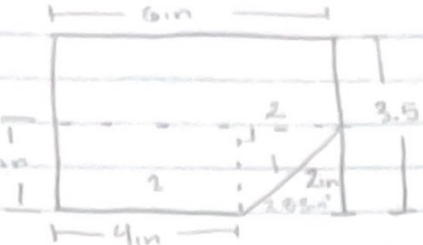
Chp 14 - 6, 15, 21, 36

6)



D = 2in B = 6in W = 6in

$W_p = 2 + 4 + 2.83$

$W_p = 8.83in$

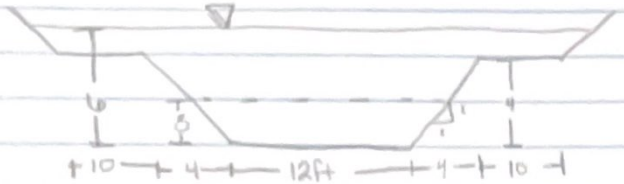
$R = \frac{A}{W_p}$ area / wetted perimeter $R = \frac{10in^2}{8.83in} = 1.13in$

$A_1 = \frac{1}{2}(2)(2) = 2in^2$ $\quad A = 10in^2$

$A_2 = 4 \cdot 2 = 8in^2$

$L = \sqrt{(2)^2 + (2)^2} = 2.83in$

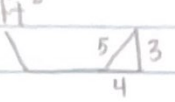
15)



$Q = A \cdot V$

$V = \frac{1}{n} R^{2/3} S^{\frac{1}{2}}$

$A = \left(\frac{12 + 20}{2}\right) \cdot 3 = 48ft^2$



$R = \frac{A}{W_p}$

$W_p = 12 + 5 + 5 = 22ft$

$r = \frac{48ft^2}{22ft} = 2.18ft$

$Q = \frac{1}{0.4}(2.18)^{\frac{2}{3}}(0.00015)^{\frac{1}{2}} \cdot 48ft^2 = 2.47 \frac{ft^3}{s}$

b)

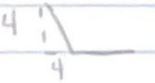
$A = \frac{1}{2}(12+20)4 + \frac{1}{2}(40+44)2$

$A = 148ft^2$

$\sqrt{(2)^2 + (2)^2} = 2.83ft$

$W_p = 2.83 + 10 + 5.66 + 12 + 5.66 + 10 + 2.83$

$W_p = 48.98ft$



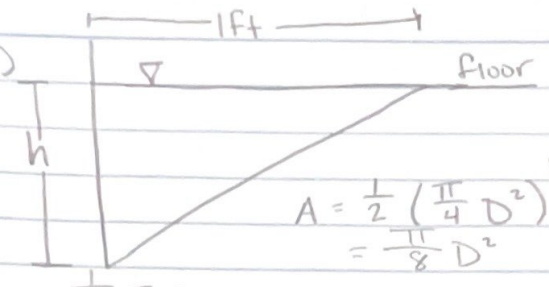
$\sqrt{(4)^2 + (4)^2} = 5.66ft$

$R = \frac{148ft^2}{48.98ft} = 3.02ft$

$Q = \frac{1}{0.4}(3.02)^{\frac{2}{3}}(0.00015)^{\frac{1}{2}} \cdot 148$

$Q = 9.47 \frac{ft^3}{s}$

21)



$Q = 500 gal/min \cdot \frac{1 \frac{m^3}{s}}{15,850.3 \frac{gal}{min}}$

$= 0.0315 \frac{m^3}{s}$

$n = 0.014 \rightarrow$ table file

$A = \frac{1}{2}\left(\frac{\pi}{4} D^2\right)$

$= \frac{\pi}{8} D^2$

$W_P = \frac{1}{2} \pi \cdot D$

$R = \frac{A}{W_P} = \frac{\frac{\pi}{8} D^2}{\frac{1}{2} \pi D} = \frac{D}{4}$

$Q = \frac{1}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$

$0.0315 \frac{m^3}{s} = \frac{1}{0.014}\left(\frac{\pi}{8} D^2\right)\left(\frac{D}{4}\right)^{\frac{2}{3}}\left(\frac{0.1}{100}\right)^{\frac{1}{2}}$

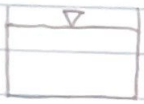
$0.0315 \frac{m^3}{s} = 0.352 D^{\frac{8}{3}}$

$D = 0.405 m$

36) $Q = 1.25 \frac{ft^3}{s}$ $V = 2.75 \frac{ft}{s}$

$A = \frac{Q}{V} \Rightarrow \frac{1.25 \frac{ft^3}{s}}{2.75 \frac{ft}{s}} = 0.45 ft^2$

a)



$A = 2y^2 \Rightarrow y = \sqrt{\frac{A}{2}} = \sqrt{\frac{(0.45 ft^2)}{2}} = 0.48 ft$

$H_R = \frac{y}{2} \Rightarrow \frac{(0.48 ft)}{2} = 0.24 ft$

b)

$A = y^2$ $y = \sqrt{A} \Rightarrow \sqrt{0.45 ft^2} = 0.67 ft$

$H_R = 0.354 y$

$= 0.354(0.67 ft) = 0.237 ft$

c)

$A = 1.73 y^2$ $y = \sqrt{\frac{A}{1.73}} = \sqrt{\frac{0.45}{1.73}} = 0.51 ft$

$H_R = \frac{y}{2} = \frac{0.51}{2} = 0.255 ft$

d)

$A = \frac{1}{2} \pi y^2$

$y = \sqrt{\frac{2(0.45)}{\pi}} = 0.535 ft$

$H_R = \frac{y}{2} = \frac{0.535}{2} = 0.27 ft$

D is the most efficient because it has the largest Hydraulic Radius (H_R) meaning more fluid flow.