Norwegian University of Science and Technology
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TMA4125 Matematikk 4N
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Exercise set 9

Exercises from Kreyszig (8th ed):

1 *Exercise 5.3.5*

Laplace transform. Sketch the following function and find its Laplace transform. (show the details of your work.)

$$t^2u(t-1)$$

2 *Exercise 5.3.10*

Laplace transform. Sketch the given function, which is assumed to be zero outside the given interval. Find its Laplace transform. (show the details of your work.)

$$1-e^{-t} \quad (0<t<2)$$

3 *Exercise 5.3.17*

Inverse transform. Find and sketch the inverse Laplace transform. (show the details of your work.)

$$3(1-e^{-\pi s})/(s^2+9)$$

4 *Exercise 5.3.22*

Initial Value Problems. Using the Laplace transform, solve the following problem. (show the details.)

$$y''+3y'+2y=\begin{cases}4t & \text{if } 0<t<1\\ 8 & \text{if } t>1\end{cases}$$

$$y(0)=0, \quad y'(0)=0$$

5 *Exercise 5.3.28*

Initial Value Problems. Using the Laplace transform, solve the following problem. (show the details.)

$$y''+4y'+5y=\delta(t-1)$$

$$y(0)=0, \quad y'(0)=3$$

$\boxed{6}$ *Exercise 17.1.3*

Small differences of large numbers may be particularly strongly affected by rounding errors. Illustrate this by computing $0.81534/(35.724-35.596)$ as given with $5S$ (5 significant digits), then rounding stepwise to $4S$, $3S$ and $2S$, where 'stepwise' means: round the rounded numbers, not the given ones.

$\boxed{7}$ *Exercise 17.1.5*

Write the quotient $a/(b-c)$ in Prob. 17.1.3 as $a(b+c)/(b^2-c^2)$. Compute it first with $5S$, then round the numerator 58.150 and the denominator 9.1290 stepwise as in Prob 17.1.3. Compare and comment.

$\boxed{8}$ *Exercise 17.1.9*

(Change of formula) How can we get good values of $\sqrt{9+x^2}-3$ if $|x|$ is small?

$\boxed{9}$ *Exercise 17.2.1*

Why do we obtain a monotone sequence in Example 1, but not in Example 2?

$\boxed{10}$ *Exercise 17.2.2*

Perform the iterations indicated at the end of Example 2. Sketch a figure similar to Fig. 395.

$\boxed{11}$ *Exercise 17.2.17*

(Vibrating beam) Find the solution of $\cos x \cosh x = 1$ near $x = \frac{3}{2}\pi$ to $6S$-accuracy. (This determines a frequency of a vibrating beam; see Problem set 11.4.)

$\boxed{12}$ *Exercise 17.2.21*

Solve the given problem by the secant method, using x_0 and x_1 as indicated.

$$\text{Prob. 17}, \; x_0 = 4, \; x_1 = 5$$

Non-Kreyszig exercise:

$\boxed{13}$ Formuler Newtons metode for systemet:

$$x^2 + xy^3 - 9 = 0$$
$$3x^2y - y^3 - 4 = 0.$$

Bruk startverdiene $x_0 = 1.2$ og $y_0 = 2.5$ og utfør to iterasjoner.

14 Bruk Lagrangeinterpolasjon for å finne et polynom av grad 3 som interpolerer datasettet

x_i	-1	0	2	3
y_i	2	0	2	0

15 Interpoler $f(x) = \sin(x)$ i punktene 0, $\pi/2$ og π med et polynom av grad 2. Bruk det interpolerende polynomet for å approksimere $\sin(\pi/4)$. Bruk feilformelen(side 851 i ed.8) til å finne en skranke for feilen i approksimasjonen.