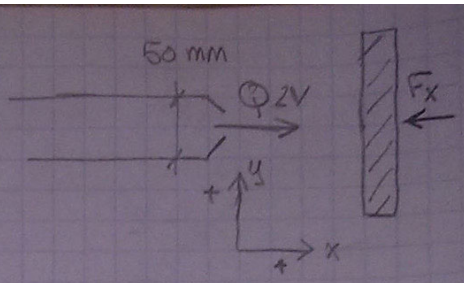
* Sheet "8"



Q2 $Q = 0.05\ m^3/s$, $d = 0.05\ m$

a) plate and stationary ... "البلاط ثابت"

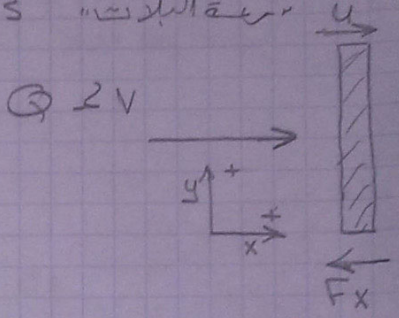
$$\Rightarrow \Sigma F_x = P * Q * (V_f - V_i) \qquad 2Q = V * A \Rightarrow V_i = \frac{0.05}{\frac{\pi (0.05)^2}{4}} = 25.478\ m/s$$

$$\Rightarrow -F_x = 1000 * 0.05 (0 - 25.478)$$

$$F_x = 1273.9\ N$$

(السرعة النهائية للمية بعد ما هتصدم مع البلاط)

b) "سرعة البلاط" $U = 12\ m/s$ * البلاط بتتحرك بسرعة ولازم نحسب السرعة النسبية بين المية والبلاط إشطه.



$$\Rightarrow Q = A * (V - U) = \frac{\pi (0.05)^2}{4} * (25.478 - 12)$$

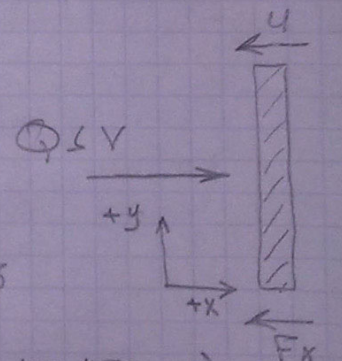
R.V السرعة النسبية

$$\Rightarrow Q = 0.026\ m^3/s$$

$$\Rightarrow -F_x = P * Q * (V_f - V_i) \Rightarrow -F_x = 1000 * 0.026 * (0 - (25.478 - 12))$$

$$F_x = 350.428\ N$$

c) $U = 12\ m/s$ * هنا بقا البلاط بيمشي عكس المية فبنجمع السرعتين سوا عشان نجيب السرعة النسبية



$$\Rightarrow Q = A * (V + U) = \frac{\pi (0.05)^2}{4} * (25.478 + 12)$$

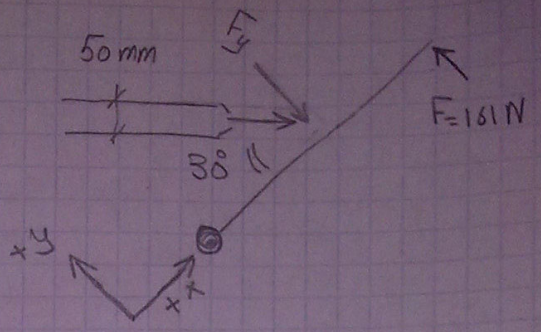
$$\Rightarrow Q = 0.074\ m^3/s$$

$$\Rightarrow -F_x = P * Q * (V_f - V_i) \Rightarrow -F_x = 1000 * 0.074 * (0 - (25.478 + 12))$$

$$F_x = 2773.372\ N$$

Q3 $L = 1.2\ m$ ∠ $F = 101\ N$

نفرض أن المية بتخبط في النص



* Force on plate

$\Sigma M_{hinge} = Zero \Rightarrow 161 * 1.2 - F_y * 0.6 = 0$

$\Rightarrow F_y = 322\ N$

$\Sigma F_y = \rho * Q * (V_f - V_i)$ $\quad \because Q = A * V \Rightarrow V = \frac{Q}{\frac{\pi (0.05)^2}{4}} \Rightarrow V = \frac{Q}{1.96 \times 10^{-3}}$

