Math 254-2 Exam 3: 10/7/8
Please read the exam instructions.

Notes, books, papers, calculators and electronic aids are all forbidden for this exam. Please write your answers on **the attached page only** (front and back if necessary). Indicate clearly what work goes with which problem. Cross out work you do not wish graded; incorrect work can lower your grade. You may use this first page as scratch paper; keep it for your records. Show all necessary work in your solutions; if you are unsure, show it. Extra credit may be earned by handing in revised work in class on Thursday 10/9; for details see the syllabus. Each problem is worth 10 points; your total will be scaled to the standard 100 point scale. You have approximately 30 minutes.

1. Carefully state the definition of "dimension", in the context of this course. Give two examples: a four-dimensional vector space, and an infinite-dimensional vector space.

2. Suppose that A, B are square, $n \times n$, invertible matrices. Prove that AB is invertible, and that $(AB)^{-1} = B^{-1}A^{-1}$.

   The remaining problems all concern the following matrix: $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$

3. Be sure to justify your answers to the following questions.

   (a) Is A diagonal?

   (b) Is A triangular?

   (c) Is A orthogonal?

   (d) Calculate $\text{tr}(A)$.

   (e) Calculate A^T.

4. Find a symmetric matrix B and skew-symmetric matrix C such that $A = B + C$.

5. Is A invertible? If so, find A^{-1}.

Please hand in ONLY the second page; keep this first page.