

Math 3413.001: Physical Mathematics I

Homework 6, due March 5 (Thursday)

Lecture 13 (Feb 25) Due date 03/05/2020 : Section 7.3

1. Solve the following initial value problem using Laplace transforms

$$2x'' + 3x' - 2x = te^{-2t}, \quad x(0) = 0, x'(0) = -2.$$

2. Solve the following initial value problem using Laplace transforms

$$x'' - 6x' + 15x = 2 \sin(3t), \quad x(0) = -1, x'(0) = -4$$

3. Find the inverse Laplace transform of $F(s)$

$$\begin{aligned} F(s) &= \frac{2}{s^3(s-2)^2(s+5)(s^2+1)(s^2-4s+8)} \\ &= \frac{23}{32000} \frac{1}{s} + \frac{13}{1600} \frac{1}{s^2} + \frac{1}{160} \frac{1}{s^3} - \frac{171}{78400} \frac{1}{s-2} + \frac{1}{1120} \frac{1}{(s-2)^2} - \frac{1}{8440250} \frac{1}{s+5} \\ &\quad + \frac{1}{650} \frac{s-3}{s^2+1} + \frac{1}{881920} \frac{232-67s}{s^2-4s+8} \end{aligned}$$

Suggested problems from the book (DO NOT SUBMIT): Pg 464-465, #3, 6, 14, 19, 28, 33, 37

Lecture 14 (Feb 27) Due date 03/05/2020 : Section 7.4

1. (a) Find the convolution $f(t) * g(t)$ with $f(t) = g(t) = \sin(t)$.
(b) Solve the IVP $x'' + x = \sin(t)$, $x(0) = x'(0) = 0$ using part (a) above. (DO NOT USE PARTIAL FRACTIONS)
2. Find a non-trivial solution to

$$tx'' + (t+2)x' + x = 0$$

such that $x(0) = 0$.

3. Find inverse Laplace transform of

$$F(s) = \ln\left(\frac{s-1}{s^2+4}\right).$$

Suggested problems from the book (DO NOT SUBMIT): Pg 473-474, #5, 10, 16, 22, 24, 31