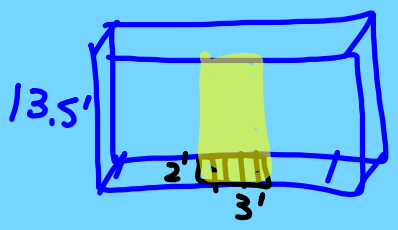
Fluid Force

Fluid – a substance which conforms to its container (gas or liquid)



Force = lbs

$F = \rho \cdot l \cdot w \cdot h$

$F = 62.4 \cdot 2 \cdot 3 \cdot 13.5$

$= 5054.4$ lb.

$\frac{5054.4}{6} \frac{lb}{ft^2} = 842.4 \frac{lb}{ft^2}$

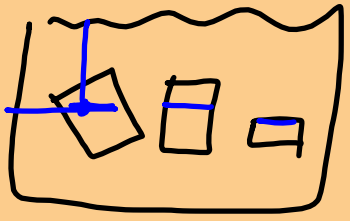
Pressure $= \frac{lb}{in^2} = psi$

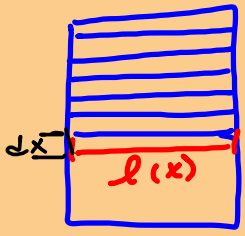
$= \frac{lb}{ft^2}$

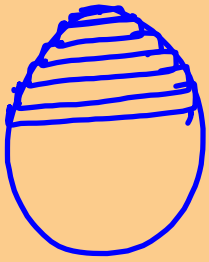
$= \frac{N}{m^2} = Pa$

Pascals

Pascal's Principle – pressure is the same at any depth regardless of the position of the object







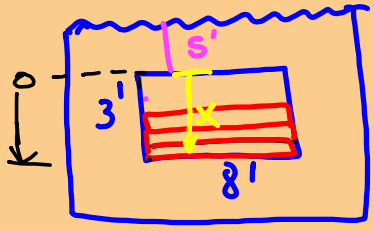
depth at top + bottom of object

ft ft ft

$h(x)\ l(x)\ dx$

depth · length of rect. · Thickness of rect.

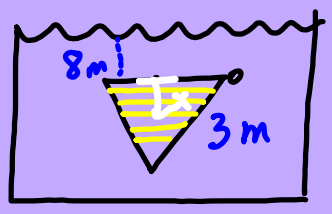
Weight density of fluid



dx

Find fluid force on rectangle.

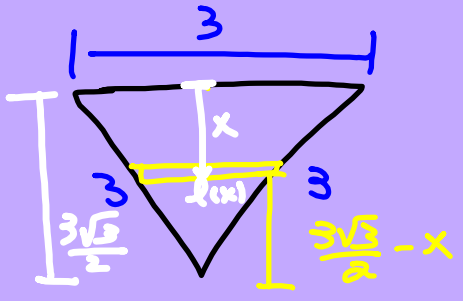
$$62.4\int_0^3 (x+5)8\cdot dx = 9734.4 \text{ lb}$$

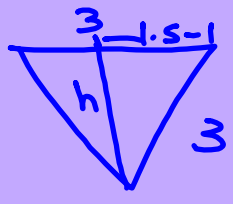


$$\rho \int_a^b h(x)\, \ell(x)\, dx$$

$$9810 \int_0^{\frac{3\sqrt{3}}{2}} (8+x)\, \frac{2}{\sqrt{3}} \left(\frac{3\sqrt{3}}{2} - x\right) dx$$

$$\approx \boxed{339{,}230 \text{ N}}$$





$$\left(\frac{3}{2}\right)^2 + h^2 = 3^2$$

$$\frac{9}{4} + h^2 = 9$$

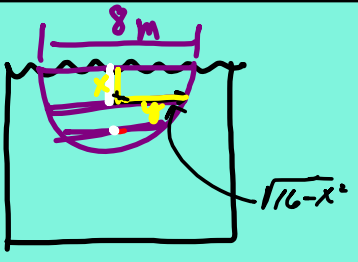
$$h^2 = \frac{27}{4}$$

$$h = \sqrt{\frac{27}{4}} = \frac{3\sqrt{3}}{2}$$

$$\frac{\ell(x)}{\frac{3\sqrt{3}}{2} - x} = \frac{3}{\frac{3\sqrt{3}}{2}} = 3 \cdot \frac{2}{3\sqrt{3}}$$

$$\frac{\ell(x)}{\frac{3\sqrt{3}}{2} - x} = \frac{2}{\sqrt{3}}$$

$$\ell(x) = \frac{2}{\sqrt{3}} \left(\frac{3\sqrt{3}}{2} - x\right)$$



$$\int_a^b \rho \cdot h(x) \cdot l(x) \cdot dx$$

↓ depth

$l \cdot w$

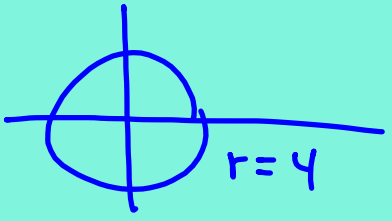
$$x^2 + y^2 = r^2$$

$$x^2 + y^2 = 16$$

$$\sqrt{y^2} = \pm\sqrt{16 - x^2}$$

$$9810 \int_0^4 x \cdot 2\sqrt{16-x^2}\, dx$$

$$= \boxed{418{,}560\ N}$$



$$x^2 + y^2 = 16$$