

Rate In/Out Problems

2. A large tank contains 40 gallons of water at time $t = 0$. During the time interval $0 \leq t \leq 3$ hours, water is being poured into the tank at the rate

$$W(t) = 0.6e^{t^2-1} \text{ gallons per hour}$$

During the same time interval, water is leaking from a small hole that is being fixed. The rate that water leaks out is given by:

$$L(t) = 6 \cos(0.7t) \text{ gallons per hour}$$

- (a) How much water has been poured into the tank after 2 hours?
- (b) Find the time t , on $0 \leq t \leq 3$ hours, when the amount of water in the tank is a minimum. Justify your answer.
- (c) Is the amount of water in the tank increasing or decreasing at $t = 1$? Give a reason for your answer.
- (d) The tank holds up to 300 gallons of water. For $t > 2$, water continues to be poured into the tank at a rate of $W(t)$. However, water leaks out of the tank at a constant rate of 1.02 gallons per hour. Set up, but do not evaluate, an equation involving one or more integrals that could be used to find the time w when the tank first becomes full.