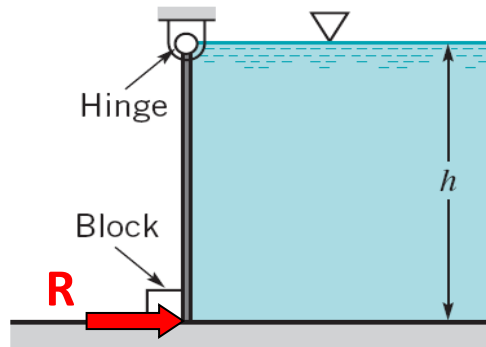NAME

Student ID

Quiz 2. A gate of negligible weight is used to hold back water in a channel of width b as shown below.

(a) Find the resultant force F_R acting on the gate. (3 points)

(b) Find the vertical location of center of pressure y_R. (Hint: $I_{xc} = \frac{bh^3}{12}$) (3 points)

(c) Determine the force of the block against the gate R in terms of the specific weight of water γ, water depth h, and width b. (4 points)

Solution:

(a)

$$F_R = \gamma h_c A$$

(+2points)

$$F_R = \gamma h_c A = \gamma \left(\frac{h}{2}\right)(h \times b) = \frac{\gamma h^2 b}{2}$$
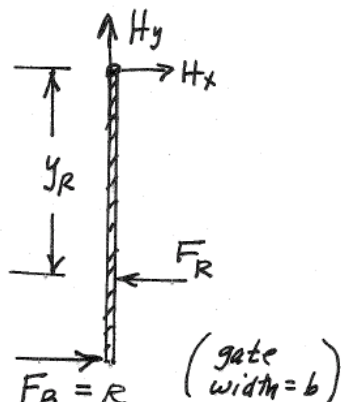
(+1points)

(b)

$$y_R = \frac{I_{xc}}{y_c A} + y_c$$

(+2points)

$$y_R = \frac{I_{xc}}{y_c A} + y_c = \frac{bh^3/12}{(h/2)(bh)} + \frac{h}{2} = \frac{2}{3}h$$

(+1points)

(c)

$$\sum M_{hinge} = 0$$

(+2points)

$$hR = y_R F_R = \left(\frac{2}{3}h\right)\left(\frac{\gamma h^2 b}{2}\right)$$

(+1points)

Ans: $R = \dfrac{\gamma h^2 b}{3}$

(+1points)