**Problem 1 Laplace Transform**
Find the Laplace transform of the following functions:

(a) $e^{-2t} - e^{-5t}$
(b) $2e^{-3t} - 4e^{-6t}$
(c) $5 + 3e^{-10t}$

**Problem 2 Inverse Laplace Transform**
Find the inverse Laplace transform of the following functions:

(a) $\frac{10}{s + 5}$
(b) $\frac{10}{s(s + 5)}$
(c) $\frac{5s + 4}{s^2 + 5s + 20}$
(d) $\frac{5s + 4}{s(s^2 + 5s + 20)}$

**Problem 3 Step response**
Find the unit step response of the following system using Laplace transforms. Then plot the output for each of

(a) $k = 0.1$  
(b) $k = 1$  
(c) $k = 10$

with MATLAB.
**Problem 4** More step response
For the system given below, find the unit step response if \( k = 5 \).

\[
x(t) \xrightarrow{\sum} \frac{1}{s+k} \xrightarrow{\frac{5}{s}} y(t)
\]

**Problem 5** Impulse response
Given the system below. Find the impulse response with \( k = 1 \) and \( k = 0.1 \). Use MATLAB to plot both responses. How does decreasing \( k \) change the output?

\[
x(t) \xrightarrow{\sum} \frac{10}{s+1} \xrightarrow{\frac{k}{s}} y(t)
\]

**Problem 6** System spectrum
Given the system below, use Laplace analysis to find the transfer function. Then find the response to a step input of magnitude 10 setting \( k = 20 \). Plot the magnitude and phase of the system from 1 to 200 rad/sec and use \texttt{unwrap} command for phase greater than 180°.

\[
x(t) \xrightarrow{\sum} e^{-0.01s} \xrightarrow{\frac{k}{s}} y(t)
\]

**Problem 7** System responses
For the system shown below, with \( K = 1 \), find the response to

(a) a function stepping from 0 to 4 (on the \( y \)-axis)
(b) a function equivalent to 4 times the impulse function
\[ s x(t) + s y(t) - 3 \]