HOMEWORK 19
DIFFERENTIAL EQUATIONS
DUE 11-12

Show your work!

(1) In class, we set up the solution of the differential equation

$$y'' + 2y + 5 = e^{-t}\sin(t), \quad y(0) = 1, y'(0) = 0.$$

We found that, if $Y = \mathcal{L}\{y\}$, then

$$Y = \frac{s^3 + 4s^2 + 6s + 5}{(s^2 + 2s + 2)(s^2 + 2s + 5)}.$$

We decided to decompose this using partial fractions as

$$Y = A\frac{s+1}{s^2+2s+2} + B\frac{1}{s^2+2s+2} + C\frac{s+1}{s^2+2s+5} + D\frac{2}{s^2+2s+5}.$$

(a) Explain why this choice of decomposition is a good one when we are using Laplace transforms. (Hint: Write each piece of the decomposition as a Laplace transform.)
(b) By clearing denominators and comparing coefficients, find a system of linear equations in A, B, C, and D.
(c) By hand or with a calculator, use (b) to find the values of A, B, C, and D.
(d) Use (a) and (c) to find a formula for y.

- **Six** book problems: #6.2.2, 8, 10, 11, 22, 23.