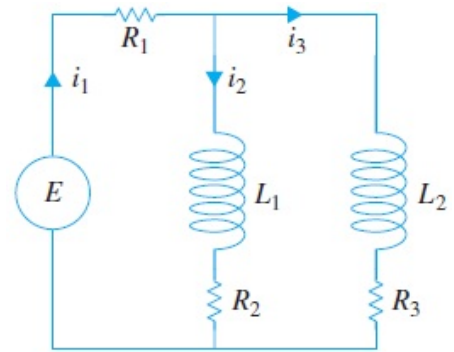Instructions: Write complete legible solutions to the following problems in the space provided. Be sure to supply all the necessary steps that lead to your answers.

1.     Determine a system of first-order differential equations that describes the currents $i_2(t)$ and $i_3(t)$ in the electrical network shown in the figure below.
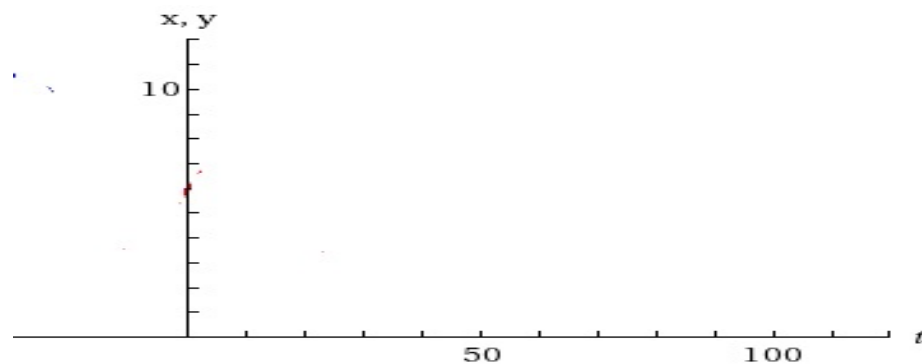


2.     Consider the Lotka-Volterra predator-prey model defined by

$$x' = -0.1x + 0.02xy$$

$$y' = 0.2y - 0.025xy$$

where the populations x(t) (predators) and y(t) (prey) are measured in thousands. Suppose x(0) = 6 and y(0) = 6. Use a numerical solver to graph x(t) and y(t).

3.    Use the information given in the figure below to construct a mathematical model for the number of pounds of salt $x_1(t)$, $x_2(t)$, and $x_3(t)$ at time t in tanks A, B, and C, respectively. (Assume a = 4, b = 2, c = 1, d = 6, e = 5, and f = 4.)

pure water
a gal/min

mixture
b gal/min

mixture
c gal/min

A
100 gal

B
100 gal

C
100 gal

mixture
d gal/min

mixture
e gal/min

mixture
f gal/min