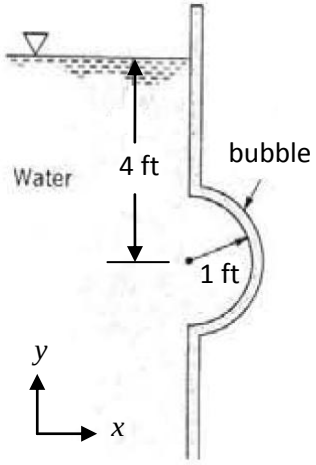
September 15, 2010

NAME

Fluids-ID

Quiz 2. A 1-ft-radius hemispherical plexiglass "bubble" is to be used as a special window on the side of an above-ground swimming pool. The window is to be bolted onto the vertical wall of the pool and faces outward, covering a 2-ft-diameter opening in the wall. The center of the opening is 4 ft below the surface. Determine the horizontal and vertical components of the force of the water on the hemisphere.



- $F_R = p_c \cdot A$
  - p_c = Centeroidal pressure
  - A = Area
- $V = (4/3)\pi R^3$
  - V = Volume of a sphere
  - R = Radius of a sphere
- $\gamma = 62.4$ lb/ft^3 for water

Solution:

1) $\sum F_x = 0$:

$$F_H = F_R = p_c A$$ (+3 points)

Thus,

$$F_H = \gamma h_c A = \left(62.4 \frac{\text{lb}}{\text{ft}^3}\right)(4 \text{ ft})(\pi(1 \text{ ft})^2) = 784 \text{ lb}$$ (+2 points)

Note: F_H to right

2) $\sum F_y = 0$:

$$F_V = W = \gamma \forall$$ (+3 points)

Thus,

$$F_V = \gamma \left(\frac{4}{3}\pi R^3\right)/2 = \left(62.4 \frac{\text{lb}}{\text{ft}^3}\right)\left(\frac{4}{3}\pi(1 \text{ ft})^3\right)\left(\frac{1}{2}\right) = 131 \text{ lb}$$ (+2 points)

Note: F_V down on bubble