EE103_Fall2017 HW#9

November 27, 2017

1.

7.3. Consider the waveform $f(t)$ in Figure P7.3.

(a) Write a mathematical expression for $f(t)$.
(b) Find the Laplace transform for this waveform, using any method.

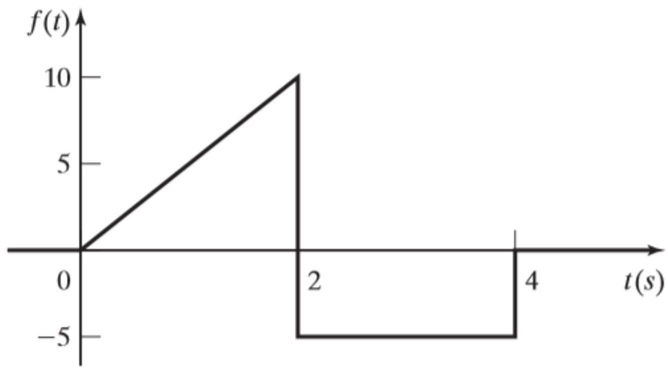

Figure P7.3

2.

7.10. Given the Laplace transform

$$V(s) = \frac{2s + 1}{s^2 + 4},$$

(a) Find the initial value of $v(t)$, $v(0^+)$, by
  (i) the initial value property;
  (ii) finding $v(t) = \mathcal{L}^{-1}[V(s)]$.
(b) Find the final value of $v(t)$ by
  (i) the final value property;
  (ii) finding $v(t) = \mathcal{L}^{-1}[V(s)]$.

3.

7.16. Find the inverse Laplace transforms of the functions given. Sketch the time functions.

(a) $F(s) = \dfrac{e^{-2s}}{s(s+1)}$

(b) $F(s) = \dfrac{1 - e^{-s}}{s(s+1)}$

(c) $F(s) = \dfrac{e^{-2s} - e^{-3s}}{2}$

(d) $F(s) = \dfrac{1 - e^{-5s}}{s(s+5)}$

4.

7.17. Consider the LTI systems described by the following differential equations:

(i) $\dfrac{d^2y(t)}{dt^2} + 5\dfrac{dy(t)}{dt} + 4y(t) = 2x(t)$

(ii) $\dfrac{d^2y(t)}{dt^2} + 5\dfrac{dy(t)}{dt} + 4y(t) = 2\dfrac{dx(t)}{dt} + 6x(t)$

(iii) $\dfrac{d^3y(t)}{dt^3} + 3\dfrac{d^2y(t)}{dt^2} + 4\dfrac{d^2y(t)}{dt^2} + 2y(t) = 6x(t)$

(iv) $\dfrac{d^3y(t)}{dt^3} - \dfrac{d^2y(t)}{dt^2} + 2y(t) = 4\dfrac{dx(t)}{dt} - 8x(t)$

(a) Find the unit impulse response $h(t)$ for each system.

(b) Find the unit step response $s(t)$ for each system.

(c) To verify your results, show that the functions in parts (a) and (b) satisfy the equation

[eq(3.43)] $$h(t) = \frac{ds(t)}{dt},$$

relating the impulse response $h(t)$ and the step response $s(t)$.