

Math 54 Discussion Section Problems

Rob Bayer

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You should work on the following problems in groups of 3 or 4. Try to get through as many as you can, but you aren't expected to finish everything. In fact, the answers are largely unimportant; making sure **everyone** in your group knows **how** to solve all the problems is what really matters.

- (complex roots) Solve the initial value problem $y'' - 6y' + 13y = 0$ where $y(0) = 4$ and $y'(0) = 0$
- For each of the following possibilities for $f(t)$, decide if undetermined coefficients would work. For those that would, write the form of your guess:
 - e^{-3x}
 - e^{x^2}
 - $\sin 3x$
 - $\cos x - \sin 5x$
 - $\frac{\sin x}{x}$
 - $x^2 e^{-7x} \sin 6x$
 - $\frac{e^x}{x^2+1}$
 - $x + 3 + e^x$
 - $\ln x$
- Find the general solution to each of the following:
 - $y'' + 2y' - 3y = e^x$
 - $y'' + 2y' + y = e^x \cos x$
 - $y'' + 2y' + y = x e^{-x}$
- Hint for the below problems: you should probably do 3 cases for each part, one for each of the possible number of roots of the characteristic equation.
 - Show that if a, b, c are all greater than 0, then all solutions to $ay'' + by' + cy = 0$ have the property that $\lim_{x \rightarrow \infty} y(x) = 0$
 - If $a > 0, c > 0$ but $b = 0$, show that the result from part (a) is no longer true, but that all solutions are bounded as $x \rightarrow \infty$
 - If $a > 0, b > 0$ and $c = 0$, show that all solutions approach some constant (not necessarily 0) as $x \rightarrow \infty$. Determine this constant in terms of $y(0)$, which we'll call y_0 , and $y'(0)$, which we'll call y'_0