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Optimization and Dynamics

Summer term 2007

Assignment sheet 3

(10) Find the fixed points of the following dynamical systems and discuss their stability properties:

(a) $f(x) = -x - x^3$

(b) $f(x) = -x + x^3$

(c) $f(x) = -x + x^2$

(d) $f(x) = -x - x^2$.

(11) Consider the dynamical system given by

$$f(x) = 2|x| - 1.$$

Prove that there exist periodic orbits with minimal period m for any $m \in \mathbb{N}$.

(12) Consider the following family of dynamical systems

$$f(x) = ax + x^2.$$

Discuss the bifurcation that occurs at $a = 1$ and sketch the corresponding diagram.

(13) Consider the following family of dynamical systems

$$f(x) = ax + x^4.$$

Discuss the bifurcation that occurs at $a = 1$ and sketch the corresponding diagram. Compare with exercise 12.

(14) Consider the following family of dynamical systems

$$f(x) = ax + x^3.$$

Discuss the bifurcation that occurs at $a = 1$ and sketch the corresponding diagram. Compare with exercises 12 and 13.