Announcements

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

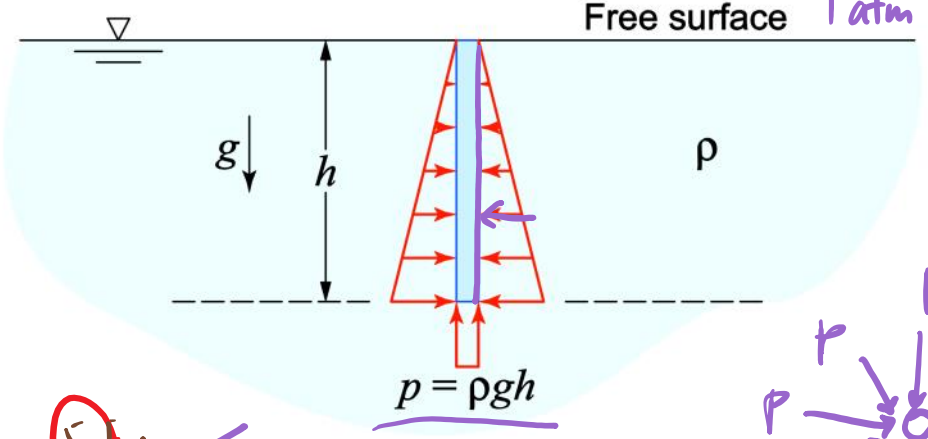
❑ Upcoming deadlines:

- Tuesday (11/27)
  - PL HW

Monday, November 12, 2018 2:56 PM

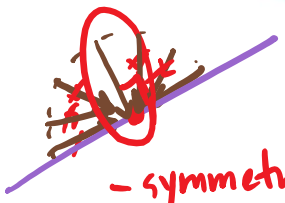
Recap: Fluid Pressure

- Pressure varies *linearly* from the free surface.
- Pressure is *constant* along any horizontal plane.
- Pressure acts perpendicular to the submerged object's surface.

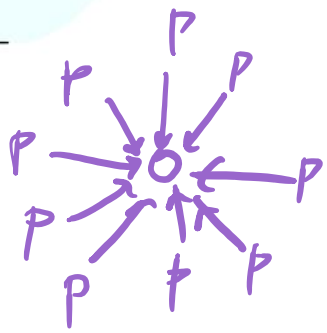


P_{atm} = negligible compared to P in liquid

(gauge pressure)

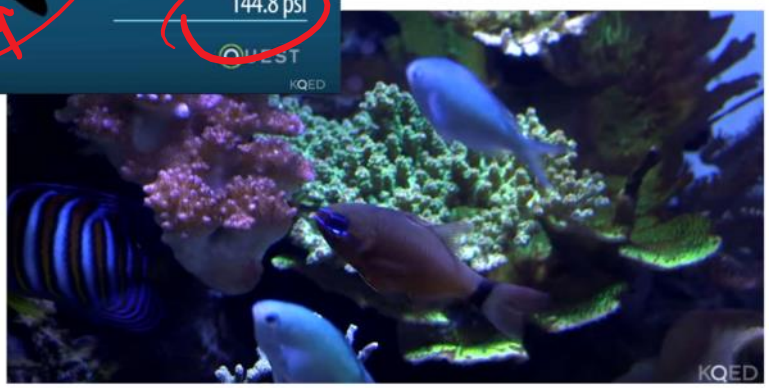


- symmetrical components cancel out.



Deep Sea Fish

How to transport deep sea creatures to aquariums?



