

## Math 207 Quiz #6 Answers

1. Auxiliary Equation:  $2r^2 + 11r + 5 = 0 \Rightarrow r = -\frac{1}{2}, r = -5$

General Solution to the DE:  $w = c_1e^{-t/2} + c_2e^{-5t}$

Using the initial conditions, we have that  $c_1 = 4$  and  $c_2 = 1$ .  $\Rightarrow$   $w = 4e^{-t/2} + e^{-5t}$

2. Auxiliary Equation:  $r^2 - 2r + 10 = 0 \Rightarrow r = 1 \pm 3i$

General Solution to the DE:  $y = c_1e^t \cos(3t) + c_2e^t \sin(3t)$

3. Solutions will be overdamped if the auxiliary equation ( $3r^2 + 5r + k = 0$ ) has real-valued solutions.

$\Rightarrow$  The discriminant is positive  $\Rightarrow 5^2 - 4(3)(k) > 0$

$\Rightarrow 25 - 12k > 0 \Rightarrow k < \frac{25}{12}$

So, if  $k < \frac{25}{12}$ , the system has solutions that are overdamped.