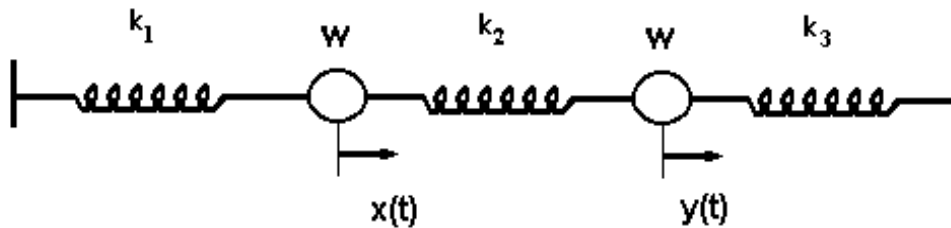


Show all work. Give your answers in terms of real functions only.

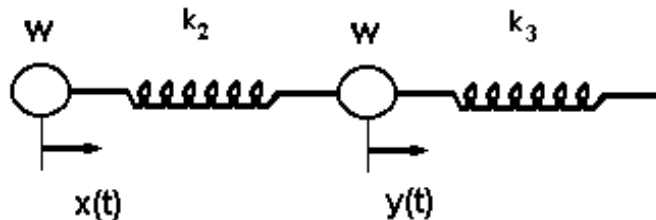
1. A tank initially contains 25 gallons of water. Alcohol enters at the rate of 2 gallons per minutes and the well-stirred mixture leaves at the rate of 1 gallon per minute. What will be the concentration of alcohol when 50 gallons of the mixture is in the tank? 2. At a certain instant, 12 gm of a radioactive substance are present. After 20 minutes, 3 gm are present. Determine the half-life of the sbstance. 3. We have derived the equations of motion for the spring-mass system as shown below



to be

$$\frac{W}{g}x'' = -(k_1 + k_2)x + k_2y, \quad \frac{W}{g}y'' = k_2x - (k_2 + k_3)y.$$

(A) Write down the equations for the system as shown below



with $W = 32 \text{ lb}$, $k_2 = 2 \text{ lb/ft}$, and $k_3 = 3 \text{ lb/ft}$. (Use $g = 32 \text{ lb/ft}^2$.)

(B) Find the general solutions $x_g(t)$, $y_g(t)$.

4. Use Euler's method to compute $x(0.2)$, $x'(0.2)$ where $x(t)$ is governed by the initial value problem,

$$x'' + x = 0, \text{ with } x(0) = 1, \quad x'(0) = -1.$$

(A) Convert it to a first order system of two equations.

(B) Use a stepsize of $h = 0.1$ in Euler's method, list your results in the following table, and show all computations.

n	t	x	y	x'	y'
0					
1					
2					