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 Wednesday 12/10; for details see the syllabus. Each problem is worth 10 points; your total will be doubled to fit the standard 100 point scale. You have approximately 30 minutes.

1. Carefully define the term “basis”. Give two examples in $\mathbb{R}^2$.

For the remaining problems, consider the matrix $A = \begin{pmatrix} 2 & -1 & 1 \\ 0 & 3 & 0 \\ 1 & 0 & 2 \end{pmatrix}$.

Hint: all solutions can be expressed with integers.

2. Calculate the characteristic polynomial $\Delta(t)$ (or $p(\lambda)$) for $A$.

3. Find all the eigenvalues of $A$.

4. For each eigenvalue, find a maximal independent set of eigenvectors.

5. For each eigenvalue, give its algebraic and geometric multiplicity. Is $A$ diagonalizable? What is the Jordan form of $A$?

Please hand in ONLY the second page; keep this first page.
Please write all solutions on this page (front and back if necessary).