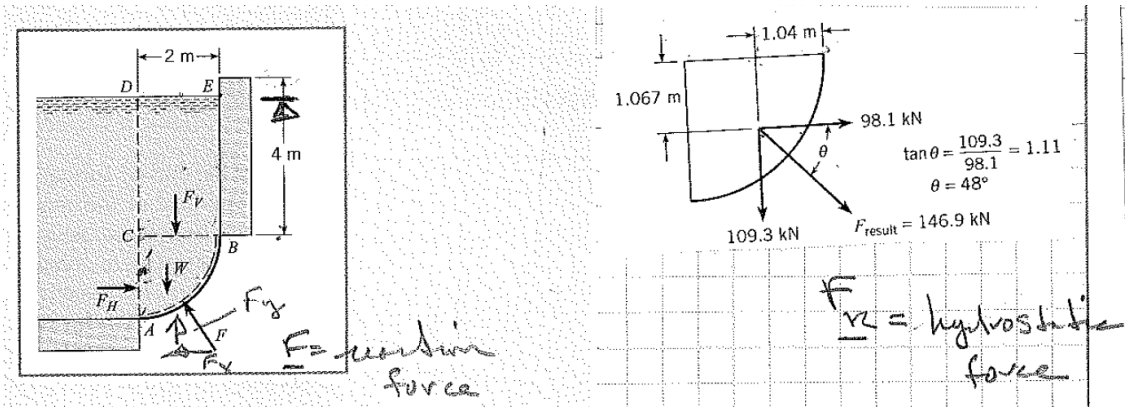


In the figure, surface $AB$ is a circular arc with a ridius of 2m and a depth of 1m into the paper. The distance $EB$ is 4m. The fluid above surface $AB$ is water, and atmospheric pressure prevails on the free surface of the water and on the bottom side of surface $AB$. Find the magnitude and line of action of the hydrostatic force acting on surface $AB$.

**Solution:**

$$F_R = F_{R_x}\hat{i} + F_{R_y}\hat{j}$$

$$\begin{aligned} F_{R_y} &= -\gamma V_{CDEB+ACB} \\ &= -\gamma\left[4\times 2\times 1 + \frac{1}{4}\pi 2^2 \times 1\right] = -109.3\text{kN} \end{aligned}$$

$$x_{cp}F_{R_y} = 1\times\gamma V_{CDEB} + \left(r - \frac{4r}{3\pi}\gamma V_{ACB}\right)$$

$$x_{cp} = 1.04\text{m}$$

$$F_{R_x} = \overline{p}A = \gamma\times 5\times 2\times 1 = 98.1\text{kN}$$

$$y_{cp} = \overline{y} + \frac{\overline{I}}{\overline{y}A} = 5.067\text{m}$$

where

$$\overline{I} = \frac{bh^3}{12} = \frac{1\times 2^3}{12}$$