Announcements

- 8 days until Thanksgiving, got your Thanksgiving pants ready?

- Upcoming deadlines:
  - Tuesday (11/27)
    - PL HW

![Image](image-url)
Recap: Fluid Pressure

- Pressure varies \textit{linearly} from the free surface.
- Pressure is \textit{constant} along any horizontal plane.
- Pressure acts \underline{perpendicular} to the submerged object’s surface.

\[ p = \rho gh \]

\text{Patm \small{\text{negligible compared to P in liquid}} (gauge pressure)}
Deep Sea Fish

How to transport deep sea creatures to aquariums?
The factor of safety for tipping of the concrete dam is defined as the ratio of the stabilizing moment due to the dam’s weight divided by the overturning moment about $O$ due to the water pressure. Determine this factor if the concrete has a density of $\rho_{\text{conc}} = 2.5 \text{ Mg/m}^3$ and for water $\rho_{\text{water}} = 1 \text{ Mg/m}^3$.

\[ F_R = \frac{P_d \cdot h}{2} \cdot w = 117600 \text{ w N} \]

\[ \sum F_y = N - W = 0 \rightarrow N = W = \rho_{\text{conc}} V \]

\[ N = \rho_c \left[ \frac{4m + l_1 m}{2} \right] hw \]

\[ N = 367875 \text{ w N} \]

Centroid / Center of $g$ ($d_4$)

\[ \begin{array}{c|c|c}
\hline
& 1 & 2 \\
\hline
A & \frac{3}{4} \text{ m} & \frac{1}{2} \text{ m} \\
\hline
A & 3.6 \text{ m}^2 & 1.6 \text{ m}^2 \\
\hline
\end{array} \]

\[ (\text{from A}) \]
\[ d_4 = \bar{x} = \frac{(2\text{m})(9\text{m}^2) + (\frac{1}{2}\text{m})(6\text{m}^2)}{15\text{m}^2} = 1.4 \text{ m} \]

**Location of \( F_R \)**

\[ d_1 = \frac{1}{3}(6\text{m}) = 2\text{m} \]

- Stabilizing moment from \( W \) about \( A \): \( M_w = Wd_4 \)
- Overturning moment from \( F_R \) about \( A \): \( M_F = F_R d_1 \)
- Safety factor: \( f = \frac{M_w}{M_F} = 2.19 \)

**What is \( d_3 \)? (location of \( N \))**

*Don't automatically assume \( d_3 = 4\text{m} \)!

\[ \sum M_A = F_R d_1 + Wd_4 - Nd_3 = 0 \rightarrow d_3 = \frac{F_R d_1 + Wd_4}{N} \]

\[ d_3 = 2.04\text{m} \]
Determine the magnitude of the resultant force acting on the 100-m wide dam due to hydrostatic pressure. Let \( d = 2.5 \text{ m} \) and \( \rho_{\text{water}} = 1 \text{ Mg/m}^3 \).

\[
F_{Rx} = \frac{P_a \cdot h \cdot w}{2} = 17658 \text{ kN}
\]

\[
F_{Ry} = W = \rho_{\text{water}} V g
\]

\[
F_r = \sqrt{F_{Rx}^2 + F_{Ry}^2} = 18201 \text{ kN}
\]
Determine the magnitude of the resultant force acting on the 10-m wide dam due to hydrostatic pressure.

\( \rho_{\text{water}} = 1 \text{ Mg/m}^3 \)

\[
F_{Rx} = \frac{\rho g r^2 w}{2}
\]

\[
= \left( \frac{ggr}{2} \right) rw
\]

\[
= 441 \text{ kN}
\]

\[
F_{Ry} = W = \rho V g, \quad V = (r^2 - \frac{\pi r^2}{4})w
\]

\[
= \boxed{\_ \_ \_ \_ \_ \_} - \square \quad F_{Ry} = 189 \text{ kN}
\]

\[
F_R = \sqrt{F_{Rx}^2 + F_{Ry}^2} = 480 \text{ kN}
\]