

Lesson Summary

The formulas $V = Bh$ and $V = rt$, where r is flow rate, can be used to solve real-world volume problems involving flow speed and flow rate. For example, water flowing through a square pipe can be visualized as a right rectangular prism. If water is flowing through a 2 in. \times 2 in. square pipe at a flow speed of $4 \frac{\text{ft.}}{\text{s}}$, then for every second the water flows through the pipe, the water travels a distance of 4 ft. The volume of water traveling each second can be thought of as a prism with a 2 in. \times 2 in. base and a height of 4 ft. The volume of this prism is:

$$\begin{aligned} V &= Bh \\ &= \frac{1}{6} \text{ ft.} \times \frac{1}{6} \text{ ft.} \times 4 \text{ ft.} \\ &= \frac{1}{9} \text{ ft}^3 \end{aligned}$$

Therefore, $\frac{1}{9} \text{ ft}^3$ of water flows every second, and the flow rate is $\frac{1 \text{ ft}^3}{9 \text{ s}}$.

Problem Set

1. Harvey puts a container in the shape of a right rectangular prism under a spot in the roof that is leaking. Rainwater is dripping into the container at an average rate of 12 drops a minute. The container Harvey places under the leak has a length and width of 5 cm and a height of 10 cm. Assuming each raindrop is roughly 1 cm^3 , approximately how long does Harvey have before the container overflows?
2. A large square pipe has inside dimensions 3 in. \times 3 in., and a small square pipe has inside dimensions 1 in. \times 1 in. Water travels through each of the pipes at the same constant flow speed. If the large pipe can fill a pool in 2 hours, how long will it take the small pipe to fill the same pool?
3. A pool contains $12,000 \text{ ft}^3$ of water and needs to be drained. At 8:00 a.m., a pump is turned on that drains water at a flow rate of 10 ft^3 per minute. Two hours later, at 10:00 a.m., a second pump is activated that drains water at a flow rate of 8 ft^3 per minute. At what time will the pool be empty?
4. In the previous problem, if water starts flowing into the pool at noon at a flow rate of 3 ft^3 per minute, how much longer will it take to drain the pool?
5. A pool contains $6,000 \text{ ft}^3$ of water. Pump A can drain the pool in 15 hours, Pump B can drain it in 12 hours, and Pump C can drain it in 10 hours. How long will it take all three pumps working together to drain the pool?
6. A 2,000-gallon fish aquarium can be filled by water flowing at a constant rate in 10 hours. When a decorative rock is placed in the aquarium, it can be filled in 9.5 hours. Find the volume of the rock in cubic feet ($1 \text{ ft}^3 = 7.5 \text{ gal.}$)