(17) If $R_1 = R_2$, the volume remains constant so $V(t) = V_0$

If $R_1 > R_2$, V increases

If $R_1 < R_2$, V decreases

(no other specifics provided by the book)

(19) eqn:

$$y = 2t + 400 - 390 \cdot 200^3 (t+200)^{-3}$$

possible more solutions later.

17. Find the amount of salt $y(t)$ in a tank with initial volume V_0 gallons of liquid and y_0 pounds of salt using the given conditions.
    a. $R_1 = 4$ gal/min, $R_2 = 4$ gal/min, $S_1 = 2$ lb/gal, $V_0 = 400$, $y_0 = 0$.
    b. $R_1 = 4$ gal/min, $R_2 = 2$ gal/min, $S_1 = 1$ lb/gal, $V_0 = 500$, $y_0 = 20$.
    c. $R_1 = 4$ gal/min, $R_2 = 6$ gal/min, $S_1 = 1$ lb/gal, $V_0 = 600$, $y_0 = 100$.
    Describe how the values of R_1 and R_2 affect the volume of liquid in the tank.
18. A tank contains 100 gal of a brine solution in which 20 lb of salt is initially dissolved. (a) Water (containing no salt) is then allowed to flow into the tank at a rate of 4 gal/min and the well-stirred mixture flows out of the tank at an equal rate of 4 gal/min. Determine the amount of salt $y(t)$ at any time t. What is the eventual concentration of the brine solution in the tank? (b) If instead of water a brine solution with concentration 2 lb/gal flows into the tank at a rate of 4 gal/min, what is the eventual concentration of the brine solution in the tank?
19. A tank contains 200 gal of a brine solution in which 10 lb of salt is initially dissolved. A brine solution with concentration 2 lb/gal is then allowed to flow into the tank at a rate of 4 gal/min and the well-stirred mixture flows out of the tank at a rate of 3 gal/min. Determine the amount of salt $y(t)$ at any time t. If the tank can hold a maximum of 400 gal, what is the concentration of the brine solution in the tank when the volume reaches this maximum?
20. A tank contains 300 gal of a brine solution in which 300 lb of salt is initially dissolved. A brine solution with concentration 4 lb/gal is then allowed to flow into the tank at a rate of 3 gal/min, and the well-stirred mixture flows out of the tank at a rate of 4 gal/min. Determine the amount of salt $y(t)$ at any time t. What is the concentration of the brine solution after 10 min? What is the eventual concentration of the brine solution in the tank? For what values of t is the solution defined? Why?

The temperature $u(t)$ inside a building can be based on three factors: (1) the heat produced by people or machinery inside the building, (2) the heating (or cooling) produced by the furnace (or air conditioning system), and (3) the temperature outside the building based on Newton's Law of Cooling. If the rate at which these factors affect (increase or decrease) the temperature is given by $A(t)$, $B(t)$, and $C(t)$, respectively, the differential equation that models this situation is

$$\frac{du}{dt} = k(C(t) - u(t)) + A(t) + B(t),$$

where the constant $k > 0$ depends on the insulation of the building.

21. Find the temperature (and the maximum temperature) in the building with $k = 1/4$ if the initial temperature is 70°F, and (a) $A(t) = 0.25$, $C(t) = 75$, and $B(t) = 0$; (b) $A(t) = 0.25$