7.3 Exercises

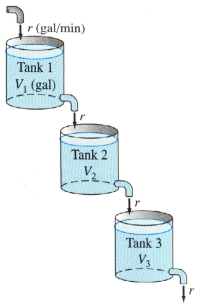
Problem 1 Apply the eigenvalue method of this section to find a general solution of the given system:

$$x_1' = x_1 - 5x_2, \qquad x_2' = x_1 + 3x_2.$$

Problem 2 Apply the eigenvalue method to find a general solution of the system.

$$x_1' = 5x_1 + 5x_2 + 2x_3, \qquad x_2' = -6x_1 - 6x_2 - 5x_3, \qquad x_3' = 6x_1 + 6x_2 + 5x_3$$

Problem 3: Open Three Tank System. Freshwater flows into tank-1. Mixed brine (salt water) flows from tank-1 into tank-2, from tank-2 into tank-3, and out of tank-3. (see image)



All have flow rate $r = 60$ gallons per minute. Initial ($t = 0$) amounts of salt are:

$x_1(0) = 40\ lb,\quad x_2(0) = 0,$ and $x_3(0) = 0$ in the three tanks.

Initial volumes: $V_1 = 20,\quad V_2 = 12,\quad V_3 = 60.$

a.) **First**, **solve for the amounts of salt in the three tanks at time** t.

b.) **Now**, **determine the maximal amount of salt that tank-3 ever contains**.

c.) **Use an online resource** (**desmos**?) **to help you construct a graph of** $x_1(t),\ x_2(t),$ **and** $x_3(t)$.