What can a Laplace transform do? Can you tie it in a knot? Can you tie it in a bow? Can you toss it over your shoulder like a continental soldier?

Differential Equations
Class Notes
Properties of Laplace Transforms (Section 7.3)

The book presents lovely proofs of these properties. We will simply accept them, letting their utility wash over our minds as rain on a warm summer day.

TABLE 7.2 Properties of Laplace Transforms

$$\mathcal{L}\{f+g\} = \mathcal{L}\{f\} + \mathcal{L}\{g\} .$$

$$\mathcal{L}\{cf\} = c\mathcal{L}\{f\} \quad \text{for any constant } c .$$

$$\mathcal{L}\{e^{at}f(t)\}(s) = \mathcal{L}\{f\}(s-a) .$$

$$\mathcal{L}\{f'\}(s) = s\mathcal{L}\{f\}(s) - f(0) .$$

$$\mathcal{L}\{f''\}(s) = s^2\mathcal{L}\{f\}(s) - sf(0) - f'(0) .$$

$$\mathcal{L}\{f^{(n)}\}(s) = s^n\mathcal{L}\{f\}(s) - s^{n-1}f(0) - s^{n-2}f'(0) - \cdots - f^{(n-1)}(0) .$$

$$\mathcal{L}\{t^n f(t)\}(s) = (-1)^n \frac{d^n}{ds^n}\left(\mathcal{L}\{f\}(s)\right) .$$

1 and 2: Linearity
3: Translation in s
4, 5, and 6: Derivatives of $f(t)$
7: Derivatives *of* Laplace

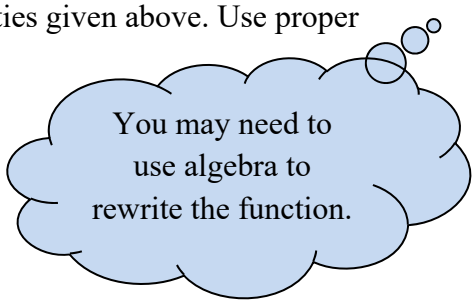
We will use the brief table of Laplace transforms given in the last section. Get out the Notes from our introduction to Laplace transforms and let's get started.

expl 1: Determine the Laplace transform of the given function using the brief table of Laplace transforms (from the last section of Notes) and these properties given above. Use proper notation. Give the constraints for s.

$$f(t) = e^{-t}\cos 3t + e^{6t} - 1$$

expl 2: Determine the Laplace transform of the given function using the brief table of Laplace transforms (from the last section of Notes) and these properties given above. Use proper notation. Give the constraints for s.

$$f(t) = \left(1 + e^{-t}\right)^2$$



expl 3: Determine the Laplace transform of the given function using the brief table of Laplace transforms (from the last section of Notes) and these properties given above. Use proper notation. Give the constraints for s.

$$g(t) = te^{2t}\cos 5t$$