

**MATH
1010****Extension Activity****Draining a Bathtub**

Evangelista Torricelli was an Italian mathematician and physicist. He is best known for his invention of the barometer, but he is also well known for his law regarding the speed of fluid flowing out of an opening. For a bathtub with a rectangular base, *Torricelli's Law* implies that the current height h of the water in the tub t seconds after it begins draining is given by the equation

$$h = \left[\sqrt{h_0} - \frac{2\pi d^2 \sqrt{3}}{\ell w} t \right]^2$$

where ℓ and w are the tub's length and width, d is the diameter of the drain, and h_0 is the water's initial height. (All measurements are in inches.)

Suppose you fill a tub completely with water. The tub is 60 inches long by 30 inches wide by 25 inches high, and has a drain with a 2-inch diameter.

Use the equation above to answer the following questions. Round to the nearest hundredth.

1. Solve for t .
2. **a.** Find the time it takes for the tub to go from being full to half full.
b. Find the time it takes for the tub to go from being half full to empty.
3. Find the time it takes for the tub to go from being full to empty.
4. Use a graphing calculator to graph the height of the water versus time. (The y -axis is the height (in inches), and the x -axis is the time (in seconds) in intervals of 30 seconds.)
5. Based on your results from Exercises 1–4, what general statement can you make about the speed at which the water drains? Explain your answer.

Bonus: Is it possible to *rationalize* the denominator after solving for t ?

