

Exam 2, Fall 1999

1. Write the following in the form $a + bi$:

a. $\frac{3 + 4i}{2 - 3i}$

b. $e^{3+i\pi/3}$

2. Solve the initial value problem

$$y'' + 5y' + 6y = 0, \quad y(0) = 1, \quad y'(0) = 0$$

3. Find the general solution to $y'' + 4y' + 8y = \cos(x)$

4. Solve the initial value problem

$$y'' - 4y = e^{-x}, \quad y(0) = 0, \quad y'(0) = 0$$

5. A mass of 4 kg is attached to a spring causing it to stretch 10 cm. The spring has a damping constant of 8 Newtons/cm (which is a kg/sec). If the spring is pulled down an additional 4 cm and released, what will be the equation of motion for the spring?

6. Suppose L is a linear operator with $Ly = f$ and $Lz = f$. Show that there is a homogeneous solution h with $y = z + h$ (h is a homogeneous solution means $Lh = 0$).

7. Give examples of differential equations and sketches of solution curves which illustrate the following:

a. overdamping,

b. beats,

c. transient and steady-state solutions.

8. Explain resonance. Include both mathematical and physical ideas in your explanation. Your explanation will be graded on both content and clarity.