1. (10 pts) Find the general solution of $2y'' + 7y' + 3y = 0$.

2. (10 pts) Find the general solution of $y'' + 10y' + 34y = 0$.

3. (10 pts) Find the general solution of $y^{iv} + 2y'' + y = 0$.

4. (20 pts) Find the general solution of $y'' - 6y' + 9y = e^{3t}$.

5. (20 pts) Find the general solution of $y'' + y = \tan t, \quad 0 < t < \frac{\pi}{2}$.

6. (6 pts) Find a nontrivial linear combination of the functions $f(t) = t + 1$, $g(t) = t - 1$, and $h(t) = 4t$ that is zero for all $t$. What does this prove about the functions $f$, $g$, and $h$?

7. (6 pts) The functions $y_1(t) = e^t$ and $y_2(t) = \frac{1}{t}$ are solutions of a linear homogeneous second order DE on the interval $(0, \infty)$. Show that $y_1$ and $y_2$ are linearly independent on this interval, and write the general solution of the DE.

8. (6 pts) Find a linear homogeneous DE that has both $y_1(t) = 7e^{2t}$ and $y_2(t) = 4e^{-t}$ as solutions.

9. (6 pts) The functions $y_1(t) = t^2$ and $y_2(t) = \frac{t^3 + 1}{t}$ are both solutions of a certain second order linear NONhomogeneous DE, and $y_3(t) = e^t$ is one solution of the corresponding homogeneous DE. Find the general solution of the nonhomogeneous DE.

10. (6 pts) Explain why, for damped free vibrations with both mass and damping constant fixed, increasing the spring constant (i.e., making the spring stiffer) leads to oscillatory motion (i.e., underdamping).