Math 21D Final Study List

15.2 Double Integrals over General Regions

- Finding limits of integration using vertical and horizontal cross-sections
- Setting up and computing double integrals using rectangular coordinates

15.3 Area by Double Integration

- Definition: Area
- Computing area using double integrals
- Computing average value using double integrals
- Computing mass, 1st moments, center of mass, centroid, or moment of inertia for double integrals in rectangular

15.4 Double Integrals in Polar Form

- Setting up and computing double integrals using polar coordinates
- Converting integral from rectangular to polar coordinates (and vice-versa)

15.5 Triple Integrals in Rectangular Coordinates

- Definition: Volume
- Setting up and computing triple integrals using rectangular coordinates

15.6 Moments and Centers of Mass

- Computing mass, 1st moments, center of mass, centroid, or moment of inertia for triple integrals in rectangular coordinates

15.7 Triple Integrals in Cylindrical and Spherical Coordinates

- Setting up and computing triple integrals using cylindrical coordinates
- Setting up and computing triple integrals using spherical coordinates
- Converting triple integral from rectangular to cylindrical/spherical coordinates (and vice-versa)

15.8 Substitutions in Multiple Integrals

- Definition: Jacobian in 2D/3D
- Computing Jacobians and magnification
- Finding image of points, curves, and/or regions in 2D using map F(u,v)
- Computing area using Jacobian
- Finding G(x,y) the inverse map of F(u,v)

13.1 Curves in Space and Their Tangents

- Graphing curves in 2D/3D
- Definition: Position vector function
- Definition: Velocity vector function
- Definition: Acceleration vector function
- Definition: Speed
- Building position vector function
- Computing velocity and acceleration vector functions, along with speed
- Differentiation Rules for Vector Functions Pg 730
- Proof: Dot Product Rule Pg 730
- Proof: Chain Rule Pg 730

13.3 Arc Length in Space

- Definition: Arc Length
- Definition: Unit Tangent Vector
- Computing arc length from t=a to t=b
- Computing arc length s(t), as a function of t
- Computing unit tangent vector

13.4 Curvature and Normal Vectors of a Curves

- Definition: Unit Normal Vector
- Definition: Curvature
- Computing unit normal vector
- Computing curvature
- Computing radius of curvature
- Proof: Circle or radius a has curvature of 1/a

16.1 Line Integrals

- Computing mass, 1^{st} moments, center of mass, centroid, or moment of inertia for line integrals
- Computing line integrals

16.2 Vector Fields and Line Integrals: Work, Circulation, and Flux

- Definition: Vector fields in 2D/3D
- Definition: Gradient fields in 2D/3D
- Definition: Work
- Definition: Flow
- Definition: Flux
- Computing work
- Computing flow
- Computing flux

16.3 Path Independence, Conservative Fields, and Potential Functions

- Definition: Path Independence
- Definition: Conservative Field
- Definition: Potential Function
- Theorem: Fundamental Theorem of Line Integrals
- Proof: Fundamental Theorem of Line Integrals
- Computing potential function from conservative field (i.e. find scalar function from gradient field)
- Determine whether vector field is conservative
- Using Fundamental Theorem of Line Integrals to compute a line integral

16.4 Green's Theorem in the Plane

- Definition: Divergence (2D)
- Definition: k-component of the curl
- Theorem: Green's Theorem 1 (Flux-Divergence)
- Theorem: Green's Theorem 2 (Circulation-Curl)
- Theorem: Green's Theorem 3 (2 Curves)
- Computing divergence
- Computing k-component of the curl
- Verifying any Green's Theorem (1-3)
- Finding area using a line integral
- Using Green's Theorem (1-3) to evaluate a line integral
- Using Green's Theorem 1 to find flux along a curve

16.5 Surfaces and Area

- Definition: Area of a parameterized surface
- Building a parameterized surface
- Computing area of a parameterized surface
- Computing area of an implicit surface
- Computing area of an explicit surface

16.6 Surface integrals

- Computing mass, 1^{st} moments, center of mass, centroid, or moment of inertia for surface integrals
- Computing surface integrals for parameterized, implicit, and explicit surfaces
- Definition: Flux
- Computing flux across a surface integral

16.7 Stokes' Theorem

- Definition: Curl

- Theorem: Stokes' Theorem
- Computing Curl
- Verifying Stokes' Theorem
- Using Stokes' Theorem to evaluate a surface integral
- Using Stokes' Theorem to evaluate a line integral

16.8 Divergence Theorem

- Definition: Divergence (3D)
- Theorem: Divergence Theorem
- Computing Curl
- Verifying Divergence Theorem
- Using Divergence Theorem to evaluate a surface integral
- Using Divergence Theorem to evaluate a triple integral

Notes:

- The test in cumulative. It will approximately focus 50% on exam 1 and 2 material, and 50% on material after exam 2.
- Any definition listed can be asked on the test.
- Any formula used in any computation above can be asked on the test, except formulas for mass, 1^{st} moments, center of mass, centroid, or moment of inertia (These will be provided)