Norges teknisk–naturvitenskapelige universitet Institutt for matematiske fag	TMA4120 Matematikk 4K H2009 **Øving 2**

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

1 (K9 6.3:15)
Find and sketch the graph of $f(t)$ if $\mathcal{L}(f) = e^{-4s}/s^2$.

2 (K9 6.3:47)
RLC-circuit: Using the Laplace transform and showing the details, find the current $i(t)$ in an RLC series circuit (see diagram in book), where $R = 2\Omega, L = 1\text{H}, C = 0.1\text{F}$, and

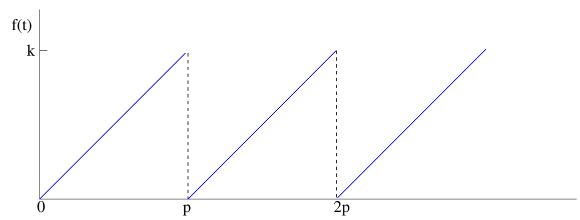
$$v(t) = \begin{cases} 255 \sin t \text{ V}, & \text{if } 0 < t < 2\pi \\ 0, & \text{if } t > 2\pi \end{cases}$$

and there is zero initial current and charge.

3 (K9 6.4:10)
Showing the details, find and sketch the solution of

$$y'' + 5y = 25t - 100\delta(t - \pi), \qquad y(0) = -2, \qquad y'(0) = 5.$$

4 (K9 6.4:16 (d))
Find the Laplace transform of the saw-tooth wave



Hint: Use the theorem (from 6.4:16 (a)):
The Laplace transform of a piecewise continuous function $f(t)$ with period p (that is, for all $t > 0, f(t + p) = f(t)$) is

$$\mathcal{L}(f) = \frac{1}{1 - e^{-ps}} \int_0^p e^{-st} f(t) \mathrm{d}t.$$

$\boxed{5}$ (K9 6.5:3)
Calculate by integration the convolution $t * \mathrm{e}^t$.

$\boxed{6}$ (K9 6.5:33)
Use the Laplace transform to solve

$$y(t) + 2e^t \int_0^t e^{-\tau} y(\tau)\mathrm{d}\tau = te^t$$

$\boxed{7}$ (K9 6.6:12)
Find $\mathcal{L}(f)$ if $f(t) = te^{-kt}\sin t$.

$\boxed{8}$ (K9 6.6:13)
Find $f(t)$ if $\mathcal{L}(f) = \frac{6}{(s+1)^2}$.