

Math 677. Fall 2009.
Homework #6.
Due Thursday 12/03/09 in class.

Solutions should represent individual work, with all necessary details. Only facts discussed in class or given in the main textbook can be used without proof. Only selected problems will be graded. No homework will be accepted after the due date has passed.

Part I. Complete the following exercises from "Differential Equations and Dynamical Systems" by Perko, 3rd edition.

Chapter 2, Problem Set 13: # 1, 5
Chapter 2, Problem Set 14: # 1, 2, 9
Chapter 4, Problem Set 2: # 1, 7
Chapter 4, Problem Set 3: # 2

Part II.

Interatomic interactions are often described by a model using the so-called six-twelve potential given by

$$U(x) = \frac{a}{12x^{12}} - \frac{b}{6x^2}$$

where $a > 0, b > 0$. Consider the corresponding Newtonian system $\ddot{x} = f(x)$.

- (a) Find the form of the forcing $f(x)$ corresponding the potential $U(x)$
- (b) Write the system in the form of a Hamiltonian system
- (c) Find the unique critical point of the system
- (d) Classify the equilibrium
- (e) Graph the phase portrait

You can use Matlab, Maple, Mathematica or other packages to help you with tedious calculations when necessary.