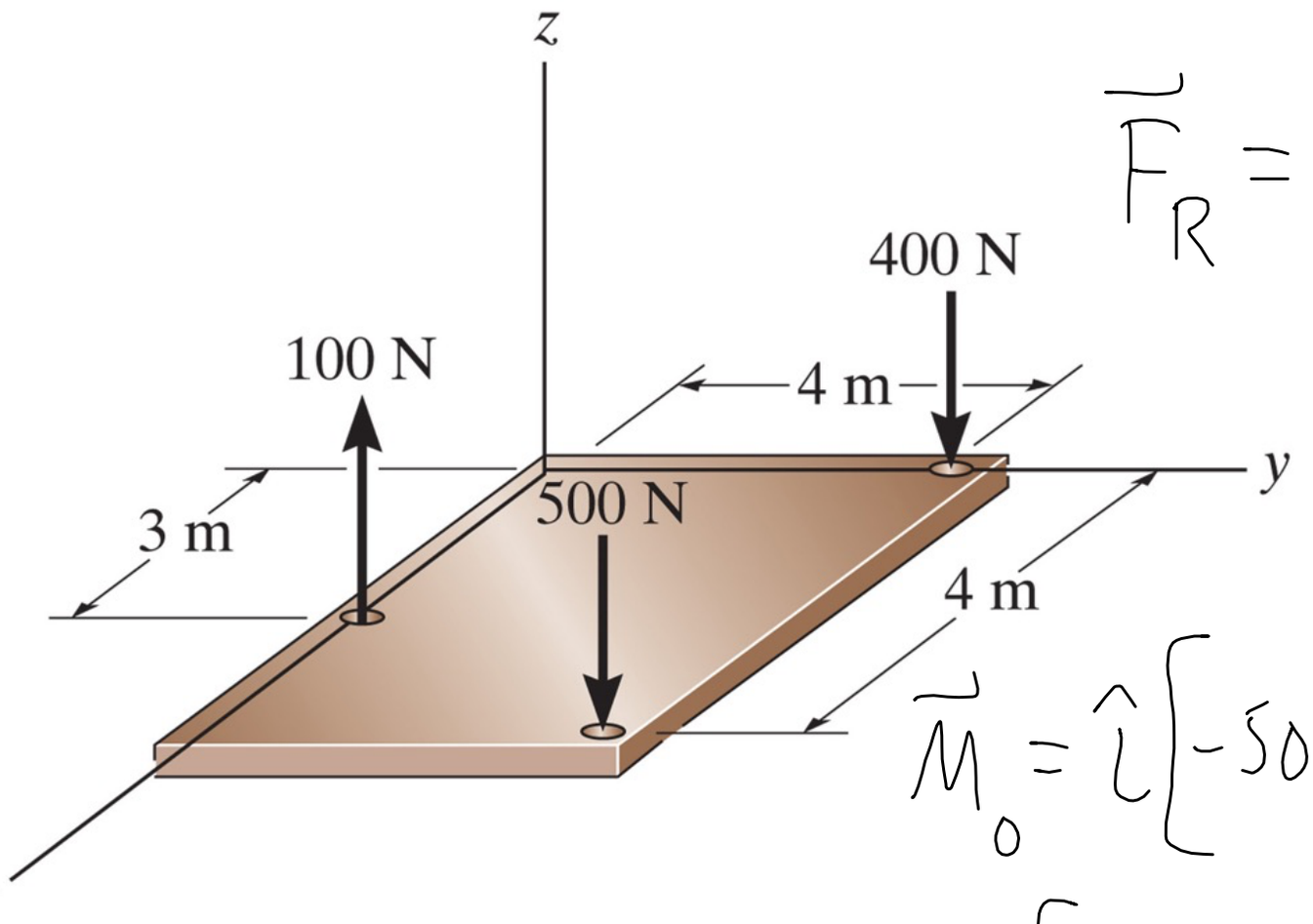


Figure: 04_FP035

$$\tilde{F}_R = -800\,\hat{k}\ \ N$$

$$\tilde{M}_0 = \hat{i}\left[-500(4) - 400(4)\right] + \hat{j}\left[500(4) - 100(3)\right] + \hat{k}\left[0\right] = -3600\,\hat{i} + 1700\,\hat{j}$$

