The majority of the credit you receive will be based on the completeness and the clarity of your responses. Please use equal signs where appropriate and write solutions with a logical flow. Show your work, and avoid saying things that are untrue, ambiguous, or nonsensical.

Chapter 4

1. Things you should know:
   - Euler's formula, and the basics of complex numbers: addition, multiplication, complex conjugation, modulus and argument.
   - The meaning of linear independence/dependence for real-valued functions.
   - How to compute a Wronskian, and how to use a Wronskian to detect linear independence/dependence of solutions to linear homogeneous ODE's.
   - How to use characteristic polynomials to solve second-order linear homogeneous ODE's with constant coefficients.
   - How to solve second-order linear non-homogeneous ODE's using the method of undetermined coefficients.
   - How to solve second-order linear non-homogeneous ODE's using the method of variation of parameters.
2. LINEAR HOMOGENEOUS EQUATIONS WITH CONSTANT COEFFICIENTS.
   Form: $ay'' + by' + cy = 0$
   - Solve the characteristic equation $a\lambda^2 + b\lambda + c = 0$ to find two solutions λ_1 and λ_2.
   - If λ_1, λ_2 are distinct real solutions, then a solution to the ODE is $y = C_1 e^{\lambda_1 t} + C_2 e^{\lambda_2 t}$.
   - If $\lambda_1 = \lambda_2$ is a repeated real solutions, then a solution to the ODE is $y = C_1 e^{\lambda_1 t} + C_2 t e^{\lambda_1 t}$.
   - If $\lambda_1 = a + bi$ and $\lambda_2 = a - bi$ are complex conjugate solutions, then a solutions to the ODE is $y = C_1 e^{at}\cos(bt) + C_2 e^{at}\sin(bt)$.
3. LINEAR EQUATIONS: UNDETERMINED COEFFICIENTS
   Form: $y'' + p(t)y' + q(t)y = f(t)$
   - Obtain a fundamental set of solutions $\{y_1, y_2\}$ to the corresponding homogeneous equation $y'' + p(t)y' + q(t)y = 0$.
   - Based on what $f(t)$ looks like, try to identify the form of the particular solution y_p to the ODE by multiplying by the appropriate t^s.
   - Compute y_p' and y_p'', and plug into the ODE to determine the values of the coefficients.
   - A general solution to the ODE is $y = y_p + C_1 y_1 + C_2 y_2$.
4. LINEAR EQUATIONS: VARIATION OF PARAMETERS
   Form: $y'' + p(t)y' + q(t)y = f(t)$
   - Obtain a fundamental set of solutions $\{y_1, y_2\}$ to the corresponding homogeneous equation $y'' + p(t)y' + q(t)y = 0$.
   - Compute the Wronskian $W(y_1, y_2)$.
   - Set $u_1' = -\dfrac{y_2(t)f(t)}{W(y_1, y_2)(t)}$ and $u_2' = \dfrac{y_1(t)f(t)}{W(y_1, y_2)(t)}$.
   - Integrate to find u_1 and u_2. Then, $y_p = u_1 y_1 + u_2 y_2$ is a particular solution to the ODE.
   - A general solution is $y = y_p + C_1 y_1 + C_2 y_2$.