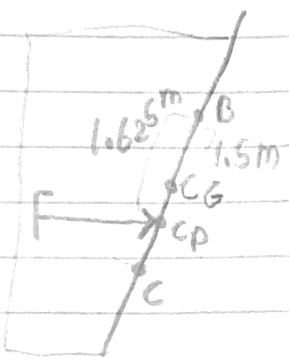
a) $F = \gamma h_{CG} A = (9790)(4.5)\sin 50 (\pi)(1.5)^2$

$= 239\ KN$

FBD



b) $|y_{cp} - y_{cG}| = \dfrac{I_{xx}\sin\theta}{h_{CG} A} = \dfrac{\frac{\pi}{4} r^4 \sin\theta}{h_{CG}\pi r^2}$

$= \dfrac{\frac{\pi}{4}(1.5)^4 \sin 50^\circ}{4.5\sin 50^\circ (\pi)(1.5)^2} = 0.125\ m$

$\therefore y_{cp}$ is 1.625 m from B

AND $y_{cp} = |y_{cp} - y_{cG}| + h_{CG} = 0.125 + 4.5 = 4.625\ m$

$\therefore y_{cp}$ is 4.625 m from free surface

c) $M_B = (238550)(1.625) = 388\ KN\cdot m$

$\therefore$ The hydrostatic force is 239 KN

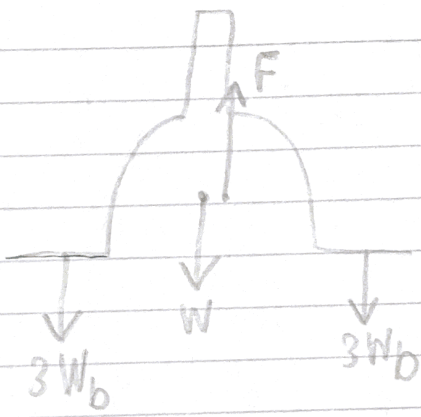
$\therefore$ The center of pressure is 4.625 m from free surface

$\therefore$ The moment about B is 388 KN·m

2) $F = W_{cylinder} - W_{hemisphere} - W_{pipe}$

$= (9790)\pi(2)^2(6) - (9790)\left(\frac{2\pi}{3}\right)(2)^3 - (9790)\frac{\pi}{4}(0.03)^2(4)$

$= 738149 - 164033 - 28 = 574088\ N$



FBD

$\Sigma F_y = 0$

$F - W - 6W_b = 0$

$W_b = \frac{F - W}{6} = \frac{574088 - 30000}{6}$

$W_b = 90700\ N = 90.7\ kN$

∴ The force in each bolt is 90.7 kN

3) $7.85 \gamma (a+b) L_W = \gamma a L_W + 13.56 \gamma b L_W$ $\div \gamma L_W$

$\therefore 7.85a + 7.85b = a + 13.56b$

$\frac{a}{b} = \frac{13.56 - 7.85}{7.85 - 1} = 0.834$

$\therefore$ The ratio of the distances a and b is 0.834

4) $h = \frac{P}{\gamma} = \frac{150000}{9790} = 15.32\,m$ above gage

$F = \gamma \bar{h} = (9790)\left[\frac{\pi}{4}(2)^2(8.32) + \frac{1}{3}\frac{\pi}{4}(2)^2(4)\right]$

$= 297000\,N = 297\,kN$

$\therefore$ The net hydrostatic force on ABC is 297 kN