

# Review for Test 3, 11/27/06

## 4.4, 5.1-5.4

November 23, 2006

1. **Vector spaces associated with a matrix  $A$ .**
  - Row space. Finding a basis of  $Row(A)$ .
  - Column space. Finding a basis of  $Col(A)$ .
  - Null space. Finding a basis of  $Null(A)$ .
  - Rank of a matrix:  $rank(A) + dim(Null(A)) = n$ .
2. **Orthogonal vectors.**
  - Scalar product, length of a vector, Cauchy-Schwarz inequality.
  - Orthogonal and orthonormal bases.
  - $V^\perp$  and properties.
  - $Row(A)^\perp = Null(A)$ ,  $Null(A)^\perp = Row(A)$ .
  - Finding a basis of  $V^\perp$ .
3. **Least squares solution. Projections on a subspace.**
  - Finding the least squares solution of  $Ax = b$ .
  - Finding a projection of vector  $b$  on  $V$ .
  - Finding a projection of  $b$  on  $V$  in the case we have an orthogonal basis of  $V$ .
  - Finding an orthogonal basis of  $V$ . Finding an orthonormal basis of  $V$ .