

MTH 256 Lesson 24 - Laplace Transforms on 2nd Order ODEs

1. Determine the Laplace Transforms for the following functions.

a. $f(t) = \sin(\omega t)$

b. $g(t) = \cos(\omega t)$

c. $\mathcal{L} \left[\frac{d^2 y}{dt^2} \right]$ given $y_0 = y(0)$ and $y'_0 = y'(0)$.

d. $\mathcal{L} [e^{at} f(t)]$

2. Find the Inverse Laplace Transform of $\frac{1}{s^2 + 2s + 5}$.

3. Determine the solution to the 2nd-Order Initial-Value Problem modeling a forced harmonic oscillator:

$$\frac{d^2y}{dt^2} + 4y = 3 \cos(t), \quad y(0) = y'(0) = 0$$

4. Determine the solution to the 2nd-Order Initial-Value Problem modeling a forced harmonic oscillator:

$$\frac{d^2y}{dt^2} + 2\frac{dy}{dt} + 5y = h(t), \quad y(0) = y'(0) = 0 \quad \text{where} \quad h(t) = \begin{cases} 5 & t < 7 \\ 0 & t \geq 7 \end{cases}$$