Homework 2

Answers to exercises are already provided in the text.

9-1. $F(s) = \frac{3}{s} - \frac{3}{s+1000} = \frac{3000}{s(s+1000)}$; two zeros at $s = \infty$; poles at $s = 0; s = -1000$.

9-3. $F(s) = -5 + \frac{50}{s} = \frac{-5(s-10)}{s}$; one zero at $s = 10$; one pole at $s = 0$.

9-7. $F(s) = \frac{1250000}{s(s^2+250000)}$; three zeros at $s = \infty$; poles at $s = 0; s = \pm j500$.

9-11. (a) $F_1(s) = \frac{-5s(s-10)}{(s+5)(s+10)}$; zeros at $s = 10; s = \infty$; poles at $s = -5; s = -10$;

(b) $F_2(s) = \frac{20s(s^2+2.5\times10^6)}{(s^2+10^6)(s^2+4\times10^6)}$; zeros at $s = 0; s = \pm j1581.1;\ s = \infty$; poles at $s = \pm j1000; s = \pm j2000$.

9-18. (a) $f(t) = Au(t) - 2Au(t-T) + Au(t-2T)$

(b) $F(s) = \frac{A}{s} - \frac{2A}{s}e^{-Ts} + \frac{A}{s}e^{-2Ts}$;

(c) apply definition

9-22. (a) $f_1(t) = \frac{1}{3}[-e^{-10t} + 4e^{-40t}]u(t)$

(b) $f_2(t) = \left[\frac{1}{10000} - \frac{99}{10000}e^{-100t} + \frac{10989}{10000}e^{-1000t}\right]u(t)$

9-23. (a) $f_1(t) = 50\delta(t) + \left[\frac{25000}{3}e^{-500t} - \frac{400000}{3}e^{-5000t}\right]u(t)$

(b) $f_2(t) = 50\delta(t) + [1250e^{-100t} - 31250e^{-500t}]u(t)$

9-30 (a) $f_1(t) = \left[-\frac{8}{19}e^{-t} + \frac{24}{17}e^{-3t} - \frac{320}{323}e^{-20t}\right]u(t)$

(b) $f_2(t) = \left[\frac{80}{3} + \frac{100}{3}\cos(6t)\right]u(t)$

9-32 (a) $f_1(t) = \left[50t - \frac{17}{3} + 6e^{-10t} - \frac{1}{3}e^{-30t}\right]u(t)$

(b) $f_2(t) = \left[\frac{25000}{13}e^{-5t} + 1109.4e^{-2t}\cos(2t + 146.31°)\right]u(t)$

9-34 (a) $f_1(t) = \frac{1}{27}[(7 + 150t)e^{-50t} + (20 - 1200t)e^{-200t}]u(t)$

(b) $f_2(t) = \frac{1}{2}[(2 - 25t)e^{-100t} - 675te^{-200t}]u(t)$

9-55 (a) $\frac{d^2v_c(t)}{dt^2} + \frac{R}{L}\frac{dv_c(t)}{dt} + \frac{1}{LC}\ v_c(t) = \frac{1}{LC}v_s(t)$

(b) $v_c(t) = \left[1 — 20e^{-200t} + 10e^{-400t}\right]u(t)$ V

9-65 (a)

$$f_1(\infty) = \lim_{s\to 0} sF_1(s) = 0$$

(b)

$$f_2(\infty) = \lim_{s\to 0} sF_2(s) = 10$$