

**Homework 10, Math 308, due April 19th**

- (1) Find the general solutions for the following differential equations.
  - (a)  $x^2y' + 3xy = 1$ .
  - (b)  $y' = \cos(x + y)$ .
  - (c)  $y'' - 2y' + y = 0$ .
  - (d)  $y''' + y = 0$ .
  - (e)  $(D + 1)(D - 3)y = 24e^{-3x}$ .
- (2) Calculate the Laplace transform of  $f(t) = te^{-at} \sin bt$ , where  $a, b$  are constants.
- (3) Find a function  $f(t)$  such that  $L(f) = \frac{p^2 + 2p - 1}{(p^2 + 4p + 5)^2}$ .
- (4) Solve, using Laplace transform,  $y' + z = 2 \cos t$ ,  $y(0) = -1$  and  $z' - y = 1$ ,  $z(0) = 1$ .
- (5) Show that for two functions  $f, g$ ,  $f' * g - f * g' = af + bg$  for constants  $f, g$ .
- (6) Use convolution to solve  $y'' + 3y' - 4y = e^{3t}$ ,  $y(0) = y'(0) = 0$ .