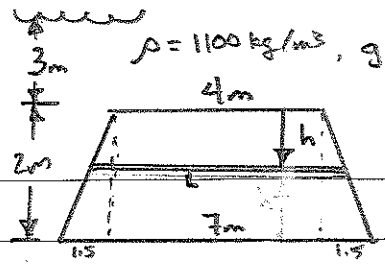
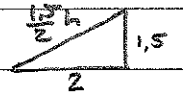
WW 2

11) 

$\rho = 1100\ kg/m^3$, $g = 9.8\ m/s^2$



$F = PA$

$P = \rho g d$

$d = h + 3$

$A = L\,dh$, $L = 4 + 2\left(\frac{1.5}{2}h\right)$

$L = 4 + 1.5h$ $\quad L(0) = 4$, $L(2) = 7$ ✓

$$F = \rho g \int_0^2 (h+3)(4+1.5h)\,dh$$

$$= \rho g \int_0^2 (4h + 1.5h^2 + 12 + 4.5h)\,dh = \rho g \int_0^2 \left(\frac{3}{2}h^2 + 8.5h + 12\right)dh$$

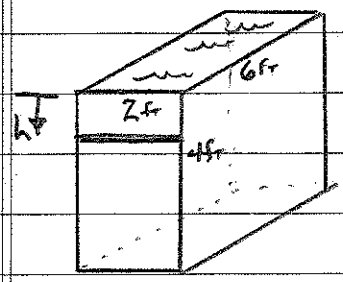
$$= \rho g \left(\frac{3}{2}\left(\frac{h^3}{3}\right) + 8.5\,\frac{h^2}{2} + 12h\right)\Big|_0^2 = \rho g\left(\frac{8}{2} + 8.5(2) + 24\right)$$

$$= \rho g(4 + 17 + 24) = 45\rho g$$

$\boxed{F = 45(1100)(9.8)\ N}$

$m^3 \cdot \frac{kg}{m^3} \cdot \frac{m}{s^2} = N$

alternate set-up:  $d = 5 - h$ $\quad L = 7 - \frac{3}{2}h$ $\quad F = \rho g \int_0^2 (5-h)\left(7 - \frac{3}{2}h\right)dh$

12) 

$g = 32\ ft/s^2$

$\rho = 1.95\ slug/ft^3$

a) $P_H = (\rho g d)$

$= \left(1.95\ \frac{s}{ft^3}\right)\left(32\ \frac{ft}{s^2}\right)(4\ ft)$

@ bottom, $P_H = (1.95)(32)(4)$

b) $F_H = P_H A$ $\quad A = 2\ ft \times 6\ ft$

$= (1.95)(32)(4)(2)(6)$

$= 48(1.95)(32)$

c) $F_H = P_H A$

$A = 2\,dh$

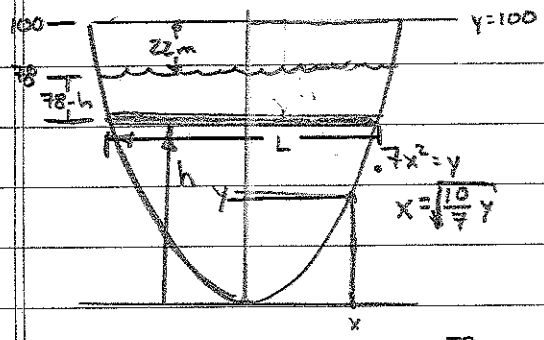
$P_H = \rho g h$

$$F_H = \rho g 2 \int_0^4 h\,dh$$

$$= 2\rho g\,\frac{h^2}{2}\Big|_0^4$$

$\boxed{F_H = 16\rho g \text{ on end}}$

13)



$F_H = P_H A$

$P_H = \rho g d$, $d = 78-h$

$A = L\,dh$

$L = \sqrt{\frac{10}{7}y} - -\sqrt{\frac{10}{7}y} = 2\sqrt{\frac{10}{7}y}$

$y = h \qquad L = 2\sqrt{\frac{10}{7}}h^{1/2}$

$$F_H = \int_0^{78} \rho g(78-h)\left(2\sqrt{\tfrac{10}{7}}h^{1/2}\right)dh$$

$$= 2\sqrt{\tfrac{10}{7}}\rho g \int_0^{78}\left(78h^{1/2} - h^{3/2}\right)dh$$

$$= 2\sqrt{\tfrac{10}{7}}\rho g\left(78\left(\tfrac{2}{3}h^{3/2}\right) - \left(\tfrac{2}{5}h^{5/2}\right)\right)\Big|_0^{78}$$

$$= 2\sqrt{\tfrac{10}{7}}\rho g\left(\tfrac{2}{3}(78)^{1/2}(78)^{3/2} - \tfrac{2}{5}(78)^{5/2}\right)$$

$$= 2\sqrt{\tfrac{10}{7}}\rho g\left(\tfrac{10}{15}(78)^{5/2} - \tfrac{6}{15}(78)^{5/2}\right)$$

$$\boxed{F_H = 2\sqrt{\tfrac{10}{7}}\rho g\left(\tfrac{4}{15}\right)(78)^{5/2}} \qquad \rho = 1000\ kg/m^3,\ g = 9.8\ m/s^2$$

15) $\frac{dy}{dt} = y^2(7+t)$

$\frac{1}{y^2}dy = (7+t)dt \Rightarrow \int y^{-2}dy = \int (7+t)dt$

$y^{-2}dy =$

$-y^{-1} = 7t + \frac{t^2}{2} + C$

$-\frac{1}{y} = \frac{14t+t^2+2C}{2}$

$y = \frac{-2}{t^2+14t+2C}$

$y(1) = 5 = \frac{-2}{1^2+14(1)+2C}$

$5(15+2C) = -2$

$10C = -2-75$

$C = -77/10$

$$\boxed{y = \frac{-2}{t^2+14t+2\left(-\frac{77}{10}\right)}}$$

OR

$u = 7+t$

$du = dt$

$\int u\,du$

$\frac{u^2}{2} = \frac{(7+t)^2}{2}$

$-\frac{1}{y} = \frac{(7+t)^2}{2} + C = \frac{(7+t)^2+2C}{2}$

$y = \frac{-2}{(7+t)^2+2C}$

$y(1) = 5 = \frac{-2}{8^2+2C}$

$5(64+2C) = -2$

$10C = -320-2 = -322$

$C = -\frac{322}{10} = -\frac{161}{5}$

$$\boxed{y = \frac{-2}{(7+t)^2+2\left(-\frac{161}{5}\right)}}$$