

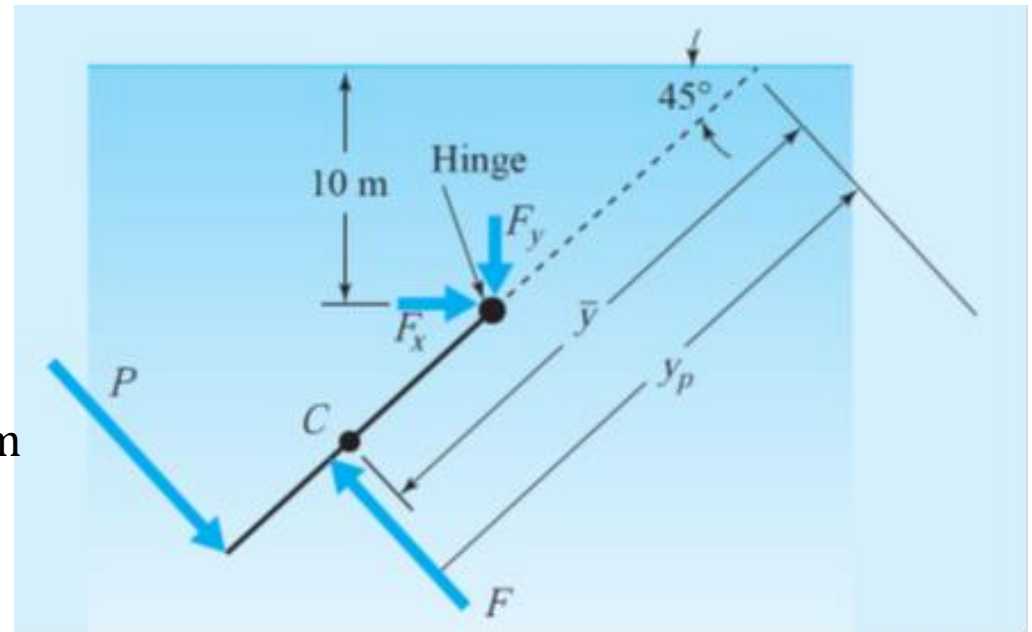
A plane area of 80 cm × 80 cm acts as an escape hatch on a submersible. If it is on a 45° angle with the horizontal, what force applied normal to the hatch at the bottom edge is needed to just open the hatch, if it is hinged at the top edge when the top edge is 10 m below the surface? The pressure inside the submersible is assumed to be atmospheric.

$$F = \gamma \bar{h} A =$$

$$= 9,810 \times \left(10 + 0.4 \times \sin \frac{\pi}{4} \right) \times 0.8 \times 0.8$$

$$= 64,560 \text{ N}$$

$$\bar{y} = \frac{\bar{h}}{\sin \frac{\pi}{4}} = \frac{10 + 0.4 \times \sin \frac{\pi}{4}}{\sin \frac{\pi}{4}} = 14.542 \text{ m}$$



$$y_P = \bar{y} + \frac{\bar{I}_x}{A\bar{y}} = 14.542 + \frac{0.8 \times 0.8^3 / 12}{0.8 \times 0.8 \times 14.542} = 14.546 \text{ m}$$

$$0.8P = (y_P - \bar{y} + 0.4)F$$

$$P = \frac{14.546 - 14.542 + 0.4}{0.8} \times 64,560 = 32,610 \text{ N}$$

