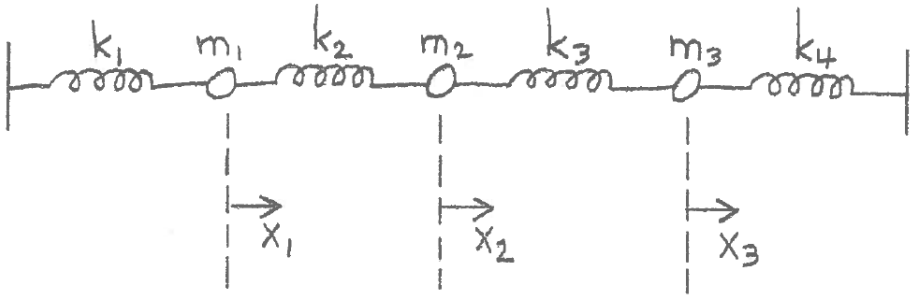
Sample 6b Steps



Step 1 – Write down a 2nd order differential equation for each mass

$$m_1 \frac{d^2x_1}{dt^2} = -k_1 x_1 \qquad + k_2(x_2 - x_1)$$

$$m_2 \frac{d^2x_2}{dt^2} = -k_2(x_2 - x_1) + k_3(x_3 - x_2)$$

$$m_3 \frac{d^2x_3}{dt^2} = -k_3(x_3 - x_2) - k_4 x_3$$

Step 2 – Convert each 2nd order equation into 2 1st order equations

$$\frac{dx_1}{dt} = v_1$$

$$\frac{dv_1}{dt} = \frac{1}{m_1}\left(-k_1 x_1 \qquad + k_2(x_2 - x_1)\right)$$

$$\frac{dx_2}{dt} = v_2$$

$$\frac{dv_2}{dt} = \frac{1}{m_2}\left(-k_2(x_2 - x_1) + k_3(x_3 - x_2)\right)$$

$$\frac{dx_3}{dt} = v_3$$

$$\frac{dv_3}{dt} = \frac{1}{m_3}\left(-k_3(x_3 - x_2) - k_4 x_3\right)$$