Fall 2013 Math 3 Final review (Draft)

Pre-calc

- Basic functions and basic graphs
  - lines (esp. point slope form)
  - polynomials, rational functions,
  - trigonometric functions
    - unit circle, special values, identities (even/odd, Pythagorean, angle addition)
  - exponentials, logarithms
- Transformations (and using them to sketch)
- Inverse functions (definition and graphing them)
- Domain/range
- **Limits**
  - Calculating basic limits, properties of limits
  - Limits at infinity (esp. rational functions, e^x)
  - Asymptotes (vertical and horizontal)
  - Continuity (definition, removable discontinuities, continuous extensions)

Differentiation

The basics

- Estimates: Average change, Mean Value Theorem
- Limit definition of a derivative
  - Instantaneous rate of change
  - Calculating derivatives using limits
- Properties of derivatives
- Derivatives of basic functions
- Derivative rules (scaling, sum, chain, product, quotient)
- Higher order derivatives (how, what they mean, notation)

Implicit differentiation

- Definition and how
- Derivatives of inverse functions
  - How to simplify things like tan(arcsin(x))
- Related rates

Tangent lines and approximations

- Formula for tangent line
- Linearization
  - Higher order: Taylor polynomials
- Newton's method for roots
  - Rolle's Theorem
- Euler's method (see differential equations)

Meanings of derivatives

- Physics: position, velocity, acceleration
- **Graphing**
  - Critical points and intervals of increase/decrease
  - Concavity and inflection points
  - First and second derivative tests for finding local maxima and minima
  - Optimization problems

Integration

Antiderivatives

- Meaning
- Scaling and sum rule
- Substitution
- Partial fractions (integrating things like 1/(y(y-2)))

Definite integrals

Estimates

- Rectangles
  - Upper (circumscribed, over-estimate, use max of f over each interval)
  - Lower (inscribed, under-estimate, use min of f over each interval)
  - Left, Right, Mid
  - Summation notation
  - Limit definition of the definite integral
- Trapezoids
- Simpson's rule
- Error

Properties of the definite integral

- Symmetries (even and odd functions)
- Reversing endpoints
- Area versus signed area

Fundamental theorem of calculus

- I: Evaluating definite integrals using antiderivatives
- II: Function endpoints and derivatives

Applications

- Average value
- Mean Value Theorem for integrals
- Arc length
- Area between curves
  - flipping inverse functions

Differential equations

- Initial value problems
  - General solution
  - Particular solution
- Separable equations
- Checking solutions to differential equations
- Word problems
  - Growth and decay problems
  - Newton's law of cooling
  - Logistic growth
- Slope fields
- Euler's Method