$\Rightarrow -322 = 1000 * Q (0 - \frac{Q}{1.96 \times 10^{-3}} * \sin 30)$

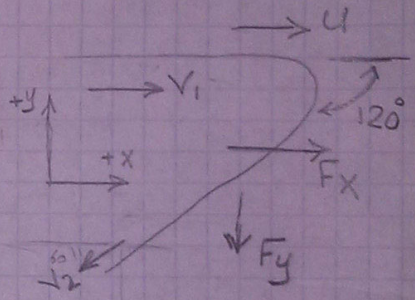
$\Rightarrow Q^2 = 1.26 \times 10^{-3} \Rightarrow \boxed{Q = 0.036\ m^3/s}$

لاحظ أننا حللنا السرعة عشان القوة مايلة أصلاً

Q4 $d = 0.075\ m$ ∠ $V_1 = V_2 = 12\ m/s$ ∠ $U = 4.8\ m/s$

$Q = A * (V - U) \Rightarrow Q = \pi (\frac{0.075}{2})^2 * (12 - 4.8)$ ∠ $V = 7.2\ m/s$

$\Rightarrow Q = 0.032\ m^3/s$



$\Sigma F_x = \rho * Q * (V_f - V_i)$ ∠ $V_i = 7.2\ m/s$ ∠ $V_f = -7.2 \cos 60\ m/s$

$\Rightarrow F_x = 1000 * 0.032 (-7.2 \cos 60 - 7.2) = -345.6\ N \Rightarrow \boxed{F_x = -345.6\ N}$

$\Sigma F_y = \rho * Q * (V_f - V_i)$ ∠ $V_i = 0$ ∠ $V_f = -7.2 \sin 60\ m/s$

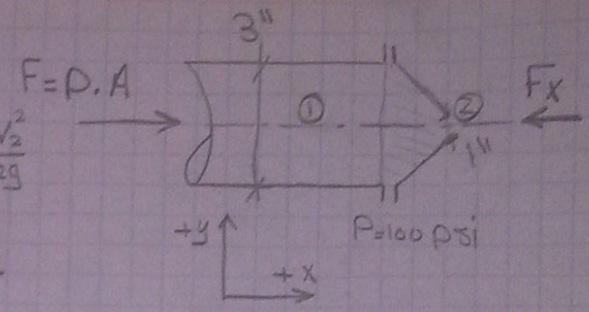
$\Rightarrow -F_y = 1000 * 0.032 (-7.2 \sin 60 - 0) = -199.53\ N$

$\Rightarrow \boxed{F_y = 199.53\ N}$

$\Rightarrow R = \sqrt{F_x^2 + F_y^2} = 399.06\ N$

$\Theta = 150°$

Q5 S.G = 0.85



$\Rightarrow$ apply B.E ①→② $\Rightarrow \frac{P_1}{\gamma} + Z_1 + \frac{V_1^2}{2g} = \frac{P_2}{\gamma} + Z_2 + \frac{V_2^2}{2g}$

$\Rightarrow \frac{100*144}{0.85*62.4} + 0 + \frac{(Q/A_1)^2}{2*32.2} = 0 + 0 + \frac{(Q/A_2)^2}{2*32.2}$

$\Rightarrow \left(\frac{Q}{\pi(\frac{1}{24})^2}\right)^2 - \left(\frac{Q}{\pi(\frac{3}{24})^2}\right)^2 = 17484.1629 \Rightarrow Q^2 = 0.526 \Rightarrow Q = 0.725\ Ft^3/s$

$\Rightarrow V_1 = \frac{Q}{A_1} \Rightarrow V_1 = \frac{0.725}{\pi(\frac{3}{24})^2} = 14.76\ Ft/s$ & $V_2 = \frac{0.725}{\pi(\frac{1}{24})^2} = 132.99\ Ft/s$

$\Rightarrow \Sigma F_x = \rho * Q * (V_f - V_i) \Rightarrow P_1 A_1 - F_x = \rho * Q * (V_2 - V_1)$

