# Math 24 Discussion Section

## Warm Up

Given $ay'' + by' + cy = 0$, a second-order linear homogeneous equation with constant coefficients, let $r_1$ and $r_2$ be the roots of the corresponding characteristic equation. Write the general solution for

i. $r_1$ and $r_2$ both real but not equal.

ii. $r_1$ and $r_2$ complex conjugates.

iii. $r_1 = r_2$.

With your group, review the following terms and techniques including their associated formulas:

| | | |
|---|---|---|
| Repeated Roots | Reduction of Order | Undetermined Coefficients |
| Complementary Solution | Particular Solution | Variation of Parameters |

## Problems

1. Solve the following IVP: $y'' + 14y' + 49y = 0,\ y(-4) = -1,\ y'(-4) = 5.$
2. Find the general solution to $t^2 y'' + 2ty' - 2y = 0$ given that $y_1(t) = t$ is a solution.
3. (a) Given the nonhomogeneous equation $y'' + p(t)y' + q(t)y = g(t)$, find the particular solution $Y(t)$ (if possible) when

   $$i.\ \ g(t) = 3e^{2t} \quad ii.\ \ g(t) = \sin(2t) \quad iii.\ \ g(t) = 3e^{2t} + \sin(2t) \quad iv.\ \ g(t) = \log(t) \quad v.\ \ g(t) = 3e^{2t}\sin(2t)$$

   (b) What about the case where $y'' - y = e^t$?

   (c) List (or construct a table of) the families of functions for which you can apply the method of undetermined coefficients.
4. Find the solution to $y'' + 4y' + 3y = -e^{-t}(2 + 8t),\ y(0) = 1,\ y'(0) = 2.$
5. Find the general solution of $y'' + 4y' + ry = t^{-2}e^{-2t}.$