Science Connection: For a bathtub with a rectangular base, $Torricelli's\ Law$ implies that the height h of the water in the tub t seconds after it begins draining is given by

$$h = \left(\sqrt{h_0} - \frac{2\pi d^2 \sqrt{3}}{lw} \cdot t \right)^2$$

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 completely fill a tub 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.

    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.
    c.   Based on your results, what general statement can you make about the speed at which water drains?

Now suppose you have the same bathtub but the diameter d varies.

    d.   Find the time it takes for the tub to go from being full to empty with a diameter twice the size.
    e.   Find the time it takes for the tub to go from being full to empty with a diameter half the size.
    f.   Based on your results, what general statement can you make about the impact the diameter of the drain has on the speed in which water drains. Does doubling the drain diameter make it drain twice as fast and halving it make if drain half as fast? How could you be sure?

*As always be sure your work is rubric ready. That means neat, complete work shown as well as complete sentence responses to all questions. Be sure to include units where appropriate. If you would like to work with a partner or in groups of no more than four and turn in one assignment per group that is okay with me. I hope you work together there is some messy algebra in here. Team work helps with challenging tasks. ☺ Good luck and have fun!