Please read all the relevant sections in the textbook.

Homework problems will be assigned bi-weekly and will consist of odd number textbook problems, even number textbook problems, and non-textbook problems. Please only submit even numbered textbook problems and all non-textbook problems for grading. Please hand the problems to me before the class begins. You may discuss these problems with other students, but you must independently write up and submit your own solutions. Copying any part of a solution from a book, solutions guide, or website is cheating! Students are expected to abide by the Georgia Tech Academic Honor Code.

Late homeworks will not be excepted, but you may drop your two lowest homework grades. Emailed homeworks will only be accepted with prior agreement of the Instructor - else they will not be accepted.

To receive credit for a solution, you must clearly indicate how you obtained your solution. You will receive no credit without an explanation. Please keep your written answers brief; be clear and to the point. The grader will deduct points for rambling and for incorrect or irrelevant statements. Please do not show arithmetic and most algebra calculations. Your solutions should look like the solutions of examples in the text. If you are asked to show or prove a general result, you will receive no points for numerically verifying the result or proving it for $2 \times 2$ or $3 \times 3$ matrices. However, counterexamples can certainly be $2 \times 2$ matrices.

In order to grade as many problems as possible, your submitted problem sets should be printed very neatly and stapled. Please do not cross out. Write on only one side of each page and do not use paper that has been torn out of spiral bound notebooks. The grader will deduct points for not following these directions. You may typeset your solutions, but this is definitely not required.

1. Appendix A: 8, 9
2. Prove that the sum of $k$ rank-1 matrices has rank $\leq k$.
3. Prove that $A^T$ is singular if and only if $A$ is singular.
4. Prove the $P_2$ (the vector space of quadratic polynomials) is isomorphic to $\mathbb{R}^3$.
5. 4.2: 1, 4, 5, 6, 7, 8, 11, 12, 13, 14, 16, 18, 20, 22, 26, 27, 29
6. 4.3: 1, 2, 3, 4, 5, 14, 15, 16, 20, 22, 25, 26, 34
7. 4.4: 1, 2, 5, 18, 37
8. (Challenge) Starting with the sum of permutations definition of determinant, verify Properties I, II, III.
9. Suppose that two time-dependent vectors are linearly related, i.e., $x(t) = Pu(t)$, where $P$ is a (constant) matrix. Verify that $\dot{x} = P \dot{u}$.
10. 5.1: 4, 5, 9, 10, 11, 14, 18, 19, 25, 26, 27, 29, 39, 40
11. 5.2: 1, 3, 4, 9, 10, 12, 13, 15, 19, 21, 23, 25, 26, 30, 33, 37, 38, 39,
12. 5.3: 22
13. Solve the following systems of ODEs:

   $$(i) \ x' = \begin{pmatrix} 2 & 3 \\ 4 & 3 \end{pmatrix} \ x, \quad (ii) \ x' = \begin{pmatrix} 3 & -2 \\ 2 & -2 \end{pmatrix} \ x, \quad x(0) = \begin{pmatrix} 1 \\ -1 \end{pmatrix}, \quad (iii) \ x' = \begin{pmatrix} 3 & -1 & 2 \\ 3 & -1 & 6 \\ -2 & 2 & -2 \end{pmatrix} \ x$$
