

**Exercise 1.76**

In the United States, water used for irrigation is measured in acre-feet. An acre-foot of water covers an acre to a depth of exactly 1 ft. An acre is 4840 yd<sup>2</sup>. An acre-foot is enough water to supply two typical households for 1.00 yr. (a) If desalinated water costs \$1950 per acre-foot, how much does desalinated water cost per liter? (b) How much would it cost one household per day if it were the only source of water?

**Solution****Part (a)**

Use dimensional analysis to convert from dollars per acre-foot to dollars per liter.

$$1950 \frac{\$}{1 \text{ acre} \cdot \cancel{\text{ft}}} \times \frac{1 \text{ acre}}{4840 \cancel{\text{yd}}^2} \times \left(\frac{1 \cancel{\text{yd}}}{3 \cancel{\text{ft}}}\right)^2 \times \left(\frac{1 \cancel{\text{ft}}}{12 \cancel{\text{in}}}\right)^3 \times \left(\frac{1 \cancel{\text{in}}}{2.54 \cancel{\text{cm}}}\right)^3 \times \frac{1 \cancel{\text{cm}}^3}{1 \cancel{\text{mL}}} \times \frac{1000 \cancel{\text{mL}}}{1 \text{ L}} \approx 1.58 \times 10^{-3} \frac{\$}{\text{L}}$$

**Part (b)**

Use dimensional analysis again.

$$1950 \frac{\$}{1 \text{ acre} \cdot \cancel{\text{ft}}} \times \frac{1 \text{ acre} \cdot \cancel{\text{ft}}}{2 \text{ households} \cdot \cancel{\text{year}}} \times \frac{1 \cancel{\text{year}}}{365 \text{ days}} \approx 2.67 \frac{\$}{\text{household} \cdot \text{day}}$$

Therefore, it will cost one household

$$1 \text{ household} \times 2.67 \frac{\$}{\text{household} \cdot \text{day}} \approx 2.67 \frac{\$}{\text{day}}$$