$\tilde{r}_{F_R} = ?$ Assume in $z = 0$ plane

$$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ x & y & 0 \\ 0 & 0 & -800 \end{vmatrix} = -3600\hat{i} + 1700\hat{j}$$

$$-800y = -3600 \Longrightarrow y = \frac{3600}{800}$$

$$800x = 1700 \Longrightarrow x = \frac{1700}{800}$$

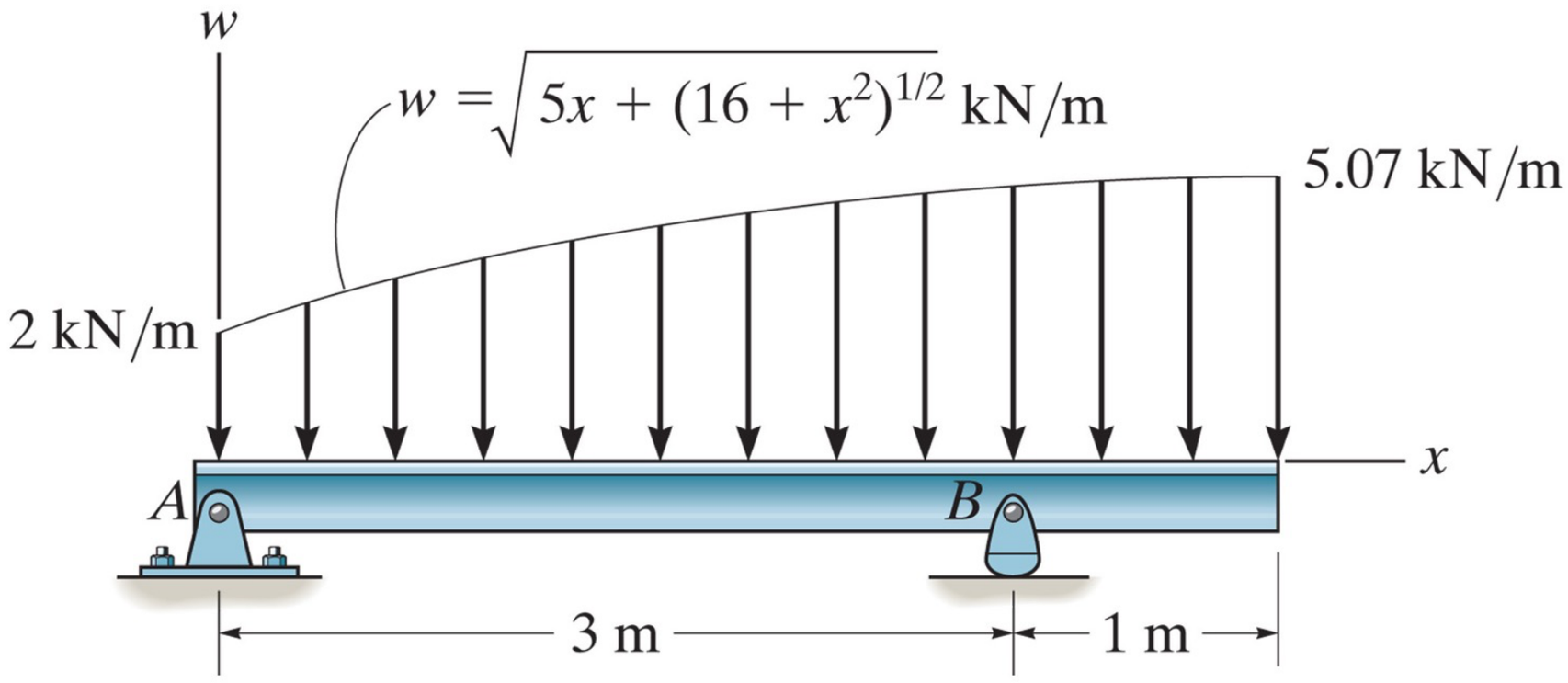


Figure: 04_P162

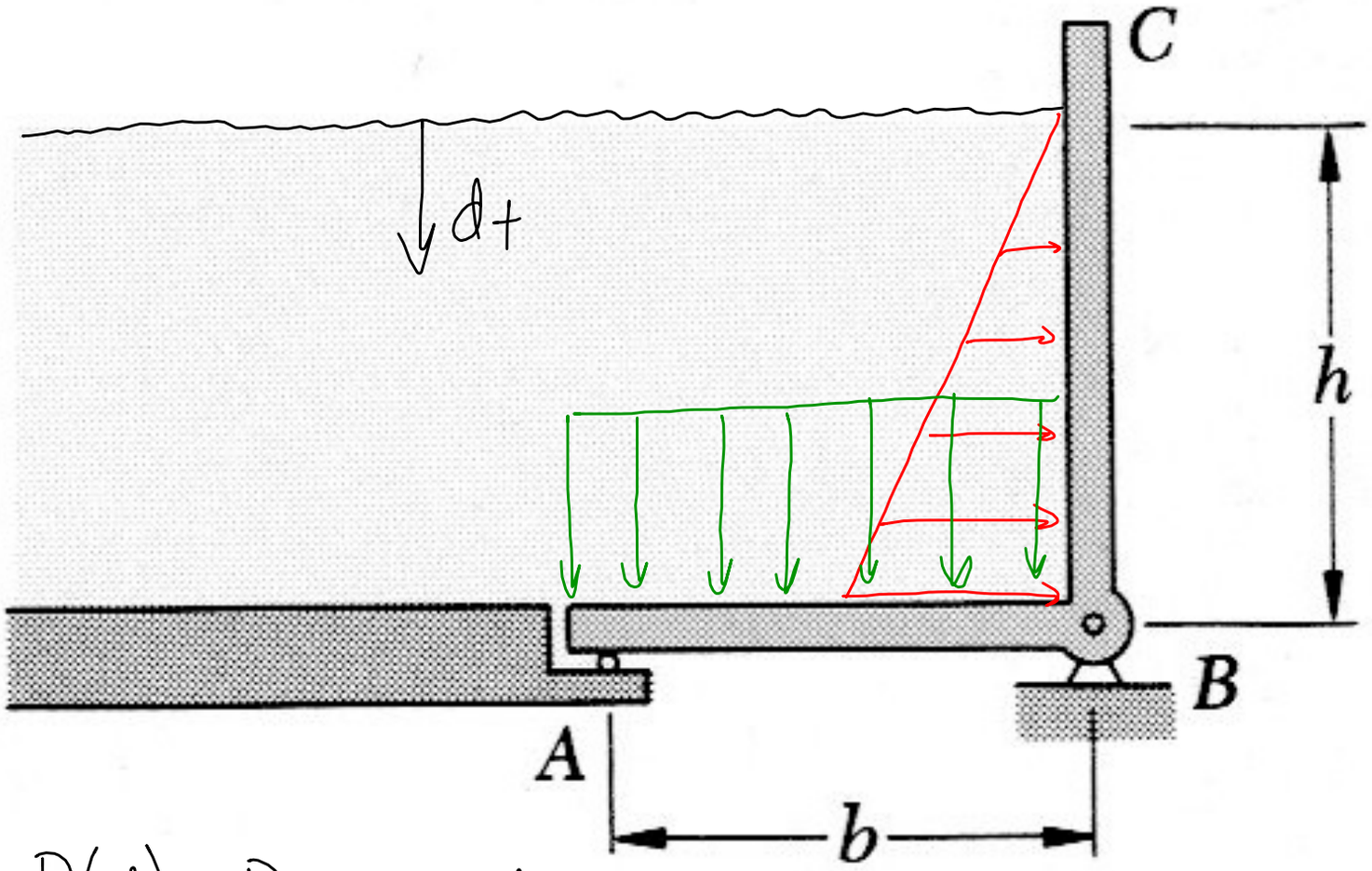
$$F_R = \int w(x)\,dx = \int_0^4 \mathrm{SQRT}\left[5x + \mathrm{SQRT}\left[16 + x^2\right]\right] dx$$

Using Mathematica's NIntegrate, $F_R = 14.8852$ kN

$$M_0 = \int x\, w(x)\, dx = \int_0^4 x \ \mathrm{SQRT}\left[5x + \mathrm{SQRT}\left[16 + x^2\right]\right] dx$$

$$= 33.735 \ kN \cdot m \quad \text{(same method)}$$

$$X_R = \frac{M_0}{F_R} = \frac{33.735}{14.8852} = 2.27 \ m$$



Gate has width W into page

