NAME & EID: Solutions

M 427K Quiz 4 **September 26, 2012** **Instructor: James Pascaleff**

- Show all work.
- No books, notes, calculators, or other electronic devices.

This problem is about the second order linear homogeneous ordinary differential equation

$$y'' + y' - 2y = 0 \tag{1}$$

1. (4 points) Write down the characteristic equation and find its solutions.

$r^2 + r - 2 = 0$

$r = \dfrac{-1 \pm \sqrt{1^2 - 4 \cdot 1 \cdot (-2)}}{2 \cdot 1} = \dfrac{-1 \pm \sqrt{9}}{2} = \dfrac{-1 \pm 3}{2}$

$r_1 = \dfrac{-1+3}{2} = 1 \qquad r_2 = \dfrac{-1-3}{2} = -2$

2. (3 points) Write down the general solution of the differential equation.

$y = c_1 e^{t} + c_2 e^{-2t}$

3. (3 points) Solve the initial value problem $y(0) = 1$, $y'(0) = 1$.

$y' = c_1 e^{t} - 2c_2 e^{-2t}$

$\begin{cases} y(0) = c_1 + c_2 = 1 \\ y'(0) = c_1 - 2c_2 = 1 \end{cases}$

$c_1 = 1 + 2c_2$

$(1 + 2c_2) + c_2 = 1$

$3c_2 = 0 \rightarrow c_2 = 0$

so $\begin{cases} c_1 = 1 \\ c_2 = 0 \end{cases}$

$\boxed{y(t) = e^{t}}$