MAP 2302 PRACTICE TEST 2 - JAMES KEESLING

NAME ____

Do all problems. Each problem is worth 20 points. Partial credit will be given for correct reasoning when the final answer may be incorrect. Credit will be deducted if reasoning is wrong even if the final answer is correct.

Problem 1. Solve the following linear homogeneous equations.

$$\frac{d^2x}{dt^2} + 3\frac{dx}{dt} + 2x = 0$$
$$\frac{d^2x}{dt^2} + 4\frac{dx}{dt} + 4x = 0$$
$$\frac{d^2x}{dt^2} + 4\frac{dx}{dt} + 29x = 0$$

Problem 2. Solve the following differential equations. Use both the undetermined coefficients and the variation of parameters methods.

$$\frac{d^2x}{dt^2} + 3\frac{dx}{dt} + 2x = \exp(-t) + \sin(t)$$
$$\frac{d^2x}{dt^2} + 4\frac{dx}{dt} + 4x = \cos(5t)$$
$$\frac{d^2x}{dt^2} + 4\frac{dx}{dt} + 29x = \exp(-2t) \cdot \cos(5t)$$

Problem 3. Show that $\sin(2t)$ and $\sin(t)$ are linearly independent.

Problem 4. Convert the following differential equation into first order and solve by matrix methods. Give the numerical solution for $x''(0) = 3$, $x'(0) = -1$, and $x(0) = 2$ using $h = 1/10$ and $n = 10$.

$$\frac{d^3x}{dt^3} - 2\frac{dx}{dt} + x = 0$$

Problem 5. Solve the following system of differential equations using Laplace transforms.

$$\frac{dx_1}{dt} = 2x_1 + 3x_2 + \exp(3t)$$
$$\frac{dx_2}{dt} = x_1 + 2x_2 + \sin(t)$$
$$x_1(0) = 2 \quad x_2(0) = 1$$