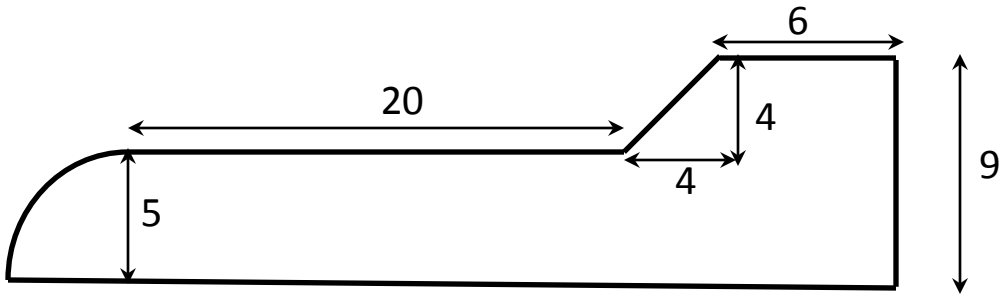
Example



Compute the surface area and volume of the tank obtained by rotating the above profile about the horizontal axis.

$$A = 2\pi y_c L$$

$$y_c = \frac{\sum_i y_c^i L_i}{\sum_i L_i} = \frac{\left[\left(2\times\frac{5}{\pi}\right)\times\frac{\pi\times5}{2}+5\times20+7\times\sqrt{32}+9\times6+4.5\times0\right]}{\left[\frac{\pi\times5}{2}+20+\sqrt{32}+6+0\right]} = \frac{218.6}{39.51} = 5.532\ ft$$

$$A = 2\pi \times 5.532 \times 39.51 = 1373.1\ ft^2$$

The length of the vertical segment has been taken as zero. This is because here we were not interested in calculating the area of the bottom face of the tank. If it is necessary to calculate the area of the bottom face as well, then this should be equal to 9.0

$$V = 2\pi y_c A$$

$$y_c = \frac{\sum_i y_c^i A_i}{\sum_i A_i} = \frac{\left[\left(4\times\frac{5}{3\pi}\right)\times\frac{\pi\times5^2}{4}+2.5\times100+3.12\times28++4.5\times54\right]}{\left[\frac{\pi\times5^2}{4}+100+28+54\right]} = \frac{622.03}{201.63} = 3.085\ ft$$

$$V = 2\pi \times 3.085 \times 201.63 = 3908.31\ ft^2$$