Differential Equations
Homework 10 (Revised)
(HW 10 will Not be collected but one of the problems will be in Midterm 3)
(HW 10 solution will be available on 4/15)

Note:

- Please show all of your work (writing a list of answers is not sufficient).
- Please indicate the people you worked with.
- **Please staple your HW.**
- Several random problems will be graded (1 point each).

1. Determine the period and frequency of the simple harmonic motion (damping coefficient $c = 0$) of a $m = 0.75$ kg mass on the end of a spring with spring constant $k = 48$.

2. A mass of $m = 3$ kg is attached to the end of a spring that is stretched 0.2 m by a force of 15 N. At a time $t = 0$ the body is pulled 1 m, stretching the spring, and set in motion with an initial velocity of -10 m/s.

   (a) Find $u(t)$ in the form of $C\cos(\omega_0 t - \delta)$

   (b) Find the amplitude and period of motion of the body.

3. Suppose that the mass in a mass-spring system with $m = 25$, $c = 10$, and $k = 226$ is set in motion with $u(0) = 20$ and $u'(0) = 41$.

   (a) Find the position function $u(t)$ in the form of single cosine function.

   (b) Find the pseudo-period of the oscillation and time-varying amplitude.

4. A mass $m = 1/2$ is attached to a spring with spring constant $k = 4$ and damping coefficient $c = 3$. The mass is set in motion with initial position $u(0) = 2$ and initial velocity $u'(0) = 0$. Find u(t) and determine whether the motion is overdamped, critically damped, or underdamped. If it is underdapmed, write $u(t)$ in the form of $Ce^{-pt}\cos(\omega_0 t - \delta)$.

5. A mass $m = 2$ is attached to a spring with spring constant $k = 50$ and damping coefficient $c = 12$. The mass is set in motion with initial position $u(0) = 1$ and initial velocity $u'(0) = -7$. Find u(t) and determine whether the motion is overdamped, critically damped, or underdamped. If it is underdapmed, write $u(t)$ in the form of $Ce^{-pt}\cos(\omega_0 t - \delta)$.