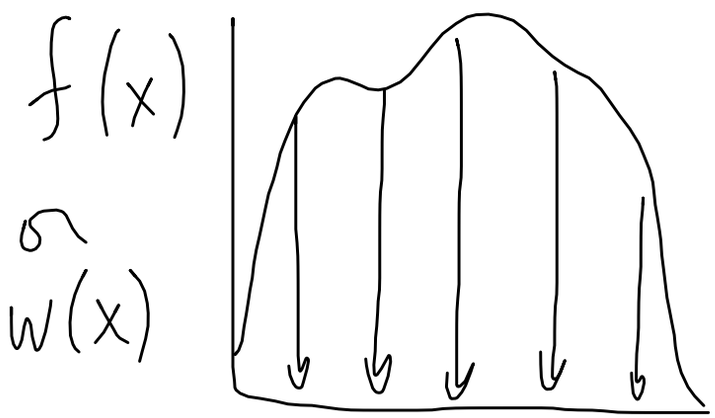
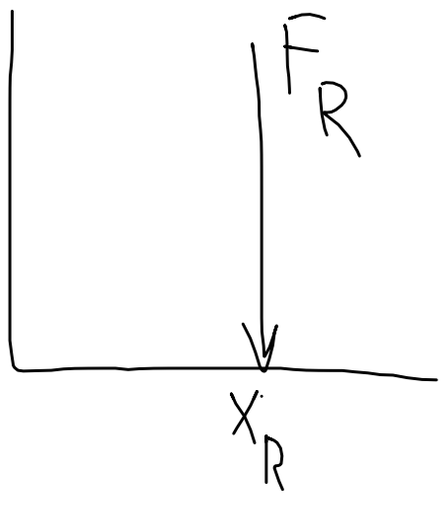
Distributed forces



