APEX Calculus

1. Limits

    (a) Graphical and Numerical Explorations

    (b) δ-ϵ Proofs

    (c) Finding Limits Analytically Subtitle: Using known limits to find unknown limits. Contains several "big" theorems.

    (d) One Sided Limits and Continuity

    (e) Limits Involving Infinity

2. Derivatives

    (a) Introduction Speed during free fall at a particular time; relate this to tangent line problems.

    (b) Basic Differentiation Rules Power ($n > 0$), trig, log, exponential.
        Average rate of change $\rightarrow$ inst. rate of change
        ?? Numerical derivative approximations? (I think above.)
        Higher order derivatives

    (c) Product and Quotient Rules Define rest of the trig functions

    (d) Chain Rule $f(x) = a^x$

    (e) Implicit Differentiation

    (f) Derivatives of Inverse Functions Especially inverse trig functions

3. Graphical Behavior of Functions

    (a) Extreme Value Thm (including definition of critical numbers, etc.)

    (b) Mean Value Theorem (usually includes Rolle's Thm)

    (c) 1st Deriv. Test (intervals of incr/decr)

    (d) 2nd Deriv Test (concavity explained, etc.)

    (e) Curve Sketching (recall we've already talked about limits at infinity, asymptotes, etc.)

4. Application of Derivatives

    (a) Newton's Method (?) This one is good, but not critical to me at the moment

    (b) Related Rates

    (c) Optimization (hopefully with not too trivial examples)

    (d) Differentials (with an eye towards both approximation and a lead-in to integration)

5. Fundamental Theorem of Calculus: Integration

    (a) Antiderivatives

    (b) Finite/Riemann Sums – Area Approximations (summation notation, etc.) Left/Right hand sums

    (c) Riemann Sums and Definite Integrals

    (d) Fundamental Theorem of Calculus

    (e) Numerical Integration

6. Integration Techniques

    (a) Integration by Substitution

        i. Integrals Involving Logarithms
        ii. Integrals Involving Inverse Trigonometric Functions

    (b) Integration by Parts

    (c) Integrals Involving Trigonometric Functions

    (d) Integrals Involving Partial Fraction Decomposition