Midterm 01 Conceptual Review

Exam details

Length	5-6 problems, many of which may have multiple parts.
Material	§1.1, §1.2, §1.3 and §2.1, §2.2, §2.3, §2.4 (only material covered in Week 07).
Aids	One standard-sized (3×5 inch) notecard is allowed, but <u>no calculators are allowed</u>.

<u>Note</u>: Sample problems appear in **blue**.

1. Systems of linear equations

(1) What is the definition of a linear equation? Do you know examples of equations that are not linear?

(2) What is a *solution* to a linear system? What is the trichotomy that describes the solutions to systems of linear equations? **§1.1: 1**

(3) What is the augmented matrix associated to a system of linear equations? **§1.1: 7, 8**

(4) What are the standard row operations?

(5) What is the definition of row echelon form (REF)? Of reduced row echelon form (RREF)? What is the difference between these two definitions? **§1.2: 1, 2**

(6) What is a leading variable? A free variable? How do they help you solve linear systems?

(7) Can you solve linear systems? **§1.2: 3, 5, 12**,

(8) Can you solve system of equations that involve unknown constants? In examples, can you tell when a system that involves unknown constants has a unique solution, no solution, or infinitely many solutions? **§1.1: 12 §1.2: 9 §1.3: 2**

(9) What does the term *linear combination* mean? Given a collection of vectors, all of the same size, how would you go about checking if some given vector is a linear combination of the vectors in your collection? **§1.3: 3, 4**

(10) What is the definition of a homogeneous system of linear equations? What is the dichotomy that describes the solution to a system of linear equations? In this context, what does the terminology *trivial solution* refer to? **§1.3: 1**

(11) Can you solve homogeneous systems of equations? What is a *basic solution* to a homogeneous system? What does it have to do with leading and free variables? **§1.3: 5**

2. Matrix Algebra

(1) When can you add and subtract matrices?
(2) What are the basic properties of scalar multiplication for matrices, matrix addition, subtraction, and transposition? Can you solve matrix equations involving these basic operations? **§2.1: 1, 3, 4, 15**
(3) What is the definition of multiplying an $m \times n$ matrix by a column vector?What does it have to do with linear combinations?
(4) Can you compute $A\mathbf{x}$ when A is a matrix and $\mathbf{x}$ is a column vector of the appropriate size?
(5) What basic properties hold for the operation $A\mathbf{x}$? How does it behave with respect to scalar multiplication? What are the distributive properties here? Can you use these to simplify expressions? **§2.2: 3, 4**
(6) Given a system of linear equations, can you rewrite it in the form $A\mathbf{x} = \mathbf{b}$? **§2.2: 2**
(7) What is the definition of matrix multiplication? When can you multiply two matrices? **§2.3: 1, 2, 3**
(8) What is the dot product of a row and column? What does this have to do with matrix multiplication?
(9) What is the identity matrix? What properties does it satisfy?
(10) What are the basic properties of matrix multiplication? Can you use these to simplify expressions? **§2.3: 4, 16**

3. Inverses

Note: These topics will be covered during Week 07
(1) What is the definition of the inverse of a matrix? How do you verify that matrices are inverses of each other?
2.4: 1, 28abd, 9h
(2) How do you calculate the inverse of a square matrix? **2.4: 2, 16, 17**