Machine Learning
Exercise Sheet 2

Prof. Dr. Dr. Lars Schmidt-Thieme, Nicolas Schilling
Information Systems and Machine Learning Lab
University of Hildesheim

October 31st, 2016
Submission until November 7th, 13.00 to schilling@ismll.de or baker@ismll.de

Exercise 3: Gradient Descent (10 Points)

Apply gradient descent on the function $f(x) = \frac{1}{4}x^4 + \frac{1}{3}x^3 - \frac{1}{2}x^2$ under the following configurations:

a) Use step length $\alpha = 0.3$ and starting point $x_0 = -1$ and show the first four iterations. What is your minimum?

b) Use step length $\alpha = 2$ and starting point $x_0 = -1$ and show the first four iterations. What has happened and why?

c) Use step length $\alpha = 0.3$ and starting point $x_0 = 0$ and show the first two iterations. What has happened and why?
Do the same again with $\alpha = 0.8$ and starting point $x_0 = 0.5$ and show the first four iterations. Where is your minimum now?
What would be a possible solution to overcome the problem just identified?

Exercise 4: Linear Regression (10 Points)

Given is following data:

x_1	x_2	y
1	2	3
-1	3	0
-1	2	-1
1	4	5
3	1	6

Learn a linear regression by estimating its parameters using normal equations (i.e. the closed form solution)! Do not forget to include the bias term!