

MATH 308. Differential Equations

Homework 7

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Deadline: Oct 20, 11:00 pm

In this home assignment, you may use the Table of Laplace transforms (p.252 of the textbook).

Task 1. (1+1+2 pt)

(a) Compute $\mathcal{L}\{t \sin(2t)\}$;

(b) Plot the graph of $f(t) = tu_2(t)$ and compute $\mathcal{L}\{tu_2(t)\}$;

(c) Compute $\mathcal{L}^{-1}\left\{\frac{6e^{-3s}+6}{(s+1)^4}\right\}$; also, plot the graph of your answer.

To check your answer in (c): the answer is a continuous function.

Task 2. (3 pt) Solve the initial value problem

$$y'' + 4y = t - (t - 2)u_2(t), \quad y(0) = 0, y'(0) = 1.$$

Plot the graph of $y(t)$.

Task 3. (3 pt) Solve the initial value problem

$$y'' + 3y' + 2y = \begin{cases} 0, & t < 1 \\ 1, & 1 < t < 2 \\ 0, & t > 2 \end{cases}, \quad y(0) = 0, y'(0) = 0.$$

Plot the graph of $y(t)$.

To check your answer in Task 2 and 3: the resulting function $y(t)$ will satisfy the differential equation, will be continuous, and will have continuous derivative (you can check this visually after you plot the graph of $y(t)$).