Name:_____
M555: Differential Equations I (Spring 2018)
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Good Problems 6: Sections 3.5, 3.6, Chapter 4

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Instructions *Complete all problems, showing enough work. A selection of problems will be graded based on the organization and clarity of the work shown in addition to the final solution (provided one exists).*

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1. Find the general solution of the differential equation.

$$\begin{cases} y'' + y = \tan t \\ 0 < t < \frac{\pi}{2} \end{cases}$$

2. Consider the initial value problem (IVP),

$$\begin{cases} t^2 y'' - 7ty' + 7y = 0, \\ y(1) = 1, \\ y'(1) = -1. \end{cases}$$

This is a second order linear homogeneous differential equation with non-constant coefficients. Assume that the solutions are of the form

$$\varphi(t) = t^r$$

for some r. Plug this into the DE and solve for r to find the general solution, then find the particular solution of the IVP.

3. Consider the second order linear differential equation

$$at^2y'' + bty' + cy = 0.$$

Differential equations of this type are known as *Euler equations*. Apply the method described in the previous good problem to find the general solution.

4. Find the general solution of the differential equation

$$y'' - 4y' + 4y = e^t \sin(t).$$