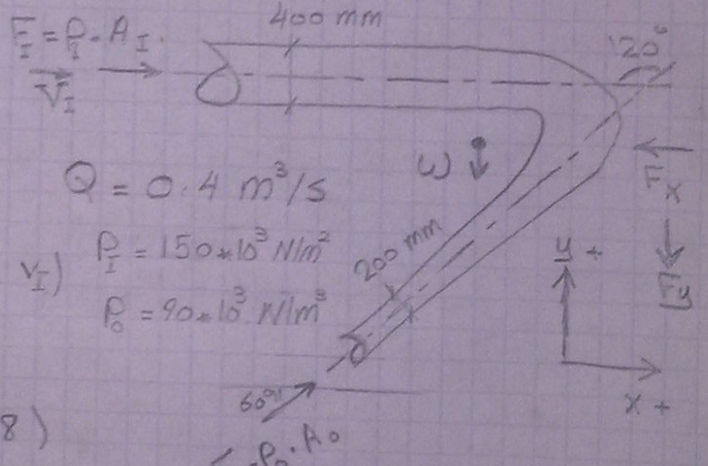
$\Rightarrow 100*144*\pi(\frac{3}{24})^2 - F_x = 1.94*0.725*(132.99 - 14.76)$

$F_x = 540\ lb$

⇐ لدينا وا ضدين مقطع من الماسورة
حسبنا القوة ضغط المية

Q6 $V_I = \frac{Q}{A_2} = \frac{0.4}{\pi(0.2/2)^2} = 3.18\ m/s$

$V_o = \frac{Q}{A_o} = \frac{0.4}{\pi(\frac{0.2}{2})^2} = 12.74\ m/s$



$Q = 0.4\ m^3/s$

$P_I = 150*10^3\ N/m^2$

$P_o = 90*10^3\ N/m^2$

$\Sigma F_x = \rho * Q * (V_f - V_i)$

$\Rightarrow P_I \cdot A_I - F_x + P_o \cdot A_o \cos 60 = \rho * Q(-V_o \cos 60 - V_I)$

$\Rightarrow 150*10^3*\pi(\frac{0.4}{2})^2 - F_x + 90*10^3*\pi(\frac{0.2}{2})^2 * \cos 60$
$= 1000*0.4*(-12.74\cos 60 - 3.18)$

$17427 - F_x = -3820 \Rightarrow \boxed{F_x = 21247\ N}$

$\Rightarrow W = \rho * \forall$

$\Rightarrow W = 200\ N$

$\Rightarrow \Sigma F_y = \rho * Q * (V_f - V_i) \Rightarrow P_o \cdot A_o * \sin 60 - F_y - W = \rho * Q * (-V_o \sin 60 - 0)$

$\Rightarrow 90*10^3*(\frac{0.2}{2})^2 * \pi * \sin 60 - F_y - 200 = 1000*0.4*(-12.74\sin 60)$

$2247.388 - F_y = -4413.265 \Rightarrow \boxed{F_y = 6660.653\ N}$

⇐ ركز مع الإ تجاهات بتاعة السرعة و الضغط مع الفرض بيف ⊕ عكسه بيف ⊖

Q7 $F_I = P_I \cdot A_I = 10 * 144 * \pi \left(\frac{18}{24}\right)^2 = 2543.4\ lb$

$\Rightarrow F_2 = P_2 \cdot A_2 = 10 * 144 * \pi \left(\frac{6}{24}\right)^2 = 282.6\ lb$

$\Rightarrow F_3 = P_3 * A_3 = 10 * 144 * \pi \left(\frac{12}{24}\right)^2 = 1130.4\ lb$

$\Rightarrow Q_I = 20\ Ft^3/s \quad \& \quad Q_2 = 8\ Ft^3/s \quad 2Q_3 = 12\ Ft^3/s$

$\Rightarrow V_I = \frac{Q_I}{A_I} = \frac{20}{\pi \left(\frac{18}{24}\right)^2} = 11.32\ Ft/s$

$\Rightarrow V_2 = \frac{Q_2}{A_2} = \frac{8}{\pi \left(\frac{6}{24}\right)^2} = 40.76\ Ft/s \quad \& \Rightarrow V_3 = \frac{Q_3}{A_3} = \frac{12}{\pi \left(\frac{12}{24}\right)} = 15.29\ Ft/s$