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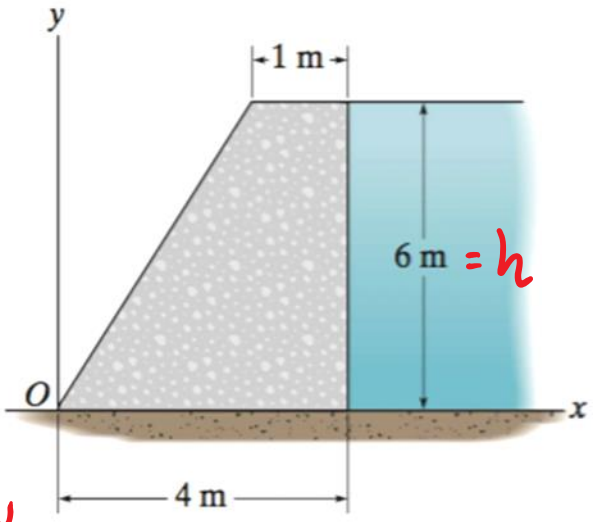
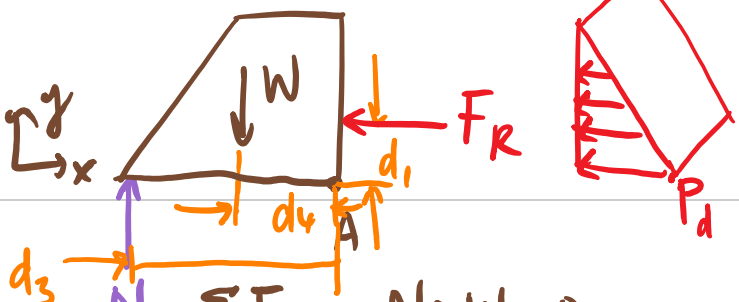
The factor of safety for tipping of the concrete dam is defined as the ratio of the stabilizing moment due to the dam's weight divided by the overturning moment about *O* due to the water pressure. Determine this factor if the concrete has a density of $\rho_{conc} = 2.5\ Mg/m^3$ and for water $\rho_{water}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



FBD

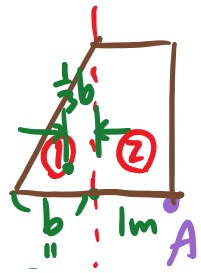


$F_R = \frac{P_d \cdot h}{2} \cdot w = 117600w\ N$

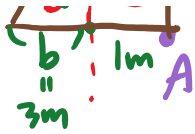
$\Sigma F_y = N - W = 0 \rightarrow N = W = \rho_{conc} V_{conc} g$

$\rightarrow N = \rho_c \left[\left(\frac{4m+1m}{2}\right) hw\right] g = 367875w\ N$

Centroid / Center of g (d_4)



	①	②	
$\bar{x}$	$1+\frac{3}{5}m$	$\frac{1}{2}m$	(from A)
A	$3.6\ m^2$	$1.6\ m^2$	



A | $\frac{3.6}{2}\ m^2$ | $1.6\ m^2$

$$d_4 = \bar{x} = \frac{(2m)(9m^2) + (\frac{1}{2}m)(6m^2)}{15\ m^2} = 1.4\ m$$

Location of F_R

$d_1 = \frac{1}{3}(6m) = 2m$

- Stabilizing moment from W about A: $M_w = W d_4$
- 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)

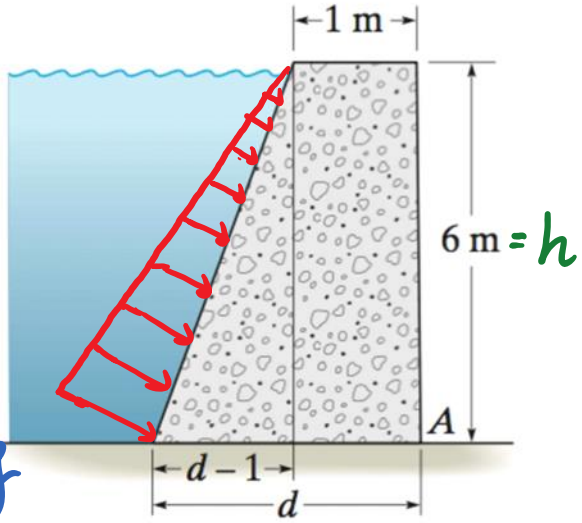
* Don't automatically assume $d_3 = 4m$!