$f \Rightarrow \frac{\text{force}}{\text{length}}$

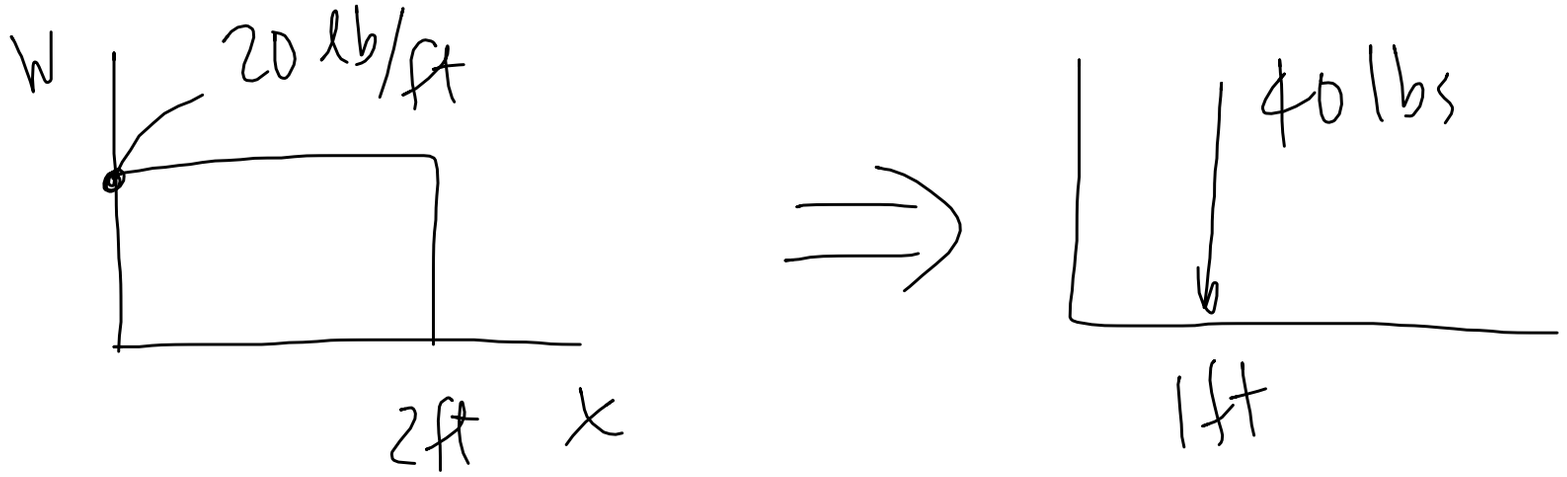
$$F_R = \int w(x)\,dx$$

$$\bar{x}$$



$$M_o = \int x\, w(x)\,dx$$

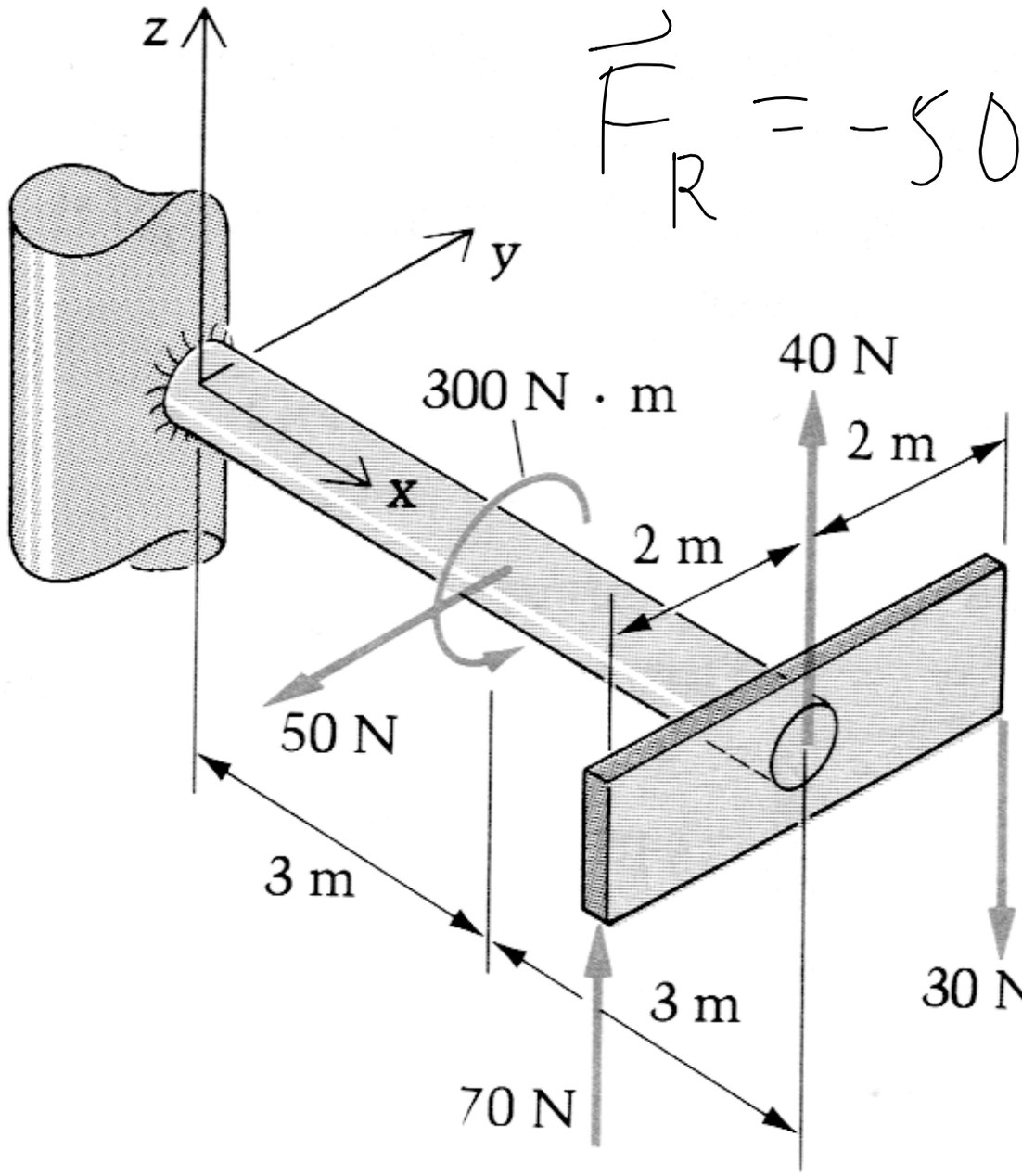
$$X_R = \frac{M_o}{F_R}$$



$$F_R = 9 \text{ lbs}$$

$$M_0 = \int x\, w(x)\,dx = \int_0^6 x \cdot \frac{1}{2}x\,dx = \frac{x^3}{6}\Big|_0^6 = 36 \text{ ft-lb}$$

