

Honors Pre-Calculus November Brainteasers

4 points

1) If a cylindrical tank holds 100,000 gallons of water, which can be drained from the bottom of the tank in an hour, then Torricelli's Law gives the volume V of water remaining in the tank after t minutes as

$$V(t) = 100,000 \left(1 - \frac{t}{60}\right)^2 \quad 0 \leq t \leq 60$$

Find the rate at which the water is flowing out of the tank (the instantaneous rate of change of V with respect to t) as a function of t . What are its units? For times $t = 0, 10, 20, 30, 40, 50$ and 60 min, find the flow rate and the amount of water remaining in the tank. Summarize your findings in a sentence or two. At what time is the flow the greatest? The least?

2) Simplify:

a. $\frac{3^{-2}}{3^{-3} + 3^{-2}}$

b. $\frac{2^{-1} - 2^{-2}}{2^{-1} + 2^{-2}}$

2 points

3) A wooden block is in the shape of a rectangular prism with dimensions n cm, $(n+3)$ cm, and $(n+9)$ cm, for some integer n . The surface area of the block is painted and the block is then cut into 1 cm cubes by cuts parallel to the faces. If exactly half of these cubes have no paint on them, find the dimensions of the original block.

4 points