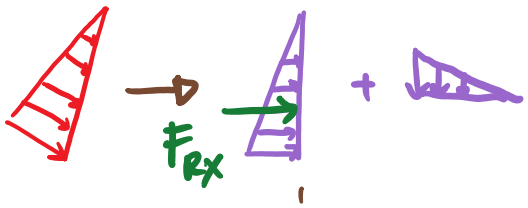
$$\Sigma M_A = F_R d_1 + W d_4 - N d_3 = 0 \rightarrow d_3 = \frac{F_R d_1 + W d_4}{N}$$

$d_3 = 2.04m$

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

= w





$F_{Rx} = \frac{P_A \cdot h}{2} \cdot w$

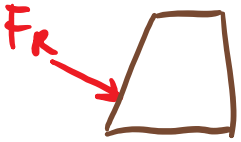
$= 17658$ kN

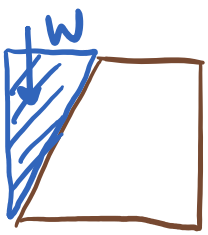
$F_{Ry} = W$

$= \rho_{water} V_{water} g$

$V_{water} = \frac{(d-1)h}{2} w$

$\rightarrow F_{Ry} = 4415$ kN





$F_R = \sqrt{F_{Rx}^2 + F_{Ry}^2}$

$= 18201$ kN

Determine the magnitude of the resultant force acting on on the 10-m wide dam due to hydrostatic pressure. ($\rho_{water} = 1\ Mg/m^3$)

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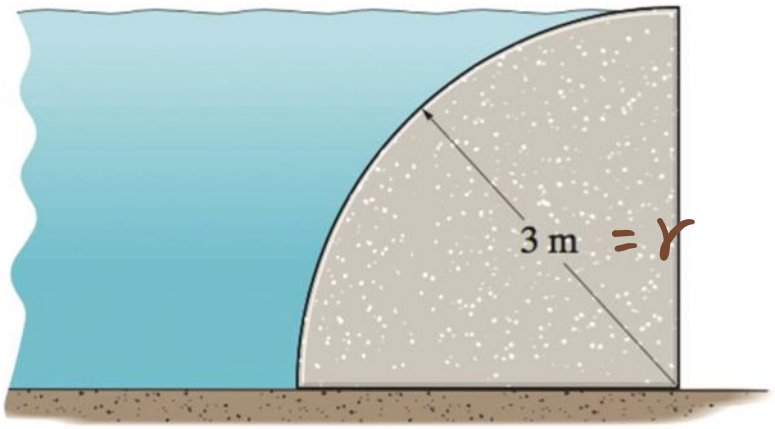
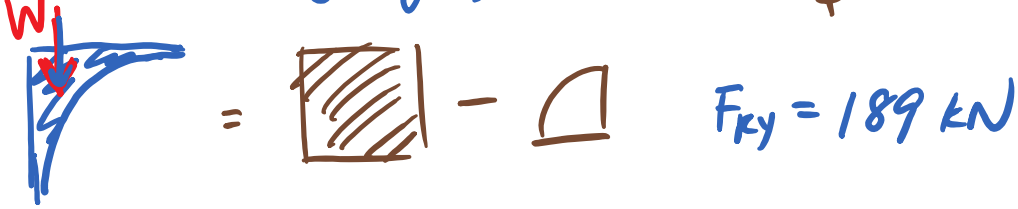


$$F_{Rx} = \frac{p_r r}{2} w$$

$$= \left(\frac{\rho g r}{2}\right) r w$$

$$= 441\ kN$$

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



$F_{Ry} = 189\ kN$

$$F_R = \sqrt{F_{Rx}^2 + F_{Ry}^2} = 480\ kN$$