Math 2280 - Assignment 9

Dylan Zwick

Spring 2013

Section 7.1 - 1, 6, 20, 30, 36

Section 7.2 - 1, 4, 15, 20, 29

Section 7.3 - 3, 8, 19, 24, 30, 33

Section 7.1 - Laplace Transforms and Inverse Transforms

7.1.1 - Calculate the Laplace transform of $f(t) = t$ using the definition of the Laplace transform.

7.1.6 - Calculate the Laplace transform of $f(t) = \sin^2 t$ using the definition of the Laplace transform.

7.1.20 - Find the Laplace transform of the function $f(t) = te^t$.

7.1.30 - Find the inverse Laplace transform of the function $F(s) = \dfrac{9+s}{4-s^2}$.

7.1.36 - Show that the function $f(t) = \sin\left(e^{t^2}\right)$ is of exponential order as $t \to \infty$ but that its derivative is not.

Section 7.2 - Transformation of Initial Value Problems

7.2.1 - Use Laplace transforms to solve the initial value problem below.

$$x'' + 4x = 0; \qquad x(0) = 5; \; x'(0) = 0.$$

7.2.4 - Use Laplace transforms to solve the initial value problem below.

$$x'' + 8x' + 15x = 0; \qquad x(0) = 2;\ x'(0) = -3.$$

7.2.15 - Use Laplace transforms to solve the initial value problem below.

$$x'' + x' + y' + 2x - y = 0,$$

$$y'' + x' + y' + 4x - 2y = 0;$$

$$x(0) = y(0) = 1; \qquad x'(0) = y'(0) = 0.$$

More space for Problem 7.2.15 if you need it.

7.2.20 - Apply Theorem 2 from the textbook to find the inverse Laplace transform of the function

$$F(s) = \frac{2s+1}{s(s^2+9)}.$$

7.2.29 - Derive the Laplace transform given below:

$$\mathcal{L}(t \sinh kt) = \frac{2ks}{(s^2 - k^2)^2}$$

Section 7.3 - Translation and Partial Fractions

7.3.3 - Apply the translation theorem to find the Laplace transform of the function

$$f(t) = e^{-2t} \sin 3\pi t.$$

7.3.8 - Apply the translation theorem to find the inverse Laplace transform of the function

$$F(s) = \frac{s+2}{s^2+4s+5}.$$

7.3.19 - Use partial fractions to find the inverse Laplace transform of the function

$$F(s) = \frac{s^2 - 2s}{s^4 + 5s^2 + 4}.$$

7.3.24 - Use the factorization

$$s^4 + 4a^4 = (s^2 - 2as + 2a^2)(s^2 + 2as + 2a^2)$$

to derive the inverse Laplace transform

$$\mathcal{L}^{-1}\left\{\frac{s}{s^4 + 4a^4}\right\} = \frac{1}{2a^2}\sinh at \sin at.$$

More room for Problem 7.3.24 in case you need it.

7.3.30 - Use Laplace transforms to solve the initial value problem

$$x'' + 4x' + 8x = e^{-t} \quad x(0) = x'(0) = 0.$$

7.3.33 - Use Laplace transforms to solve the initial value problem

$$x^{(4)} + x = 0 \quad x(0) = x'(0) = x''(0) = 0, x^{(3)}(0) = 1.$$