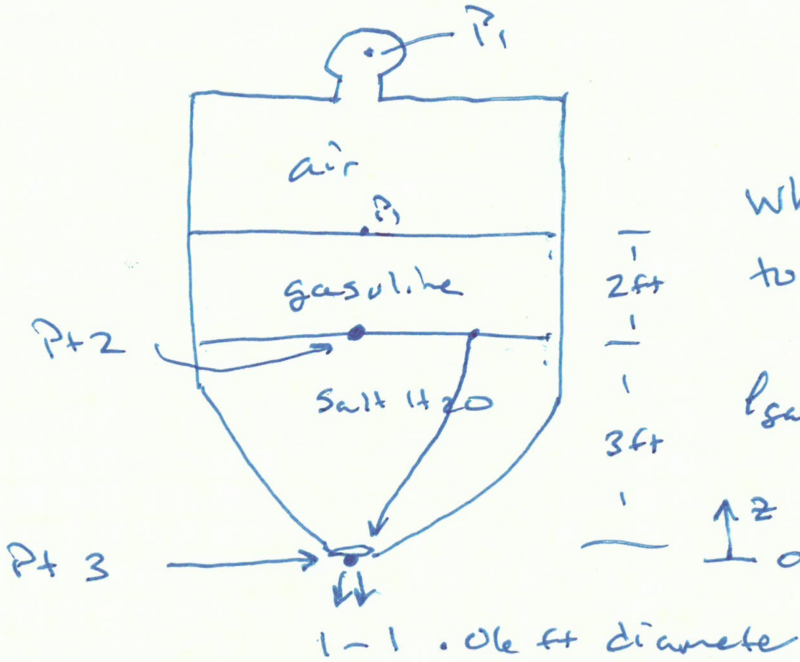


What does P_1 need to be for $Q_{exit} = 0.09 \frac{ft^3}{s}$

ρ_{gas}, ρ_{H_2O} given

Incompressible fluids $\quad Q = AV \quad$ V is uniform

$$Q_{exit} = Q_3 = \frac{\pi d_3^2}{4} V_3$$

Assume steady, inviscid, no losses, no work, assume $d_3 \ll d_2$

Bernoulli's Eqn.

$$\frac{P_2}{\gamma_w} + \frac{V_2^2}{2g} + z_2 = \frac{P_3}{\gamma_w} + \frac{V_3^2}{2g} + z_3$$

$$\frac{P_2}{\gamma_w} = \frac{P_3}{\gamma_w} + \frac{V_3^2 - V_2^2}{2g} + z_3 - z_2$$

hydrostatics across gas

$$P_2 = P_1 + \gamma_g h_g \qquad h_g \text{ - height of gasoline}$$

plugging in

$P_3 = 0$ at atm

$$\frac{P_1}{\gamma_w} + \frac{\gamma_g h_g}{\gamma_w} = \cancel{\frac{P_3}{\gamma_w}} + \frac{V_3^2 - \cancel{V_2^2}^{\,0}}{2g} - z_2$$

rearrange

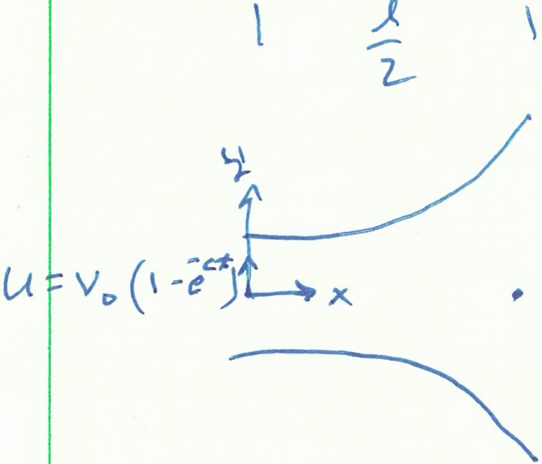
$$P_1 = P_3 + \gamma\left(\frac{V_3^{\,2}}{2g} - z_2\right) - \gamma_g h_g$$

$$P_1 = \gamma_w\left(\frac{V_3^{\,2}}{2g} - z_2\right) - \gamma_g h_g$$

$$V_3 = \frac{Q\,4}{\pi d_3^{\,2}} \qquad \gamma_w = 62.14 \ \frac{lbs}{ft^3}$$

$$\gamma_g = 42.5$$

$$P_1 = 746 \ \frac{lbs}{ft^2} = 5.18 \text{ psi}$$



$\rightarrow u = V_0\left(\frac{1}{2}\right)\left(1 - e^{-ct}\right)$

Centerline velocity is ~~defined by~~ $\vec{V} = \hat{i}\, V_0\left(1 - e^{-ct}\right)\left(1 - \frac{x}{l}\right)$

if $V_0 = 10$ ft/s and $l = 5$ ft

what value of C is the fluid acceration equal to zero for any X at time $t = 1$ s

$$a = \frac{d\vec{V}}{dt} = \frac{D\vec{V}}{Dt}$$

$$u = V_0\left(1 - e^{-ct}\right)\left(1 - \frac{x}{l}\right)$$

$$v = 0$$

$$w = 0$$

$$a_x = \frac{\partial u}{\partial t} + u\frac{du}{dx} + v\frac{du}{dy} + w\frac{du}{dz}$$

$$= V_0\left(c e^{-ct}\right)\left(1 - \frac{x}{l}\right)$$

$$u\frac{du}{dx} = V_0\left(1 - e^{-ct}\right)\left(1 - \frac{x}{l}\right)\left(V_0\left(1 - e^{-ct}\right)\left(\frac{-1}{l}\right)\right)$$

$$a_x = v_0\left(1-\frac{x}{\ell}\right)\left[ce^{-ct} - \frac{v_0}{\ell}\left(1-e^{-ct}\right)^2\right]$$

at $t = 1\,s$ $\quad a_x = 0$

$$ce^{-c} - \frac{v_0}{\ell}\left(1-e^{-c}\right)^2 = 0$$

expression for c

$$c = 0.48040396465$$