Math 3331
Ordinary Differential Equations
Sample Test 3

1. A spring is stretched 20 cm by a 4-kg mass. The weight is pulled down an additional 1 m and released with an upward velocity of 4 m/s. Find the position of the mass at and time t.

2. A spring with a mass of 2 kg has damping constant 14, and a force of 6 N is required to keep the spring stretched 0.5 m beyond its natural length. The spring is stretched 1 m beyond its natural length and then released with zero velocity. Find the position of the mass at any time t.

3. Solve the following systems

(i) $\dfrac{d\bar{x}}{dt} = \begin{pmatrix} 1 & 1 \\ 2 & 0 \end{pmatrix} \bar{x}$ $\qquad$ (ii) $\dfrac{d\bar{x}}{dt} = \begin{pmatrix} 3 & -2 \\ 2 & -2 \end{pmatrix} \bar{x},$

(iii) $\dfrac{d\bar{x}}{dt} = \begin{pmatrix} 1 & -1 \\ 1 & 3 \end{pmatrix} \bar{x},$ $\qquad$ (iv) $\dfrac{d\bar{x}}{dt} = \begin{pmatrix} 5 & -4 \\ 1 & 1 \end{pmatrix} \bar{x},$

(v) $\dfrac{d\bar{x}}{dt} = \begin{pmatrix} 6 & -1 \\ 5 & 4 \end{pmatrix} \bar{x},$ $\qquad$ (vi) $\dfrac{d\bar{x}}{dt} = \begin{pmatrix} 7 & -5 \\ 10 & -3 \end{pmatrix} \bar{x}.$