

Puzzles in Laplace Transform

1. Derive the general Laplace transform for $t^n e^{at} \sin(bt)$
2. Solve a circuit using Laplace transforms (RLC network).
3. Apply Laplace transform methods to a control system block diagram.
4. Use Laplace to solve an integro-differential equation.

Laplace Puzzle 1: The Mysterious Function

You are given that the Laplace Transform of a function $f(t)$ is:

$$F(s) = \frac{s+2}{(s+1)^2 + 4}$$

What is $f(t)$?

Laplace Puzzle 2: The Time-Shift Trap

A function $g(t)$ is zero before $t = 3$, and after that, it behaves like t .

What is the Laplace Transform of $g(t)$?

Laplace Puzzle 3: Hidden Poles

You're told that the Laplace Transform of a system has poles at $s = -2$ (double pole) and $s = -5$, and a zero at $s = -1$.

Construct a possible transfer function $H(s)$ with a DC gain of 1.