Non-proof Tasks:

1. Know and be able to use standard bases for the familiar vector spaces $\mathbf{R}^n$, $\mathbf{C}$, P_n, and $M_{m,n}(\mathbf{R})$.
2. Know what it means to refer to the coordinates of a given vector with respect to a given basis that is not necessarily the standard basis for a familiar vector space.
3. Given a vector in standard $\mathbf{R}^n$ notation, find its coordinates with respect to a given, different basis for $\mathbf{R}^n$.
4. Compute the change-of-basis matrix from one given basis to another (for any familiar vector space, not just $\mathbf{R}^n$).
5. USE the change-of-basis matrix to convert from coordinates with respect to one given basis into coordinates with respect to another.
6. State the FORMAL definitions of: nullspace, row space, column space, kernel, image. Use complete sentences and include "universal hypotheses" such as "Let A be an $m \times n$ matrix..." or "Let $L : V \to W$ be a linear transformation...."
7. State the formal definition of $Span(S)$.
8. Find a basis for each of the following:
   (a) the null space of a given (real) matrix A
   (b) the row space of a given (real) matrix A
   (c) the column space of a given (real) matrix A
   (d) the kernel of a given linear transformation $L : \mathbf{R}^n \to \mathbf{R}^m$
   (e) the image of a given subspace S (possibly $S = V$) for a given linear transformation $L : \mathbf{R}^n \to \mathbf{R}^m$
9. Find the matrix representation of a given linear transformation.

Proof Tasks:

1. Prove that a given function is/is not a linear transformation.
2. Prove my choice of "half" in the statement: a function is a linear transformation if and only if it preserves addition and scalar multiplication. (See your notes and page 167.)
3. Prove my choice of part (i) or (iii) of the Proposition on page 171.
4. Prove statements like those in #2, 3 of HW #7.
5. Prove that the kernel or image under a linear transformation is a subspace (my choice, see pages 172-173 and your notes).

The exam will take place in one of our computer labs, so that everyone can have access to the Purdue Matrix web site for equitable computing ability. I'll be able to monitor the machines so that no one goes off task.