Summer 2019 Math 225 Topics covered for Exam 2

Section 17.4 Flow of a vector field Know:

- ➢ Definition of a flow line and how to verify is a given parametric curve is a flow line of a given vector field.
- ➢ How to find flow lines for a given simple vector field (for example for a field with one component constant).

Section 18.1 The idea of a line integral Know:

- ➢ The definition of a line integral
- ➢ How to estimate and compare line integrals for a given vector field and given curves without calculating them
- ➢ Two important applications of line integrals: work and circulation
- ➢ Properties of line integrals

Section 18.2 Computing line integrals over parameterized curves Know:

- ➢ How to parameterize familiar curves (circles, lines, helices, ...)
- ➢ How to compute line integrals over parameterized curve
- ➢ The differential notation for line integrals

Section 18.3 Gradient fields and path-independent fields Know:

- ➢ Fundamental Theorem of Calculus for line integrals
- ➢ How to calculate line integrals for gradient fields
- ➢ That a continuous vector field $\mathbf{F}$ defined on an open region R is path-independent if and only if there exists f such that $\mathbf{F} = \operatorname{grad} f$.

Section 18.4 Path independent vector fields and Green's theorem Know:

- ➢ Green's theorem
- ➢ How to use Green's theorem to calculate line integrals over simple piecewise closed curves
- ➢ The curl test for vector fields in 2-space
- ➢ The curl test for vector fields in 3-space

Section 19.1 The idea of a flux integral Know:

- ➢ How to calculate flux of a constant vector field through a flat surface (the idea of the area vector)
- ➢ The definition of a flux integral
- ➢ How to determine if the flux of a given vector field through a given oriented surface is positive, negative or zero (without calculating it)
- ➢ How to compare two flux of given vector fields through given oriented surfaces (without calculating them)

Section 19.2 Know:

- ➢ How to calculate flux of a given vector field $\mathbf{F}(x, y, z)$ through a surface S given as the graph of $z = f(x, y)$ where $(x, y) \in D$:

$$\iint_S \mathbf{F} \cdot d\mathbf{A} = \iint_D \mathbf{F}\big(x, y, f(x, y)\big) \cdot \big(-f_x\mathbf{i} - f_y\mathbf{j} + \mathbf{k}\big)dx\,dy$$