:** Determine the moment created about point *O* by scalar analysis.

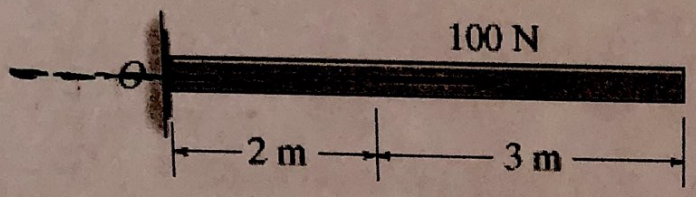
+M

$M = Fd_\perp$



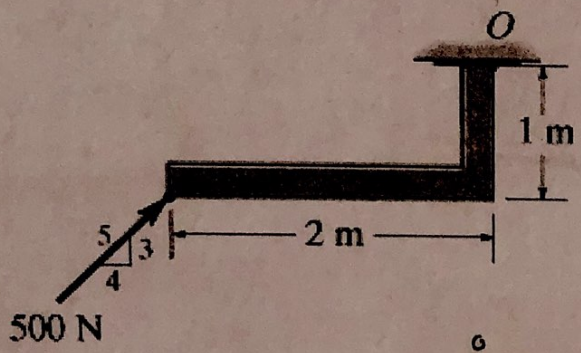
$M_O = Fd_\perp = 100N(2m)$

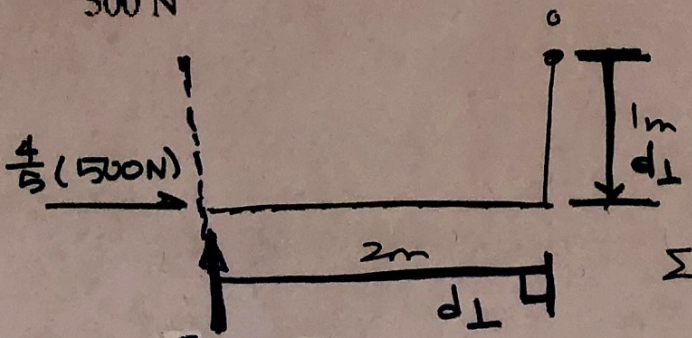
$M_O = 200Nm$



$M_O = Fd_\perp = 100N(0)$

$\boxed{M_O = 0Nm}$

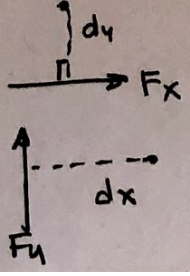




F_x d_y

$\Sigma M_O = \left(\frac{4}{5}\right)(500N)(1m) - \left(\frac{3}{5}\right)(500N)(2m)$

F_y d_x



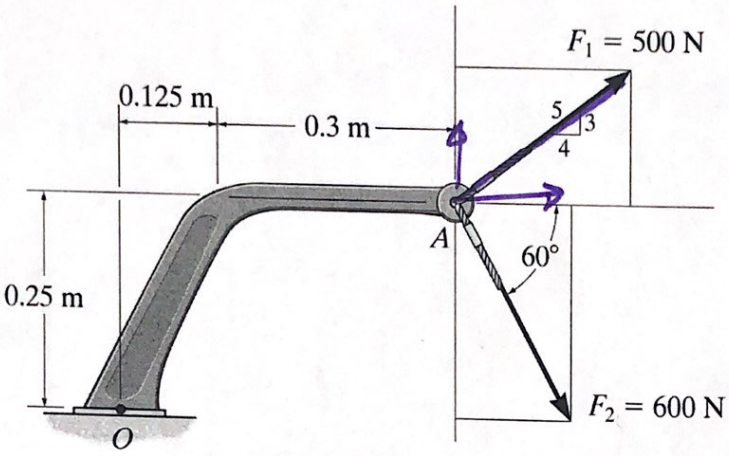
$M_O \int F_x\, dy$

$F_y\, dx$

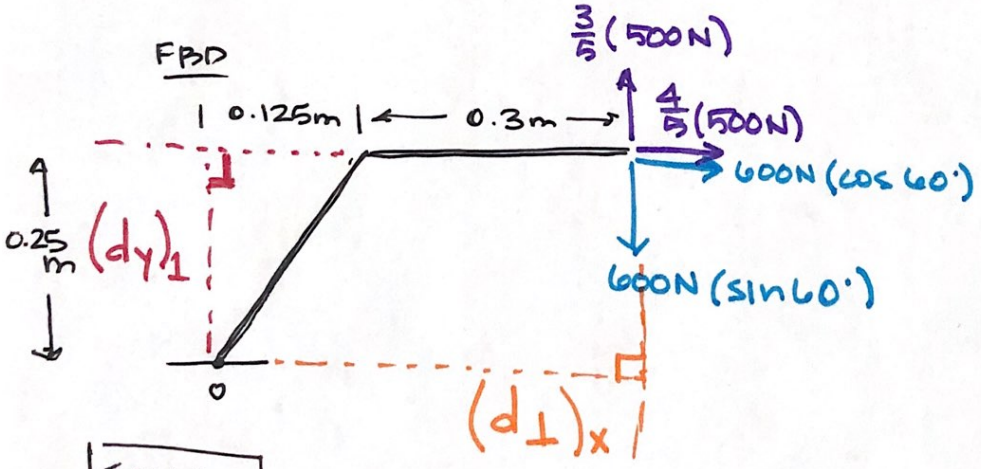
$\Sigma M_O = (400N)(1m) - (300N)(2m)$

$\boxed{M_O = -200Nm = 200Nm\,\circlearrowleft}$

- Example: Determine the moment created about point O by scalar and vector analysis.



