

## Calculus 2 (Math 120, Math 128\*) Common Topics List<sup>1</sup>

### 1. Integration

- (a) antiderivatives
- (b) Riemann Sums
  - i. definition of definite integral
  - ii. area problem
- (c) Numerical Integration
  - i. left, right, midpoint
  - ii. over estimation or under estimation
- (d) Fundamental Theorem of Calculus
- (e) Techniques of Integration
  - i.  $u$ -substitution
  - ii. integration by parts
- (f) Applications
  - i. area between curves
  - ii. specific problems that lead to an integral via Riemann sums (e.g. work, average of a function, ...)
- (g) Improper Integrals\*
- (h) L'Hopital's Rule\*

### 2. Sequences and Series\*

- (a) sequences
  - i. definition/idea
  - ii. convergence/limit
- (b) Special Series
  - i. geometric
  - ii. harmonic
  - iii. alternating
  - iv.  $p$ -series

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<sup>1</sup>This list was drafted at the 9/14/09 Math Departmental meeting and approved at the 9/28/09 meeting. Items marked with an asterisk will be taught in Math 128. This excludes most aspects of Integration except those that involve infinity.

- (c) Series Convergence Tests
  - i. integral
  - ii.  $p$ -series
  - iii. alternating series
  - iv. comparison **or** limit comparison
  - v. ratio **or** root

### 3. Taylor Polynomials\*

- (a) an application of Taylor Polynomials (e.g. approximate a definite integral, a limit)

### 4. Taylor Series\*

- (a) Taylor series usually converge to the original function (note the counterexample:  
 $f(x) = e^{-\frac{1}{x^2}}$  for  $x \neq 0$ ,  $f(x) = 0$  for  $x = 0$ ).
- (b) power series define (possibly non-elementary) functions
- (c) know the Taylor series for  $e^x$ ,  $\frac{1}{1-x}$ ,  $\sin x$ ,  $\cos x$

### 5. Power Series\*

- (a) operations on series (differentiation, integration, ...)
- (b) radius and interval of convergence

## Examples of Additional Topics

- More numerical techniques of integration: trapezoidal rule, Simpson's rule
- Fourier Series
- Laplace Transforms
- Optimization of 2-D functions