Show your work and box answers. This pdf should be printed and your solution should be handwritten on the printout. Once complete, please staple in upper left corner. Thanks.

Suggested Reading You may find the following helpful resources beyond lecture,

(a.) Chapter 6 and 8 of my lecture notes for Math 221

(b.) Chapter 5 of Lay's *Linear Algebra*

Problem 76: Consider $A : \mathbb{R} \to \mathbb{R}^{n\times n}$ where $A_{ij} : \mathbb{R} \to \mathbb{R}$ is a smooth function for each component function. We defined $\left(\frac{dA}{dt}\right)_{ij} = \frac{d}{dt}[A_{ij}]$. In other words, the derivative of a matrix is done component-wise. Calculate $\frac{d}{dt}(A^2)$ and $\frac{d}{dt}(A^3)$.

Problem 77: Suppose $\frac{dx}{dt} = x + 2y$ and $\frac{dy}{dt} = 2x + y$. Find the general solution using the eigenvector method we derived in lecture.

Problem 78: Suppose $\left\{ \begin{array}{c} \frac{dx}{dt} = 9x + 7y - 13z \\ \frac{dy}{dt} = 7x + 9y - 13z \\ \frac{dz}{dt} = -13z - 13y + 29z \end{array} \right\}$. Find the general solution using the eigenvector method we derived in lecture.

Fun fact: $\lambda^3 - 47\lambda^2 + 216\lambda - 252$ has $\lambda = 2$ as a zero.

Feel free to work these on your own paper neatly and in order. Be sure to label them as indicated below. Do not make the grader have to think hard about what they're looking at. Thanks!

Problem 79: Lay §5.1#10, 12

Problem 80: Lay §5.1#14, 16

Problem 81: Lay §5.1#20

Problem 82: Lay §5.1#25

Problem 83: Lay §5.1#33

Problem 84: Lay §5.2#14, 16, 17

Problem 85: Lay §5.2#27

Problem 86: Lay §5.3#4

Problem 87: Lay §5.3#15

Problem 88: Lay §5.5#4 and find the general solution of $\frac{dx}{dt} = 5x - 2y$ and $\frac{dy}{dt} = x + 3y$.

Problem 89: Lay §5.6#9, 11

Problem 90: Lay §5.7#17 (please use technology to calculate the eigenvalues and eigenvectors for the matrix given here)