$$\left|\int \vec{r} \times d\vec{F}\right| = \rho_s WL \frac{h^2}{2} g \sin\theta$$

$$\int \vec{r} \times d\vec{F} = \int \vec{r} \times P\vec{n} dS$$

$$\int y\hat{j} \times \hat{k} P dS = \int \hat{i} y P dS$$

$$\int_{y=0}^{h} \int_{x=0}^{W} \rho_l g(H - h + y\cos\theta) y\hat{i}\, dx\, dy = W\left(\rho_l g(H-h)\frac{h^2}{2} + \frac{\rho_l g h^3 \cos\theta}{3}\right)$$

$$W\left(\rho_l g(H-h)\frac{h^2}{2} + \frac{\rho_l g h^3 \cos\theta}{3}\right) = \rho_s WL \frac{h^2}{2} g \sin\theta$$

$$\frac{\rho_l g(H-h)}{2} + \frac{\rho_l g h \cos\theta}{3} = \frac{\rho_s L g \sin\theta}{2}$$

$$3\rho_l(H-h) + 2\rho_l h\cos\theta = 3\rho_s L \sin\theta$$

$$A = 3\rho_l(H-h)$$

$$B = 2\rho_l h$$

$$C = 3\rho_s L$$

$$A + B\cos\theta = C\sin\theta$$

$$A + B\cos\theta = C\frac{\cos 2\theta}{2\cos\theta}$$

$$A\cos\theta + B\cos^2\theta = \frac{C}{2}\cos 2\theta$$

$$A\cos\theta + B\cos^2\theta = \frac{C}{2}(2\cos^2\theta - 1)$$

$$A\cos\theta + B\cos^2\theta - C\cos^2\theta = -\frac{C}{2}$$

$$(B - 2C)\cos^2\theta + A\cos\theta + \frac{C}{2} = 0$$