Final Exam Material and Expectations

For the final exam, you should be able to do the following things:

Chapter 3.

- Do all the basic integrals expected of you in Calc I, including ones with u-substitution
- Use Integration By Parts to successfully integrate functions
- Use Partial Fraction Decomposition to successfully integrate functions
- Use trig identities to successfully integrate functions involving trig ratios
- Use Trigonometric Substitution to successfully integrate functions
- Diagnose an integral to select which method of integration to use
- Compute improper integrals by rewriting them as limits
- Approximate values of definite integrals using Midpoint Rule, Trapezoid Rule, or Simpson's Rule

Chapters 2 & 4.

- Write (and compute) an integral representing the arc length of a curve
- Write (and compute) an integral representing the surface area of a solid of revolution about either x-axis or y-axis
- Solve separable differential equations and/or initial value problems

Chapter 5.

- Determine convergence or divergence of a sequence
- Given a convergent recursively defined sequence, compute the limit
- Identify a geometric series and determine its convergence
- Identify a p-series and determine its convergence
- Use the Divergence Test to successfully identify divergent series (but realize that it does not work for all divergent series, and never tells us anything about convergent series)
- Use the Integral Test to successfully determine convergence of series
- Use the Comparison Test to successfully determine convergence of series
- Use the Limit Comparison Test to successfully determine convergence of series
- Use the Ratio Test to successfully determine convergence of series
- Use the Root Test to successfully determine convergence of series
- Use the Alternating Series Test to successfully determine convergence of alternating series
- Use tests to determine absolute convergence or conditional convergence of alternating series
- Diagnose a series to select a convergence test to use

Chapter 6.

- Find the radius of convergence and interval of convergence of a power series
- Use algebra and calculus manipulations of the geometric series to express different functions as power series
- Write the Taylor series of a function centered at a
- Determine the radius of convergence of a Taylor series of a function
- Write Taylor polynomials centered at a for a function

Chapter 7.

- Understand a curve expressed by parametric equations
- Understand polar curves as parametrizations
- Compute tangent lines to parametric curves
- Write (and compute) an integral representing the area under a parametric curve
- Write (and compute) an integral representing the arc length of a parametric curve
- Write (and compute) an integral representing the surface area of a solid resulting when a parametric curve is revolved about an axis
- Compute tangent lines to polar curves
- Write (and compute) an integral representing the area bounded by a polar curve
- Write (and compute) an integral representing the arc length of a polar curve
- Given a polar equation defining a conic section, find the eccentricity of the conic
- Use the eccentricity of a conic section to classify what type of conic it is

Derivatives and Integrals To Know.

- You should definitely still have the following memorized:
  (i) $\frac{d}{dx}(x^n) = nx^{n-1}$ $\quad\int x^n \; dx = \frac{x^{n+1}}{n+1} + C$
  (ii) $\frac{d}{dx}(\sin(x)) = \cos(x)$ $\quad\int \cos(x) \; dx = \sin(x) + C$
  (iii) $\frac{d}{dx}(\cos(x)) = -\sin(x)$ $\quad\int \sin(x) \; dx = -\cos(x) + C$
  (iv) $\frac{d}{dx}(e^x) = e^x$ $\quad\int e^x \; dx = e^x + C$
  (v) $\frac{d}{dx}(\ln(x)) = \frac{1}{x}$ $\quad\int \frac{1}{x} \; dx = \ln(|x|) + C$
  (vi) $\frac{d}{dx}\left(\tan^{-1}(x)\right) = \frac{1}{1+x^2}$ $\quad\int \frac{1}{1+x^2} \; dx = \tan^{-1}(x) + C$
- Additionally, you should know:
  – $\frac{d}{dx}(\tan(x)) = \sec^2(x)$ $\quad\frac{d}{dx}(\sec(x)) = \sec(x)\tan(x)$
- Finally, you may want to either memorize or remember the process of finding the integrals of the following functions:
  $\tan(x)$, $\sec(x)$, b^x, $\log_b(x)$.