Norwegian University of Science and Technology
Department of Mathematical Sciences

TMA4130 Matematikk 4N Fall 2014

Exercise set 9

In all problems you are supposed to show the details of your work and describe what you are doing.

Kreyszig, Chap. 19.2

1 The equation $2x^3 + 5x^2 - 4x + \sin(x) = 0$ has a solution between -3 and -4. Use Newton's method with $x_0 = -3.5$ to approximate the solution. Perform five iterations.

2

a) Derive Newton's method for the solution of the equation $x^n = a$ where n is a natural number and $a > 0$. [1]

b) Use Newton's method to approximate a solution of the equation $x^2 = 24$. Use $x_0 = 5$ as starting value and perform five iterations.

3 Use the secant method for solving the equation $\cos(x) = x$. Use the starting values $x_0 = 0.5$ and $x_1 = 1$, and perform five iterations.

Kreyszig, Chap. 19.3

4 Find the interpolation polynomial of smallest degree that interpolates the points in the following data set:

x_i	-2	-1	0	1	2
$f(x_i)$	-1	3	1	-1	3

5 Approximate the function $\sin(x)$ on the interval $[0, 1]$ by an interpolation polynomial $p(x)$ of degree 4 with interpolation points $x_0 = 0$, $x_1 = 1/4$, $x_2 = 1/2$, $x_3 = 3/4$, $x_4 = 1$. In addition, estimate the approximation error $p(1/8) - \sin(1/8)$ at the point $x = 1/8$ without actually evaluating p.

[1] For $n = 2$ (that is, computation of square roots), this method actually goes back to antiquity and is known as "Heron's method" or the "Babylonian method". See `http://en.wikipedia.org/wiki/Methods_of_computing_square_roots#Babylonian_method`.