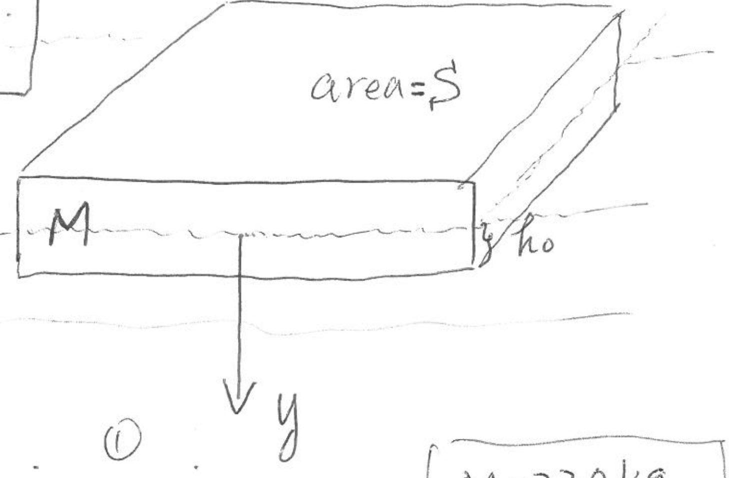
11.76

density of water = ρ_w
mass of man = m
mass of raft = M

- without man
  - at equilibrium



volume in water: $V_0 = S h_0$

Buoyant force: $S h_0 \rho_w g$

i.e.: $Mg - S h_0 \rho_w g = 0$. ①

$M = 220\,kg$
$m = 75\,kg$
$A = 0.04\,m$

  - when there is a displacement y

Volume in water: $V = S(h_0 + y)$

Buoyant force: $S(h_0 + y)\rho_w \cdot g$

- With man @ equilibrium: $y = A$.

$(m+M)g - F_B = 0 \Rightarrow (m+M)g - S(h_0 + A)\rho_w g = 0$

$mg + Mg - S h_0 \rho_w g - S A \rho_w g = 0$

Because of ①: $mg - S A \rho_w g = 0$. i.e. $m = S A \rho_w$

- Without man, moving: $y = y(t)$.

$F_{net} = Mg - S(h_0 + y)\rho_w g$

$= Mg - S h_0 \rho_w g - S y \rho_w g$

$= -S y \rho_w g = Ma$

$\therefore a = -\dfrac{S\rho_w g}{M} y = -\omega^2 y$

$$\boxed{\begin{aligned} \omega &= \sqrt{\frac{S\rho_w g}{M}} \\ S\rho_w &= \frac{m}{A} \\ \therefore \omega &= \sqrt{\frac{mg}{MA}} \\ &= 9.14\ rad/sec \end{aligned}}$$