Write your name below. This exam is worth 100 points. On each problem, you must show all your work to receive credit on that problem. You are allowed to use one page of notes. You cannot collaborate on the exam or seek outside help, nor can you use the recorded lectures, a calculator, any computational software, or material you nd online.

Name:

1. (10 points, 2 each) If the statement is always true then write **TRUE**; if it is possible for the statement to be false then write **FALSE**. No justi cation is necessary.

   (a) A square matrix always commutes with its transpose.

   (b) If A is invertible and $c \in \mathbb{R}$ is non-zero, then $(cA)^{-1} =$

3. (20 points) The following two questions are unrelated.

   (a) (10 points) Are the polynomials $x^2 + 1, x^2 - 1, x$ a basis for P^2, the vector space of all polynomials with degree ≤ 2? Justify your answer.

   (b) (10 points) Find a basis for the span of $\left\{ \begin{pmatrix} 1 \\ 1 \\ 2 \\ 1 \end{pmatrix}, \begin{pmatrix} 3 \\ 2 \\ 7 \\ 0 \end{pmatrix}, \begin{pmatrix} 2 \\ 1 \\ 5 \\ 1 \end{pmatrix} \right\}$.

      Are these vectors linearly independent? Justify your answer.

4.

5. (25 points) Let $A = \begin{pmatrix} 1 & 2 & 6 & 9 \\ 1 & 2 & 2 & 1 \\ 1 & 0 & 2 & 4 \\ 1 & 2 & 6 & 9 \end{pmatrix}$

   (a)