$$x_R = \frac{M_0}{F_R} = \frac{36}{9} = 4 \text{ ft} \Rightarrow \frac{2}{3} \text{ from pointy end}$$



$$\vec{F}_R = -50\hat{j} + 80\hat{k}$$

$$\Sigma \vec{M}_O =$$

$$\hat{i}\left[300 - 70(2) - 30(2)\right]$$

$$+\hat{j}\left[-70(6) - 40(6) + 30(6)\right]$$

$$+\hat{k}\left[-50(3)\right]$$

$$= 100\hat{i} - 480\hat{j} - 150\hat{k}$$

Test for single force resultant

$$\vec{M}_{\tilde{u}} \cdot \vec{F}_R \stackrel{?}{=} 0$$

$$-50(-480) + 80(-150) = 12000 \neq 0 \therefore \text{screwdriver}$$

$$\vec{M}_{11} = \left(\vec{M}_O \cdot \hat{u}_F\right)\hat{u}_F$$

$$= \left[\left(100\hat{i} - 480\hat{j} - 150\hat{k}\right) \cdot \frac{-50\hat{j} + 80\hat{k}}{\sqrt{8900}}\right]\left(\frac{-50\hat{j} + 80\hat{k}}{\sqrt{8900}}\right)$$

$$\left[(-480)(-50)+(-150)(80)\right]\left(\frac{-50\hat{j}+80\hat{k}}{8900}\right)=\vec{M}_{11}$$

$$-67.42\hat{j}+107.9\hat{k}=\vec{M}_{11}$$

$$\vec{M}_{\perp}=\vec{M}_{0}-\vec{M}_{11}$$

$$=100\hat{i}-412.6\hat{j}-257.9\hat{k}$$

Find (x, y, z) so that $\vec{r} \times \vec{F}_R = \vec{M}_1$

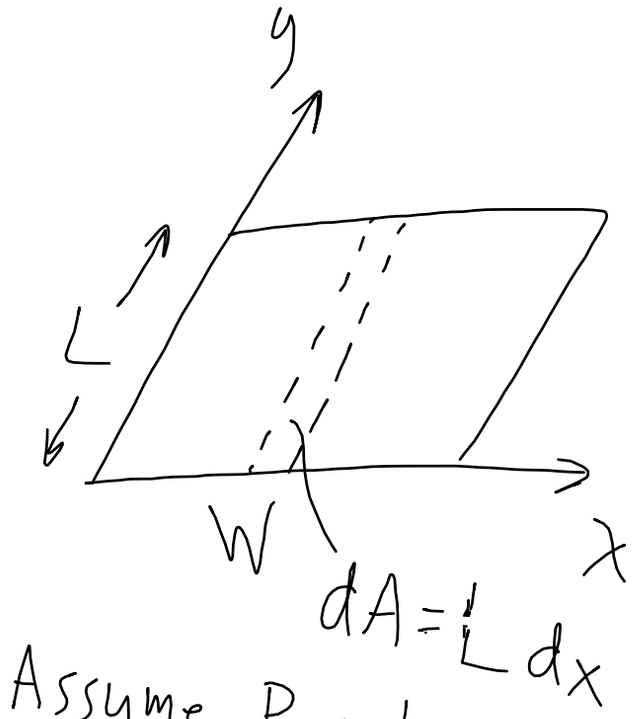
$$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ x & y & z \\ 0 & -50 & 80 \end{vmatrix} = \hat{i}(80y + 50z) - \hat{j}\,80x + \hat{k}(-50x)$$

$$= 100\hat{i} - 412.6\hat{j} - 257.9\hat{k}$$

$80y + 50z = 100 \Longrightarrow$ line $80y = -50z + 100$

$$\left.\begin{aligned} -80x &= -412.6 \\ -50x &= -257.9 \end{aligned}\right\} \Rightarrow x = 5.16\ \text{m}$$

Distributed pressure force



$p(x,y) \Rightarrow \frac{N}{m^2}$ or Pa or psi

$$F_R = \int p \, dA$$

Assume P only depends on x

$$= \int_0^W p L \, dx$$

W = Surface our old f(x) or w(x)