$\Rightarrow \sum F_{x,y} = \rho Q_2 V_2 + \rho Q_3 V_3 - P * Q_I * V_I$

$\Rightarrow F_x + F_2 \cos 60 - F_3 \cos 45 = P * Q_2 * -V_2 \cos 60 + P * Q_3 * V_3 \cos 45$

$\Rightarrow -F_x + 282.6 * \cos 60 - 1130.4 * \cos 45 = 1.94 * 8 * -40.76 * \cos 60 + 1.94 * 12 * 15.26 * \cos 45$

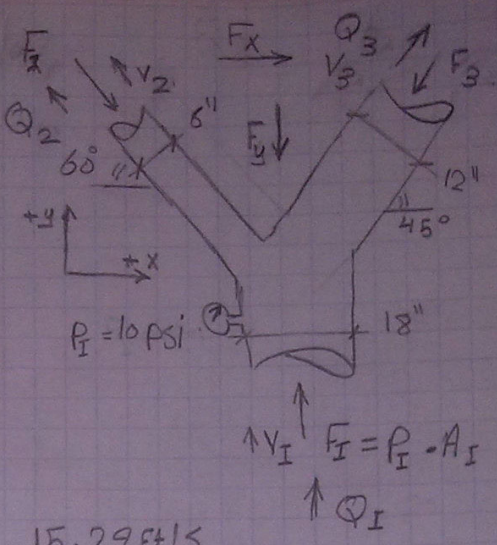
$$F_x = 592.918\ Lb$$

$\Rightarrow -F_y + F_I - F_2 \sin 60 - F_3 \sin 45 = P * Q_2 * V_2 \sin 60 + P * Q_3 * V_3 \sin 45 - P * Q_I * V_I$

$\Rightarrow -F_y + 2543.4 - 282.6 * \sin 60 - 1130.4 * \sin 45$

$= 1.94 * 8 * 40.76 * \sin 60 + 1.94 * 12 * 15.26 * \sin 45 - 1.94 * 20 * 11.32$

$$F_y = 1139.519\ Lb$$



Q8

$\Rightarrow F_{Fr} = M * W = 0.57 * 50 = 28.5\ lb$

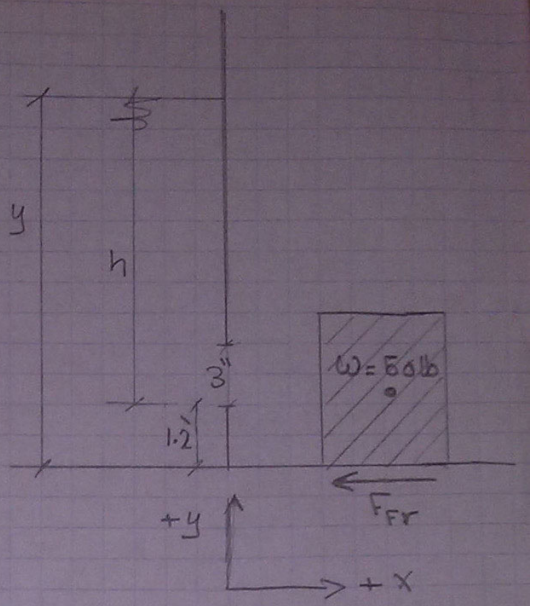
$\Rightarrow Q = Cd * A * \sqrt{2gh}$

$Q = 0.6 * \pi \left(\frac{3}{24}\right)^2 * \sqrt{2 * 32.2 * h} = 0.236\sqrt{h}\ Ft^3/s$

$\Rightarrow C_V = \frac{Cd}{C_c} = \frac{0.6}{0.62} = 0.968$

$\Rightarrow V = C_V * \sqrt{2gh} \Rightarrow V = 0.968 * \sqrt{2 * 32.2 * h}$

$V = 7.767\sqrt{h}\ Ft/s$



$\Sigma F_x = \rho Q (V_f - V_i)$

$-F_{Fr} = \rho Q (-V_i) \Rightarrow -28.5 = 1.94 * 0.236\sqrt{h} * (-7.767\sqrt{h})$

$\Rightarrow h = 7.171\ Ft \qquad \Sigma y = 1.2 + 7.171 = 8.371\ Ft$