FBD



$M_o = F_x d_y$ (F_x at d_y)

$M_o = F_y d_x$ (F_y at d_x)

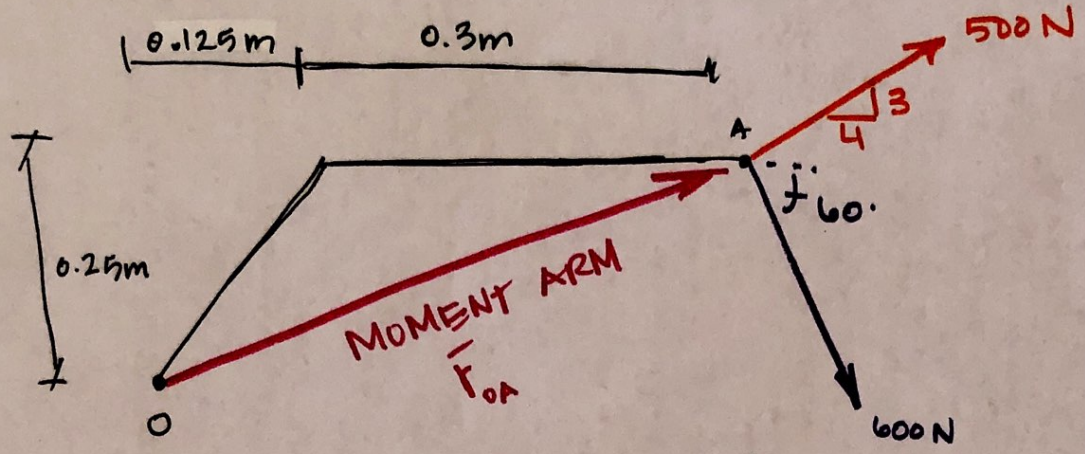
SCALAR

$$\Sigma M_o \curvearrowleft = \left[\tfrac{3}{5}(500N)(0.125+0.3m) - \tfrac{4}{5}(500N)(0.25m)\right] + \left[-600N(\cos 60°)(0.25m) - 600N(\sin 60°)(0.125+0.3m)\right]$$

$$M_o = [127.5\,Nm - 100Nm] + [-75Nm - 220.8\,Nm]$$

$$M_o = -268.3Nm = \boxed{268.3Nm \curvearrowright}$$

VECTOR ANALYSIS



$$M = \begin{vmatrix} i & j & k \\ \text{MOMENT ARM} & & \\ \text{FORCE VECTOR} & & \end{vmatrix} \quad \text{FROM POINT TO FORCE}$$

CARTESIAN VECTORS:

$\bar{r}_{OA}$: COORDINATES $0,0 \longrightarrow (.425m, 0.25m)$

$$\bar{r}_{OA} = \{0.425\bar{i} + 0.25\bar{j} + 0\bar{k}\}m$$

$$\vec{F}_1 = \left\{\tfrac{4}{5}(500)\bar{i} + \tfrac{3}{5}(500)\bar{j} + 0\bar{k}\right\}N = \{400\bar{i} + 300\bar{j} + 0\bar{k}\}N$$

$$\vec{F}_2 = \{600\cos 60\,\bar{i} - 600\sin 60\,\bar{j} + 0\bar{k}\}N = \{300\bar{i} - 519.6\bar{j} + 0\bar{k}\}N$$

MATRIX:

$$\vec{M}_o = \begin{vmatrix} i & j & k \\ 0.425 & 0.25 & 0 \\ 400 & 300 & 0 \end{vmatrix} + \begin{vmatrix} \bar{i} & \bar{j} & \bar{k} \\ 0.425 & 0.25 & 0 \\ 300 & -519.6 & 0 \end{vmatrix} \begin{matrix} m \\ N \end{matrix} \quad \leftarrow \text{UNITS}$$

$$\vec{M}_o = \left[[0.25(0) - 0(300)]\bar{i} - [0.425(0) - 0(400)]\bar{j} + [(0.425)(300) - 0.25(400)]\bar{k}\right]$$
$$+ \left[[(0.25)(0) - (0)(-519.6)]\bar{i} - [0]\bar{j} + [(0.425)(-519.6) - 0.25(300)]\bar{k}\right]Nm$$

$$\vec{M}_o = [0\bar{i} - 0\bar{j} + 27.5\bar{k}]Nm + [0\bar{i} - 0\bar{j} - 295.83\bar{k}]Nm = [0\bar{i} + 0\bar{j} - 268.3\bar{k}]Nm$$

$$|M_o| = 268.3\bar{k}\ \text{N}$$