

Directions: Work all three questions. Hand in any scratch work that you want graded. If you need help with a derivative or integral, ask me. (The actual exam may include a question on vibrating springs.)

1. (40 points) Solve the system of linear equations

$$\begin{aligned}x_1 + 2x_2 - x_3 &= 2, \\2x_1 + x_2 + x_3 &= 1, \\x_1 - x_2 + 2x_3 &= -1\end{aligned}$$

using matrix methods.

2. (35 points) Find a suitable form for a particular solution (y_p) using the method of undetermined coefficients for the differential equation

$$y'' - 5y' + 6y = e^t \cos(2t) + e^{2t}(3t + 4) \sin t.$$

DO NOT EVALUATE THE COEFFICIENTS!

3. (25 points) Verify that

$$\mathbf{x} = \begin{pmatrix} e^{-3t} \\ -4e^{-3t} \end{pmatrix}$$

is a solution of the differential equation

$$\mathbf{x}' = \begin{pmatrix} 1 & 1 \\ 4 & -2 \end{pmatrix} \mathbf{x}.$$