Math 352 **Workshop 05**

March 12, 2014 Due: March 14 Name: _____

Second-order linear equations

1. Find the roots of the characteristic equation for the differential equation $y'' + 9y = 0$. Note that the discriminant is negative, so they are complex. Call them r_1 and r_2.

2. Evaluate $(r_1 + r_2)/2$ and $(r_1 - r_2)/2i$. What do you notice about these numbers?

3. What complex exponential functions solve the differential equation? Use the roots you found and ape the exponential trick from before.

4. Write these functions using Euler's formula. Call them u_1 and u_2 in their new, Eulerified form.

5. Write down $y_1 = (u_1 + u_2)/2$ and $y_2 = (u_1 - u_2)/2i$ and simplify. What do you notice?

6. Apply the method to each differential equation, obtaining two independent *real-valued* solutions. (Independent means the Wronskian is nonzero.) Remember:

$$e^{(x+iy)t} = e^{xt}e^{iyt}$$

(a) $y'' + 2y' + 8y = 0$

(b) $3y'' + 6y' + 4y = 0$

(c) $6y'' - 8y' + 10y = 0$