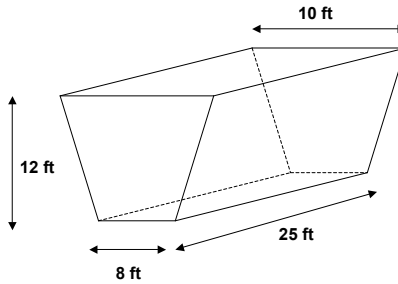# 8.5: Applications to Physics

Problems

1. The underground reservoir, pictured below, is filled to a depth of 9 feet with water. The density of water is 62.4 lbs/ft^3 and the tank is buried 5 feet below ground level.

(a) Write an expression that approximates the work required to lift a horizontal slice of water that is Δy feet thick and is located y_i feet below ground level to sluice that is 10 feet above ground level. Include units.

(b) Write an integral for the total amount of work required to pump all the water from the tank to the sluice located 10 feet above ground. Include units.

2. A scale is built by placing a metal plate on top of a spring.

(a) An object weighing 200 lbs is placed on top of the scale. If the object compresses the spring by 5 in, find the spring constant k such that the force of the spring is $F = -kx$. Include units.

(b) How much work is done by the object in compressing the spring?

3. A cylindrical tank is buried 15 m below ground and oriented so that the circular ends are vertical. The tank has a radius of 2 m and a length of 20 m and is filled with a gasoline with a density of $\delta = 719.7$ kg/m^3. Compute the work required to pump the gasoline to ground level. Include units. [You may use your calculator]

Answers

1. (a) $62.4(25)\left(-\dfrac{1}{6}y_i + \dfrac{65}{6}\right)(y_i + 10)\,\Delta y$ lb ft (b) $\displaystyle\int_8^{17} 62.4(25)\left(-\dfrac{1}{6}y + \dfrac{65}{6}\right)(y + 10)\,\mathrm{d}y$ lb ft   **2.** (a) $k = 40\,\text{lbs/in}$ (b) $41.66\,\text{lb ft}$ **3.** $30,134,622.03\,\text{J}$ or $30.1346\,\text{MJ}$