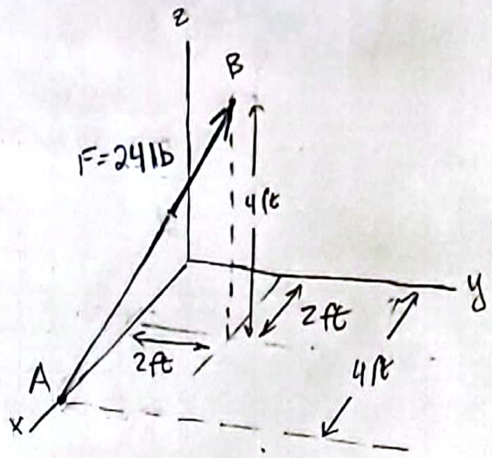
First Problem



$M_{y\text{-axis}} = \hat{e}_{y\text{-axis}} \cdot \bar{r} \times \bar{F}$

Find $\bar{F}$:

$F = 24 \text{ lb}$

$\bar{r}_{AB} = \langle 2, 2, 4\rangle - \langle 4, \emptyset, \emptyset\rangle$

$= \langle -2, 2, 4\rangle$

$r_{AB} = \sqrt{2^2 + 2^2 + 4^2} = 4.9$

$\hat{e}_{AB} = \frac{\bar{r}_{AB}}{r} = \frac{\langle -2, 2, 4\rangle}{4.9} = \langle -.41, .41, .82\rangle$

$\Rightarrow \bar{F} = 24\text{lb}\langle -.41, .41, .82\rangle = \langle -9.8, 9.8, 19.6\rangle \text{ lb}$

Find $\bar{r}$: easiest is from the origin to A

$\bar{r} = \langle 4, \emptyset, \emptyset\rangle \text{ ft}$

Find $\hat{e}_{y\text{-axis}}$: $\hat{e}_{y\text{-axis}} = \langle \emptyset, 1, \emptyset\rangle$

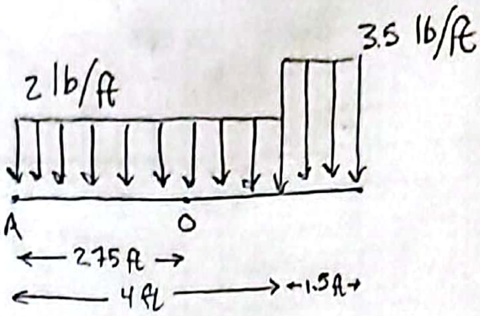
Cross product:

$M_{y\text{-axis}} = \hat{e}_{y\text{-axis}} \cdot \bar{r} \times \bar{F}$

$$= \begin{vmatrix} \emptyset & 1 & \emptyset \\ 4 & \emptyset & \emptyset \\ -9.8 & 9.8 & 19.6 \end{vmatrix} = \emptyset - 1(4 \cdot 19.6 - \emptyset) + \emptyset$$

$$\boxed{= -78.4 \text{ lb}\cdot\text{ft}}$$

Second Problem



Resultant of 2 lb/ft distributed load:

$$\left(2\,\frac{lb}{ft}\right)(4\,ft) = 8\,lb$$

Location of 2 lb/ft distributed load:

center of load ⇒ 2 ft to the right of A

⇒ $2.75\,ft - 2\,ft = 0.75\,ft$ to the left of O

Resultant of 3.5 lb/ft distributed load:

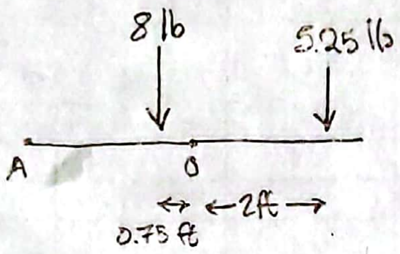
$$\left(3.5\,\frac{lb}{ft}\right)(1.5\,ft) = 5.25\,lb$$

Location of 3.5 lb/ft distributed load:

center of load ⇒ 0.75 ft from right end of shelf

⇒ $2.75\,ft - .75\,ft = 2\,ft$ to the right of O

New FBD:



use $\Sigma \overset{\curvearrowright}{M_A}$ to find location of resultants

$$8\,lb(2\,ft) + 5.25\,lb\,(4.75\,ft) = 13.25\,lb\,(x)$$

⇒ $x = 3.09\,ft$ to the right of A

⇒ Resultant: $\boxed{13.25\,lb}$

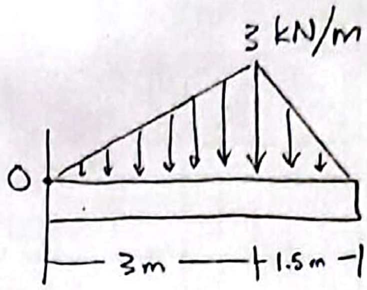
Location: $3.09\,ft - 2.75\,ft = \boxed{0.34\,ft}$ to the right of point O

10/14/21 | SI Statics Worksheet #6 | Solution

Third Problem

Equivalent load of left triangle:

$\frac{1}{2}(3\,\frac{kN}{m})(3m) = 4.5\,kN$



location:

$\frac{2}{3}(3m) = 2m$ to the right of O

Equivalent load of right triangle

$\frac{1}{2}(3\,\frac{kN}{m})(1.5m) = 2.25\,kN$

Location:

$\frac{2}{3}(1.5\,m) = 1m$ .. from right end of beam

$= (3m + 1.5m) - 1m = 3.5\,m$ to the right of O

Overall Equivalent load:

$4.5\,kN + 2.25\,kN = \boxed{6.75\,kN}$

$\overset{\curvearrowright}{\Sigma M} = (4.5\,kN)(2m) + (2.25\,kN)(3.5\,m) = (6.75\,kN)\,x$

$\Rightarrow \boxed{x = 2.5\,m}$ to the right of O