

## 18.03 Recitation Suggestions

### Recitation 6, February 24, 2004

#### Second order linear equations: constant coefficient, homogeneous

**Vocabulary:** Linear, coefficient, system, input signal, spring/mass/dashpot model, homogeneous [“ho-mo-gē'-nē-ous,” not “ho-mo'-ge-nous”], normal mode = exponential solution, characteristic polynomial, characteristic roots.

1. Find all the solutions of the form  $x = e^{rt}$ , where  $r$  is a constant, of  $\ddot{x} + 4\dot{x} + kx = 0$  for  $k = 3$ ,  $k = 4$ , and  $k = 8$ .

2. The exponentials in case  $k = 8$  should turn out to be complex. Find the real and imaginary parts of each of the two solutions. What is the difference between them? Taking real and imaginary parts of just one of the exponential solutions (if it's complex) suffices, doesn't it? Verify that the real and imaginary parts do satisfy the equation.

3. Suppose you know that  $e^{-3t} \cos(2t - \pi/6)$  is a solution to the equation  $\ddot{x} + b\dot{x} + kx = 0$ , where  $b$  and  $k$  are real constants. What are they? What if  $e^t \sin(4t)$  is a solution instead? What if 1 and  $e^{-t}$  are both solutions?