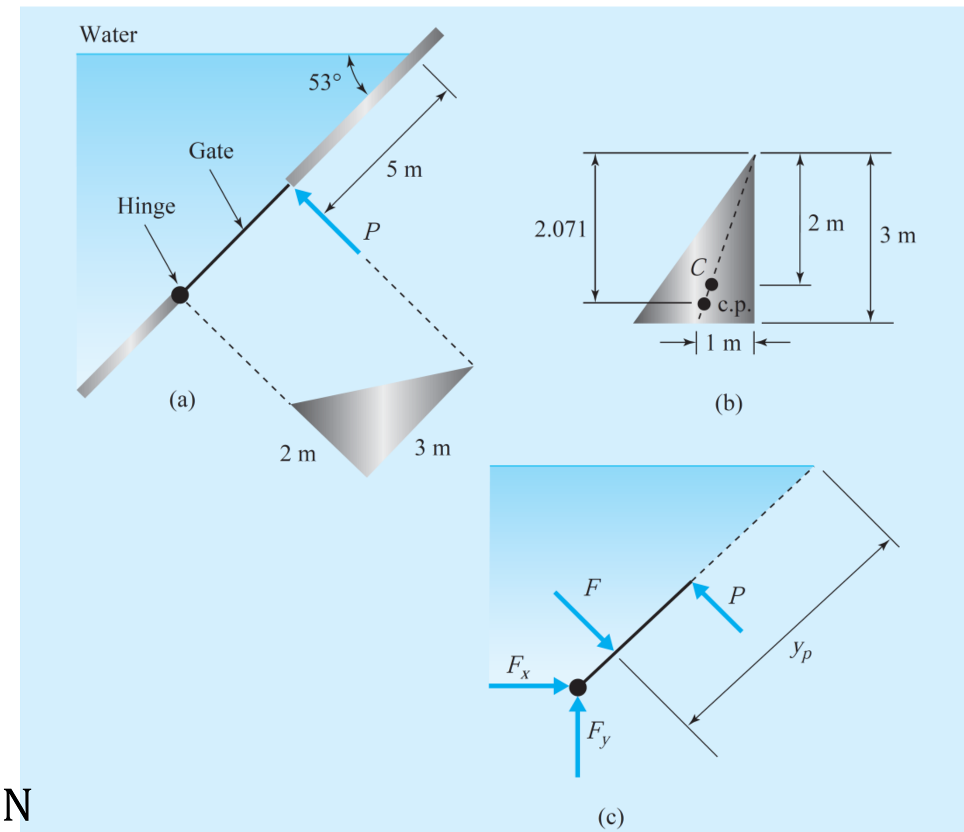
Find the location of the resultant force F of the water on the triangular gate and the force P necessary to hold the gate in the position shown in the Figure. Neglect the weight of the gate.

$$\bar{y} = 2 + 5 = 7\ \text{m} \qquad y_p = \bar{y} + \frac{\bar{I}_x}{\bar{y}A} = 7 + \frac{\frac{2 \times 3^3}{36}}{3 \times \frac{2 \times 3}{2}} = 7.071\ \text{m}$$

$$x_p = \bar{x} + \frac{\bar{I}_{xy}}{\bar{y}A} = \frac{1}{3} \times 2 + \frac{\frac{2^2 \times 3^2}{72}}{7 \times \frac{2 \times 3}{2}}$$

$$= \frac{2}{3} + \frac{4 \times 9}{72 \times 21} = \frac{2}{3} + \frac{1}{42}$$

$$= 0.666 + 0.023 = 0.689\ \text{m}$$



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

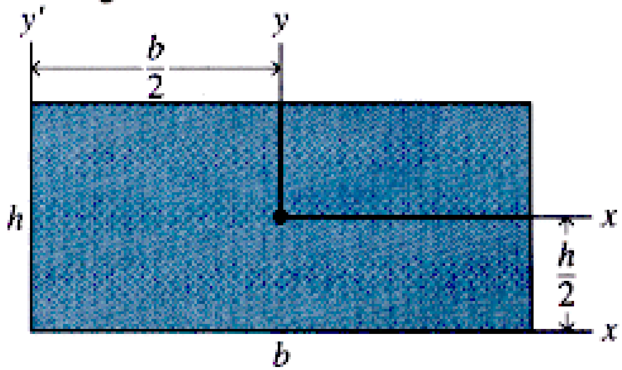
$$3P = (3 - 2.071)F$$

$$P = \frac{0.929}{3} \times \gamma \bar{h} A =$$

$$\frac{0.929}{3} \times 9{,}810 \times 7 \times \sin 53° \times 3 = 50{,}900\ \text{N}$$

SECOND MOMENTS OF PLANE AREAS

Rectangular Area



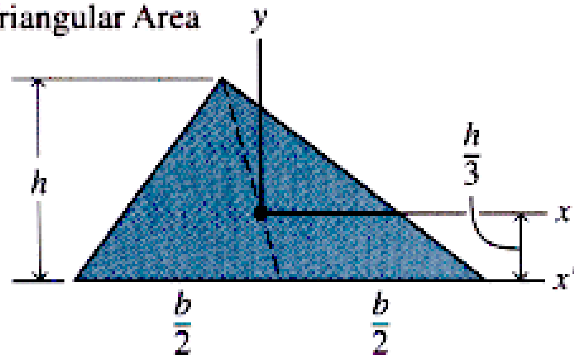
$$A = bh$$

$$I_x = \frac{bh^3}{12} \qquad I_{x'} = \frac{bh^3}{3}$$

$$I_y = \frac{hb^3}{12} \qquad I_{y'} = \frac{hb^3}{3}$$

$$I_{xy} = 0 \qquad I_{x'y'} = \frac{b^2h^2}{4}$$

Triangular Area



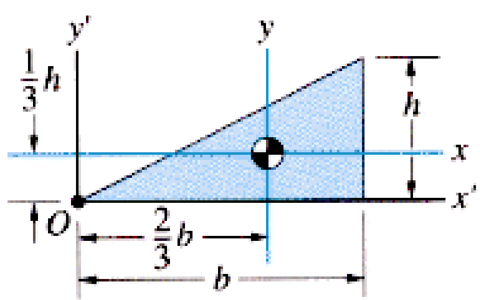
$$A = \frac{1}{2}bh$$

$$I_x = \frac{bh^3}{36} \qquad I_{x'} = \frac{bh^3}{12}$$

$$I_y = \frac{hb^3}{36}$$

$$I_{xy} = \frac{b^2h^2}{72}$$

Triangular Area



$$A = \frac{1}{2}bh$$

$$I_x = \frac{bh^3}{36} \qquad I_{x'} = \frac{bh^3}{12}$$

$$I_y = \frac{hb^3}{36} \qquad I_{y'} = \frac{hb^3}{4}$$

$$I_{xy} = \frac{b^2h^2}{72} \qquad I_{x'y'} = \frac{b^2h^2}{8}$$

Circular Area

y

$$A = \pi R^2$$

$$I_x = \frac{\pi R^4}{} \qquad I_{x'} = \frac{5\pi R^4}{}$$