Final SP 2002 Math 544

PRINT Your Name:_____

The exam is worth 100 points. There are 18 problems on 9 pages. SHOW your work. [CIRCLE] your answer. **CHECK** your answer whenever possible. **No Calculators.**

Your grade for the course will be available from VIP by the end of the week. Also, If you send me an e-mail (kustin@math.sc.edu) asking for your grade, I will e-mail it to you as soon as it is available.

1. (8 points) Let A be an $n \times n$ matrix. List 8 statements that are equivalent to the statement "A is invertible".

(1) There is a matrix B with $AB=I=BA$.
(2) There is a matrix B with $AB=I$.
(3) There is a matrix B with $BA=I$.
(4) The null space of A is $\{0\}$
(5) The cols of A are l.i.
(6) The only solution of $Ax=0$ is $x=0$.
(7) The cols of A span $\mathbb{R}^n$
(8) $Ax=b$ has a solution for all b in $\mathbb{R}^n$
(9) The cols of A are a basis for $\mathbb{R}^n$
(10) dim null space $A=0$
(11) dim col space $A=n$
(12) rank $A=n$
(13) the rows of A are l.i.
(14) the rows of A span the vector space of all row vectors with n entries
(15) dim row space $A=n$
(16) $\lambda=0$ is not an evalue of A

2. (5 points) Define "onto". Use complete sentences.

The function $f: X \to Y$ is <u>onto</u> if for every y in Y there exists at least one $x \in X$ with $f(x)=y$.

3. (5 points) Define "linearly independent". Use complete sentences.

The vectors $v_1, \ldots, v_m$ are <u>linearly independent</u> if the only constants $c_1, \ldots, c_m$ with $\sum_{i=1}^{m} c_i v_i = 0$ are $c_1 = c_2 = \cdots = c_m = 0$