

ChEE 413
Spring 2005
Homework Handout 2

1) Problem 3.1b from Edition 1:

Use the definition of what a Laplace transform is for the integral to show that the Laplace transform of:

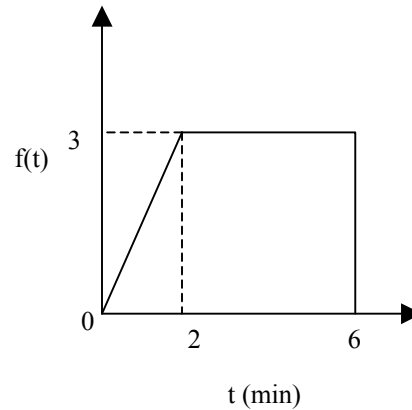
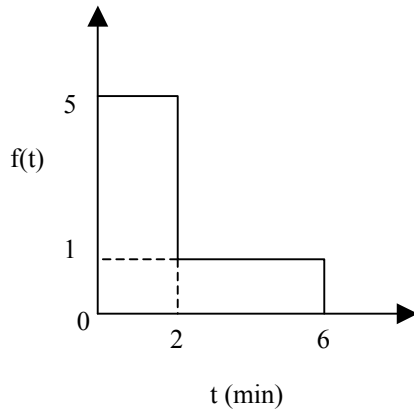
$$e^{-bt} \cos \omega t$$

is

$$\frac{s + b}{(s + b)^2 + \omega^2}$$

2) Problem 3.4 from Edition 1:

Calculate the Laplace transform of the graphical input signals in the accompanying figures:



3) Problem 3.6 from Edition 1:

Using partial fraction expansion where required, find $x(t)$ for:

a) $X(s) = \frac{s(s+1)}{(s+2)(s+3)(s+4)}$

b) $X(s) = \frac{s+1}{(s+2)(s+3)(s^2+4)}$

c) $X(s) = \frac{s+4}{(s+1)^2}$

d) $X(s) = \frac{1}{s^2+s+1}$

4) Problem 3.10 from Edition 1:

Find the mathematical form of the solutions to the following equations, that is, determine the form of the time solution but do not numerically evaluate the coefficients. Be sure to obtain correct arguments of all exponential and periodic functions. Use the Final Value Theorem to obtain the solution for the large values of time. In all cases:

$$x(0) = \dot{x}(0) = 0$$

and the dots denote differentiation with respect to time.

a) $\ddot{x} + 4\dot{x} + 8x = 10$

b) $\ddot{x} + 4\dot{x} + 4x = 10$

c) $\ddot{x} + 4\dot{x} + 3x = 10$

d) $\ddot{x} + 4\dot{x} + x = 10$

e) $\ddot{x} + 4\dot{x} = 10$

f) $\ddot{x} + 4\dot{x} - 5x = 10$

g) $\ddot{x} - 4\dot{x} + 3x = 10$

h) $\ddot{x} - 4\dot{x} + 4x = 10$