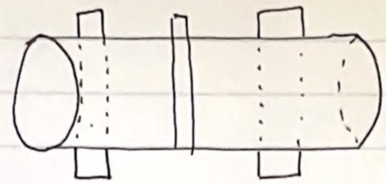
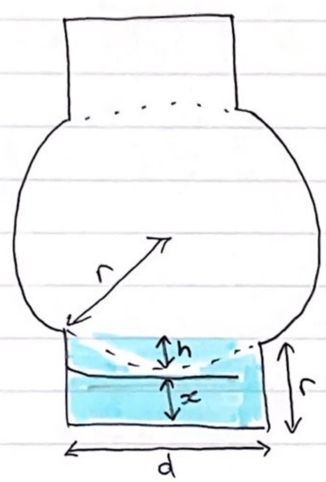
Extended Molel



Cross-section where legs are



To determine the volume inside ~~the~~ a leg of the cylinder, we will assume the tank is filled with liquid up to the top of the leg as shown on left. we will make the ~~teg~~ height of the leg the same length as the diameter.

The area of fluid within the circular section is the same as the area which we solved for the cylindrical model, which is:

$$A_l = \tfrac{1}{2} r^2 (\theta - \sin\theta)$$

The total area of the rectangle of fluid is:

$$A_{\cancel{foot}} = dr$$

So the area of the foot without the cylinder is:

$$A_{foot} = dr - A_l$$
$$= dr - \tfrac{1}{2} r^2 (\theta - \sin\theta)$$

We will assume that the liquid height is always greater than ~~heig~~ x on the diagram.

The volume contained in each foot is:

$$V_{foot} = cr\left(d - \tfrac{1}{2} r^2 (\theta \cdot \sin\theta)\right)$$

Combining this with the result from the cylindrical model, we can see that, for a volume V_0 in the tank, where $V_0 > V_{foot}$,

$$V_0 = 2cr\left(d - \tfrac{1}{2}r(\theta - \sin\theta)\right) + \tfrac{1}{2}lr^2(\theta - \sin\theta) \qquad (\star)$$

$$\cancel{V_0 = cdr - \tfrac{1}{2}cr^2(\theta-\sin\theta) + \tfrac{1}{2}lr^2(\theta-\sin\theta)}$$

$$\cancel{V_0 = cdr + \tfrac{1}{2}r^2(\theta-\sin\theta)(l-c)}$$

Using this, we can obtain the value of θ_0 for volume V_0. To calibrate the dipstick where V_0 will be marked, $h_0 = r - r\cos\left(\frac{\theta}{2}\right)$.

As long as the dipstick doesn't descend lower than the bottom of the cylinder, we can extend $(\star)$ to an ~~unlimited~~ any number of feet. The equation becomes:

$$V_0 = 2cr\left(d - \tfrac{1}{2}r(\theta - \sin\theta)\right) + \tfrac{1}{2}lr^2(\theta - \sin\theta)$$