

HOMEWORK 21
DIFFERENTIAL EQUATIONS
DUE 11-26

Show your work!

- (1) On Homework #20, handout problem #1, you found that the solution to

$$u''(t) + 4u'(t) + 5u(t) = u_3(t), \quad u(0) = 1, \quad u'(0) = -3$$

is

$$u(t) = \begin{cases} e^{-2t}(\cos(t) - \sin(t)), & t < 3 \\ 0.2 + e^{-2t}(103.7 \cos(t) + 147.4 \sin(t)), & t > 3 \end{cases}$$

(with coefficients rounded to 4 significant figures).

In class, we found that the solution to the same problem is

$$u(t) = e^{-2t}(\cos(t) - \sin(t)) + \frac{1}{5} [1 - e^{-2(t-3)}(\cos(t-3) + 2 \sin(t-3))] u_3(t).$$

- (a) Re-write the first solution as a combination of Heaviside functions.
 - (b) Show that the first solution is the same as the second solution. (HINT: You will need to use trigonometric subtraction formulæ.)
- **Seven** book problems: #6.3.14, 17, 23, 24, 39; #6.4.1, 9.