Math 341. Midterm 1. NOT a review sheet.

Maxima and Minima in Several Variables (Colley Chapter 4)

4.1: The most important thing is formula (10) on page 241.

Also, differentials (such as Problem 29)

4.2: Know how to find critical points (that is, $Df(\mathbf{a}) = \mathbf{0}$) and the second derivative test for local extrema (the chart on page 250; you can also use eigenvalues instead of the sequence of principal minors).

4.3: Lagrange multipliers for the case of one contraint (not multiple constraints)

Differential Equations

I. First-Order Differential Equations (Braun Chapter 1)

Organize for yourself all the different kinds of differential equations that we have been able to solve. Be able to find general solutions as well as solve initial-value problems.

- $\frac{dy}{dt} = f(t)$ (Section 1.1)
- $\frac{dy}{dt} + a(t)y = 0$ (Section 1.2)
- $\frac{dy}{dt} + a(t)y = b(t)$ (Section 1.2)
- $\frac{dy}{dt} = \frac{g(t)}{f(y)}$ (Section 1.4)
- $M(t,y) + N(t,y)\frac{dy}{dt} = 0$, where $M_y = N_t$ or $\frac{M_y - N_t}{N}$ is a function of t alone. (Section 1.9)

Also know:

- Orthogonal trajectories
- population models–you don't need to memorize the formulas, but be familiar with the equations and their solutions
- Existence and Uniqueness: Know the thoerems and how to use them, as in the exercises

II. Chapter 2

2.1: The exercises are good examples of what is on the test (konw the Wronskian, the meaning and importance of linear indepence)

2.2: Be able to find the general solution to

$$a\frac{d^2y}{dt^2} + b\frac{dy}{dt} + cy = 0,$$

and be able to solve the IVP

$$a\frac{d^2y}{dt^2} + b\frac{dy}{dt} + cy = 0, \;\; y(t_0) = y_0, y'(t_0) = y'(t_0).$$