

Differential Equations – Advanced Problem Set 6

Professor:

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Directions: Do the following book problems

Chapter 7.1 Problem 5, 33

Chapter 7.2 Problem 11

Chapter 7.4 Problem 32

Other Notes:

1. $\sinh(x)$ is the hyperbolic sine function. Use its exponential definition then take the Laplace transform.

2. For problem 33 use the exponential form of

$$\sin(kx) = \frac{e^{ikt} - e^{-ikt}}{2i}$$

and the formula

$$\mathcal{L}(e^{at}) = \frac{1}{s - a}$$

to derive the Laplace Transform formula.

3. Problem 11 is a challenge, see if you can figure it out! Here we have TWO coupled ODEs giving us a system of ODEs

$$\begin{aligned}x' &= 2x + y \\y' &= 6x + 3y \\x(0) &= 1 \quad y(0) = -2\end{aligned}$$

Your task is to take the Laplace transform of EACH equation. This should leave you with a system of two equations for two unknowns. Solve for the unknowns and transform back. The answer won't look right at first, but plug it in, it works!