

Math 21C Midterm 2 Study List

12.1 3D Coordinate Systems

- With equations describe regions in space
- Distance between points
- Equation for a sphere

12.2 Vectors

- Definition: Vector
- Compute a vector from 2 points
- Compute length of vector and direction of vector (unit vector)
- Vector addition, subtraction, & multiplication by scalar (Know geometric pictures)
- Definition: Midpoint between points

12.3 Dot Product

- Definition: Dot Product
- Compute angle between vectors using dot product (You need to know $\cos\theta$ for angles: 0, 30, 45, 60, & 90 degrees)
- Definition: Vectors being perpendicular
- Properties of the dot product
- Definition: Vector projection and orthogonal vector
- Computing projection and orthogonal decomposition
- Computing work done

12.4 Cross Product

- Definition: Cross Product
- Definition: Parallel vectors
- Properties of cross product
- Computing area of parallelogram using cross product
- Definition: Triple scalar product
- Computing volume of parallelepiped using triple scalar product

12.5 Lines and Planes in Space

- Definition: Parametric, symmetric, and vector equation for a line
- Find equation of a line, point on a line, or vector parallel to the line
- Compute distance from point to a line
- Definition: Equation for a plane
- Find equation of plane, point on plane, or normal to the plane
- Compute distance from point to plane

14.1 Functions of Several Variables

- Definition: Domain and Range
- Find the domain and range of a function

14.2 Limits and Continuity in Higher Dimensions

- Definition: Limit
- Properties of limits
- Taking limits of 2D functions including limits of quotients
- Definition: Continuity
- Using two path test to show limit does not exist

14.3 Partial Derivatives

- Definition: Partial Derivative with respect to x or y
- Finding 1st order partial derivatives
- Finding 2nd order partial derivatives
- Mixed Derivative Theorem

14.4 Chain Rule

- Chain rule tree and formula for 2 intermediate & 1 independent variables, 3 intermediate & 1 independent variables, and 3 intermediate & 2 independent variables
- Using chain rule in above cases
- Using formula for implicit differentiation

14.5 Directional Derivatives and Gradient Vectors

- Definition: Directional derivative of function in a direction of a unit vector
- Definition: Gradient vector
- Compute gradient vector
- Compute directional derivative using formula with the gradient vector
- Properties of directional derivative

Notes:

- Any definition listed can be asked on the test.
- Any formula used in any computation above can be asked on the test.
- I am going to ask you to prove one of the following formulas: area of parallelogram, volume of parallelepiped, distance from point to line, or distance from point to plane.

