## MA 266 Lecture 25

## 6.2 Solution of Initial Value Problems

In this section, we show how the Laplace transform can be used to solve initial value problem for linear differential equations with constant coefficients.

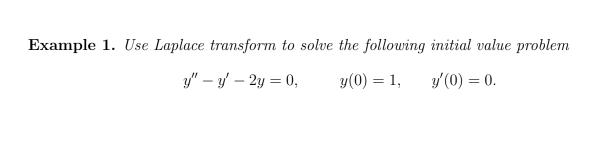
## Review

The Laplace transform  $\mathcal{L}\{f(t)\}$  of the function f is

Question: what is  $\mathcal{L}\{f'(t)\}$ ?

$$\mathcal{L}\{f'(t)\} =$$

$$\mathcal{L}\{f''(t)\} =$$



For the general second order equation with constant coefficients:

$$ay'' + by' + cy = f(t).$$

## Remarks

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Question: How to determine y(t) corresponding to Y(s)?

$f(t) = \mathcal{L}^{-1}\{F(s)\}$	$F(s) = \mathcal{L}\{f(t)\}$

Table 6.2.1 (pg 321) in the text book contains more functions and their Laplace transforms.

Example 2. Find the inverse Laplace transform

$$F(s) = \frac{2s - 3}{s^2 + 2s + 10}$$

Example 3. Solve the initial value problem using Laplace transform

$$y'' + y = \sin(2t),$$
  $y(0) = 2,$   $y'(0) = 1.$ 

For n-th order equation, we need the Laplace transform

$$\mathcal{L}\{f^{(n)}(t)\} =$$

Example 4. Solve the initial value problem using Laplace transform

$$y^{(4)} - y = 0$$
,  $y(0) = 0$ ,  $y'(0) = 1$ ,  $y''(0) = 0$ ,  $y'''(0) = 0$ ,