

# Math 307 Quiz 6

May 19, 2014

**Problem 1.** For each of the following, determine the correct form of particular solution  $y_p$  to try in the method of undetermined coefficients.

(a)  $y'' + y = t^2e^{-2t} - 4te^{-2t} + 3e^{-2t}$

(b)  $y'' - 2y' + y = t^3e^t$

(c)  $y'' - y = t^4e^{-t}$

(d)  $y'' + 2y' = 3t^2 + 2t + 4$

**Solution 1.**

(a)  $y_p = (At^2 + Bt + C)e^{-2t}$

(b)  $y_p = (At^5 + Bt^4 + Ct^3 + Dt^2)e^t$

(c)  $y_p = (At^5 + Bt^4 + Ct^3 + Dt^2 + Et)e^{-t}$

(d)  $y_p = At^3 + Bt^2 + Ct$

**Problem 2.** Suppose that  $\tilde{y}_p$  is a particular solution to the differential equation

$$\tilde{y}'' + 23\tilde{y}' + 4\tilde{y} = te^{(17+4i)t}.$$

Fill in the blanks in the equation

$$y_p = \underline{\hspace{2cm}} \operatorname{Re}(\tilde{y}_p) + \underline{\hspace{2cm}} \operatorname{Im}(\tilde{y}_p)$$

so that  $y_p$  is a particular solution to the equation

$$y'' + 23y' + 4y = 3te^{17t} \cos(4t) + 7te^{17t} \sin(4t).$$

**Solution 2.**

$$y_p = 3\operatorname{Re}(\tilde{y}_p) + 7\operatorname{Im}(\tilde{y}_p).$$

**Problem 3.** Consider the differential equation

$$y'' - 4y = t \cos(2t)$$

The complex differential equation that we associate with this is

$$\tilde{y}'' - 4\tilde{y} = te^{2it}.$$

- (a) For the second equation, which form of  $\tilde{y}_p$  should we use in the method of undetermined coefficients?
- (b) How is the particular solution  $\tilde{y}_p$  to the complex equation related to the particular solution  $y_p$  of the original equation?

**Solution 3.**

(a)  $\tilde{y}_p = (At + B)e^{2it}$

(b)  $y_p = \operatorname{Re}(\tilde{y}_p)$