7.1 Exercises 

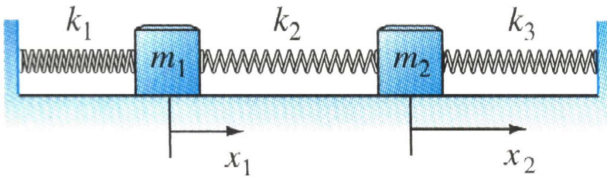
Problem 1 Transform the following system into an equivalent system of 1st-order DEQs.

$$x'' + 3x' + 4x - 2y = 0, \qquad y'' + 2y' - 3x + y = \cos t.$$

Problem 2 Find the general solution of the following system. Then, find the corresponding particular solution.

$$x' = -y, \qquad y' = 13x + 4y, \qquad x(0) = 0, \qquad y(0) = 3.$$

Problem 3 Derive the DEQs: $m_1x_1'' = -(k_1 + k_2)x_1 + k_2x_2$ and $m_2x_2'' = k_2x_1 - (k_2 + k_3)x_2$ for the displacements (from equilibrium) of the two masses shown below(but don't try to solve them!):



Recall Newton's second law (for spring constant k): $mx'' = -kx$.

Problem 4 A particle of mass m moves in the plane with coordinates $\big(x(t),\ y(t)\big)$ under the influence of a force that is directed toward the origin and has magnitude $\frac{k}{x^2+y^2}$, an inverse-square central force field. Show that: $mx'' = -\frac{kx}{r^3}$ and $my'' = \frac{ky}{r^3}$, where $r = \sqrt{x^2 + y^2}$.