
**Note:** The final exam will also cover topics from Midterm 1 and 2

3.3 Use Cramer’s Rule to solve
\[
\begin{bmatrix}
2 & 1 \\
3 & 4 \\
\end{bmatrix}
\begin{bmatrix}
x \\
\end{bmatrix} =
\begin{bmatrix}
5 \\
6 \\
\end{bmatrix}.
\]

3.3 Find the area of the parallelogram with vertices (-2,1), (0,4), (1,3), (-1,0).

5.1-5.2 Find the eigenvalues and corresponding eigenvectors for
\[
A =
\begin{bmatrix}
3 & 0 & 0 \\
0 & 7 & 4 \\
0 & 3 & 3 \\
\end{bmatrix}.
\]

5.3 Diagonalize \( A = \begin{bmatrix} 1 & 1 \\ 2 & 0 \end{bmatrix} \) if possible.

6.1-6.2 Let \( y = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} \) and \( u = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix} \). Compute the distance from \( y \) to the line through \( u \) and the origin.

6.3 \( y = \begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix} \), \( u_1 = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \), and \( u_2 = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \). Write \( y \) as a sum of a vector in \( W = \text{span}\{u_1, u_2\} \) and a vector orthogonal to \( W \).

6.5 Find the least squares solution of
\[
\begin{bmatrix}
1 & -2 \\
-1 & 2 \\
0 & 3 \\
2 & 5 \\
\end{bmatrix}
\begin{bmatrix}
x \\
\end{bmatrix} =
\begin{bmatrix}
3 \\
1 \\
-4 \\
2 \\
\end{bmatrix}.
\]

6.6 Find the equation \( y = \beta_0 + \beta_1x \) of the least squares line that best fits the data (0,1), (1,1), (2,2), (3,2).
Math 20F Winter 2016 UCSD Final Exam list of sections / topics:
(The Final Exam is Monday, March 14 from 3-6pm.)

1.1: Systems of Linear Equations
1.2: Row Reduction and Echelon Forms (and pivots)
1.3: Vector Equations (and linear combination, and span)
1.4: The Matrix Equation $Ax = b$
1.5: Solution Sets of Linear Systems (parametric vector form solution)
1.7: Linear Independence (and dependence)
1.8: Introduction to Linear Transformations (and domain, codomain, and range)
1.9: The Matrix of a Linear Transformation (and one-to-one, and unto)
2.1: Matrix Operations
2.2: The Inverse of a Matrix
2.3: Characterizations of Invertible Matrices (invertible matrix theorem)
3.1: Introduction to Determinants (and cofactor expansion)
3.2: Properties of Determinants (and row reduction determinant calculation)
3.3: Cramer’s Rule, Volume, and Linear Transformations
4.1: Vector Spaces and Subspaces (and 10 axioms)
4.2: Null Spaces, Column Spaces, and Linear Transformation
4.3: Linearly Independent Sets; Bases
4.4: Coordinate Systems (coordinate of x relative to basis B)
4.5: The Dimension of a Vector Space
4.6: Rank
4.7: Change of Basis (change of coordinate matrix from B to C)
5.1: Eigenvectors and Eigenvalues
5.2: The Characteristic Equation
5.3: Diagonalization
6.1: Inner Product, Length, and Orthogonality
6.2: Orthogonal Sets
6.3: Orthogonal Projections
6.5: Least-Squares Problems (normal equations)
6.6: Applications to Linear Models (least squares line)