Exam I Review Sheet  
MATH 289, Winter 2003

This exam will cover sections 1.1-1.9 in your text. You should pay special attention to all definitions (green boxes) and theorems (blue boxes) in these sections. Below are highlighted terms and activities from each section which are of particular interest.

1. Section 1-1, pages 2-13

**Terms:** Augmented Matrix, Consistent/Inconsistent System of Equations, Elementary Row Operations, Solution Set, Row Equivalent Matrices

**Tasks:**
(a) Solve a system of equations.
(b) Describe the solution set of a system of equations.
(c) Answer question of *existence* and *uniqueness*.

2. Section 1-2, pages 14-27

**Terms:** (Row) Echelon Form, Reduced (Row) Echelon Form, Pivot Position, Pivot Column, Pivot, Parametric Description of a Solution Set

**Tasks:**
(a) Identify (reduced) echelon form.
(b) Row reduce a matrix to (reduced) echelon form.
(c) Identify pivot positions, columns and pivots.
(d) Determine uniqueness/existence of solutions from a reduced echelon matrix.

3. Section 1-3, pages 28-39

**Terms:** Vector, Scalar, Linear Combination, Weight, Span of a Set of Vectors

**Tasks:**
(a) Translate between augmented matrix and vector equation.
(b) Perform vector arithmetic.
(c) Determine if one vector is a linear combination of a set of vectors.
(d) Determine the span of a set of vectors.

4. Section 1-4, pages 40-49

**Terms:** Matrix Equation

**Tasks:**
(a) Translate between matrix equations, vector equations, and augmented matrices.
(b) Solve a matrix equation.
(c) Interpret solution sets to a matrix equation based on theorem 4.

5. Section 1-5, pages 50-56

**Terms:** Homogeneous System of Equations, Trivial Solution, Non-Trivial Solution, Parametric Vector Form

**Tasks:**
(a) Express solutions to a matrix/vector equation in parametric vector form.
(b) Find non-trivial solutions to homogeneous equations (if they exist).
(c) Find solutions to the matrix equation based on homogeneous solutions.
6. Section 1-7, pages 65-72

**Terms:** Linear Independence, Linear Dependence

**Tasks:**
(a) Determine if sets of vectors are linearly dependent.
(b) Relate linear (in)dependence to the span of a set of vectors.
(c) Relate linear (in)dependence of the columns of a matrix $A$ to solutions of $A\vec{x} = \vec{b}$.

7. Section 1-8, pages 73-81

**Terms:** Matrix Transformation, Domain, Co-domain, Range, Image of a Vector, Linear Transformation

**Tasks:**
(a) Determine if a given transformation is linear.
(b) Compute the image of a vector $\vec{x}$ given a transformation $T(\vec{x}) = A\vec{x}$.
(c) Find the range of a linear transformation given by $T(\vec{x}) = A\vec{x}$.
(d) Use properties of linearity to compute images of linear combinations.

8. Section 1-9, pages 82-91

**Terms:** Standard Matrix of a Linear Transformation, Onto, One-to-One

**Tasks:**
(a) Find the standard matrix of a given linear transformation.
(b) Find the matrix of a 2 dimensional geometric transformation.
(c) Interpret one-to-one/onto in terms of the matrix equation $A\vec{x} = \vec{b}$ (Thm 12).