Find h/b for equil (almost ready to open)

$P(d) = P_{top} + \rho g d$

Use $dA = W\,dy$

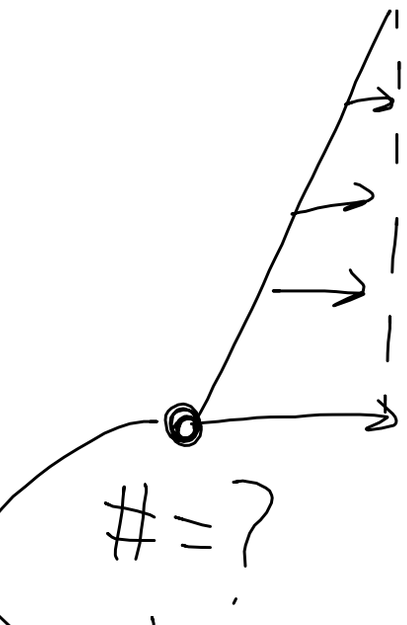
$W(y) \Rightarrow \frac{\text{Force}}{\text{length}}$

$F_R = \int_{\text{surface}} p\,dA = \int_0^h p\,W\,dy$ & $M = \int_0^h y\,p\,W\,dy$

$M = \int y\,w(y)\,dy$

So $w(y)$ s.t. $F_R = \int w(y)\,dy$ is

$pW \Rightarrow \rho g d W$



$\rho g h W$

$\therefore F_{right} = \frac{1}{2}(\rho g h W)\,h$

$= \frac{\rho g W h^2}{2}$ @ $\frac{h}{3}$ up from hinge (B)

$M_{right} = \frac{\rho g W h^3}{6}$

red

$$F_{down} = \rho g h W b \quad @ \ \frac{b}{2} \text{ left of B}$$

green

$$M_{\substack{down \\ about \\ B}} = \frac{\rho g h W b^2}{2}$$

Set |moments| equal

$$\frac{\rho g W h^3}{6} = \frac{\rho g W h b^2}{2}$$

$$\frac{h^2}{b} = \frac{b^2}{2}$$

$$\frac{h}{b} = \sqrt{3}$$