

Real-World Volume Problems

Jim wants to know how much his family spends on water for showers. Water costs _____ for _____ gallons. His family averages _____ showers per day. The average length of a shower is _____ minutes. He places a bucket in his shower and turns on the water. After one minute, the bucket has _____ gallons of water. About how much money does his family spend on water for showers in a _____-day month?

1. Harvey puts a container in the shape of a right rectangular prism under a spot in the roof that is leaking. Rain water 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 $3 \text{ in.} \times 3 \text{ in.}$, and a small square pipe has inside dimensions $1 \text{ in.} \times 1 \text{ in.}$ Water travels through each of the pipes at the same constant 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 a.m., a pump is turned on that drains water at the rate of 10 ft^3 per minute. Two hours later, at 10 a.m., a second pump is activated that drains water at the 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 the 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 ($1 \text{ ft}^3 = 7.48 \text{ gal.}$).

Jim wants to know how much his family spends on water for showers. Water costs _____ for _____ gallons. His family averages _____ showers per day. The average length of a shower is _____ minutes. He places a bucket in his shower and turns on the water. After one minute, the bucket has _____ gallons of water. About how much money does his family spend on water for showers in a _____-day month?

Number of gallons of water in one day of showering (four, ten-minute showers): _____ min. _____ gal.

Number of gallons of water in _____ days: _____ days _____ gal.

Cost of showering for _____ days: _____ gal. _____

The family spends _____ in a _____-day month on water for showers.

1. Harvey puts a container in the shape of a right rectangular prism under a spot in the roof that is leaking. Rain water is dripping into the container at an average rate of _____ drops a minute. The container Harvey places under the leak has a length and width of _____ cm and a height of _____ cm. Assuming each raindrop is roughly _____ cm^3 , approximately how long does Harvey have before the container overflows?

Volume of the container in cubic centimeters:

_____ cm _____ cm _____ cm _____ cm^3

Number of minutes until the container is filled with rainwater:

_____ cm^3 _____ min.

2. A large square pipe has inside dimensions _____ in. _____ in., and a small square pipe has inside dimensions _____ in. _____ in. Water travels through each of the pipes at the same constant speed. If the large pipe can fill a pool in _____ hours, how long will it take the small pipe to fill the same pool?

If _____ is the speed of the water in feet per minute, then in one minute the large pipe provides _____ ft^3 . In one minute the small pipe provides one-ninth as much, _____ ft^3 . Therefore, it will take the small pipe nine times as long. It will take the small pipe _____ hours to fill the pool.

3. A pool contains _____ ft^3 of water and needs to be drained. At _____ a.m., a pump is turned on that drains water at the rate of _____ ft^3 per minute. Two hours later, at _____ a.m., a second pump is activated that drains water at the rate of _____ ft^3 per minute. At what time will the pool be empty?

Water drained in the first two hours: _____ min. _____ ft^3

Volume of water that still needs to be drained: _____ ft^3 _____ ft^3 _____ ft^3

Amount of time needed to drain remaining water with both pumps working is

_____ ft^3 _____ min. or _____ h.

Total time needed to drain the pool is _____ h., so the pool will drain completely at _____ p.m.

4. In the previous problem, if water starts flowing into the pool at noon at the rate of ft^3 per minute, how much longer will it take to drain the pool?

At noon, the first pump will have been on for four hours, and the second pump will have been on for two hours. The cubic feet of water drained by the two pumps together at noon is

min. ——— min. ——— ft^3

Volume of water that still needs to be drained:

ft^3 ft^3 ft^3

If water is entering the pool at ft^3 , but leaving it at ft^3 , the net effect is that water is leaving the pool at ft^3 .

Amount of time needed to drain remaining water with both pumps working and water flowing in is

ft^3 ——— min., or h and min. The pool will finish draining at p.m. the same day. It will take an additional hour and minutes to drain the pool.

5. A pool contains ft^3 of water. Pump A can drain the pool in hours, pump B can drain it in 12 hours, and pump C can drain it in hours. How long will it take all three pumps working together to drain the pool?

Rate at which Pump A drains the pool: — pool per hour

Rate at which Pump B drains the pool: — pool per hour

Rate at which Pump C drains the pool: — pool per hour

Together the pumps drain the pool at — — — pool per hour or — pool per hour. Therefore, it will take hours to drain the pool when all three pumps are working together.

6. A gallon fish aquarium can be filled by water flowing at a constant rate in hours. When a decorative rock is placed in the aquarium, it can be filled in hours. Find the volume of the rock in cubic feet (ft^3 gal.).

Rate of water flow into aquarium:

————— —————

Since it takes half an hour less time to fill the aquarium with the rock inside, the volume of the rock is

————— hr. gal.

Volume of the rock:

gal. ————— ft^3 ; the volume of the rock is approximately ft^3 .