

## Quiz 9

Math 54-Lec 3, Differential Equations, Fall 2017

SECTION:

NAME:

You have 40 minutes to complete this quiz. To receive full credit, justify your answers.

**Problem 1.**(4 points) Find the general solution to the inhomogeneous equation  $y''(t) - 2y'(t) + y(t) = e^t/t$  by using variation of parameters.

**Problem 2.**(11 points total) Sometimes we want to find solutions to an inhomogeneous equation of the form:  $ay'' + by' + cy = g(t)$  where  $g(t)$  is only piecewise continuous (it is discontinuous at finitely many points). In this case we can still come up with a relatively good answer even if no solution exists. As an example consider the differential equation:

$$y'' + 2y' + 5y = g(t); y(0) = 0, y'(1) = 0.$$

where

$$g(t) = \begin{cases} 10 & 0 \leq t \leq 3\pi/2 \\ 0 & t > 3\pi/2 \end{cases}$$

(a.) (4 points) Find a solution to the initial value problem when  $0 \leq t \leq 3\pi/2$ .

(b.) (4 points) Find a solution to the initial value problem when  $t > 3\pi/2$ .

(c.) (3 points) Hence, find a function  $f(t)$  that is everywhere continuous and differentiable and also satisfies the initial value problem except at  $t = 3\pi/2$ . [Hint: find appropriate constants for the solutions obtained in part (a) and (b).]