Norges teknisk–naturvitenskapelige universitet
Institutt for matematiske fag

TMA4120 Matematikk 4K H2009

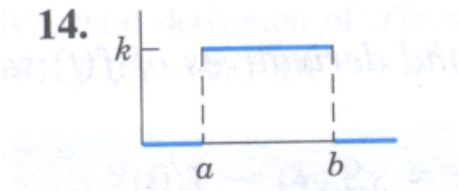
Øving 1

Oppgavene er hentet fra Erwin Kreyszigs «Advanced Engineering Mathematics», 9. utgave.

1 (K9 6.1:1)
Find the Laplace transform of $t^2 - 2t$. Show the details of your work

2 (K9 6.1:4)
Find the Laplace transform of $\sin^2 4t$. Show the details of your work.

3 (K9 6.1:14)
Find the Laplace transform of



4 (K9 6.1:50)
Find the inverse Laplace transform of $\frac{s-6}{(s-1)^2+4}$ using the first shifting theorem. Show the details.

5 (K9 6.2:11)
Solve the initial value problem by the Laplace transform. Show the details of your work.

$$y' + \frac{1}{2}y = 17\sin 2t, \qquad y(0) = -1$$

6 (K9 6.2:17)
Solve the initial value problem by the Laplace transform. Show the details of your work.

$$y'' + 7y' + 12y = 21e^{3t}, \qquad y(0) = 3.5, \qquad y'(0) = -10$$

$\boxed{7}$ (K9 6.3:11)
Sketch or graph the given function. Represent it using unit step functions. Find its transform. Show the details of your work.

$$f(t) = \begin{cases} 0 & \text{if } t \leq 3 \\ 20\cos \pi t & \text{if } 3 < t < 6 \\ 0 & \text{if } t \geq 6 \end{cases}$$

$\boxed{8}$ (K9 6.3:21)
Find and sketch the graph of $f(t)$ if $\mathcal{L}(f) = s\mathrm{e}^{-3s}/(s^2 - 4)$.

$\boxed{9}$ (K9 6.3:28)
Using the Laplace transform and showing the details, solve

$$y'' + 3y' + 2y = r(t), \qquad y(0) = 0, \qquad y'(0) = 0$$

where

$$r(t) = \begin{cases} 1 & \text{if } 0 < t < 1 \\ 0 & \text{elsewhere} \end{cases}$$

$\boxed{10}$ (K9 6.4:1)
Showing the details, find and sketch the solution of

$$y'' + y = \delta(t - 2\pi), \qquad y(0) = 10, \qquad y'(0) = 0$$