Final Exam Material and Expectations

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

Chapter 6.
- Use l'Hôpital's Rule to evaluate limits of indeterminate forms, including
  - $\dfrac{0}{0}$ form
  - $\dfrac{\infty}{\infty}$ form
  - $0 \cdot \infty$ form
  - 0^0 form
  - ∞^0 form
  - 1^∞ form

Chapter 7.
- 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

Chapter 8.
- 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
- Write (and compute) integrals that give the center of mass of a two-dimensional shape bounded by functions

Chapter 10.
- 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

Chapter 11.

- 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 Test for Divergence to successfully identify divergent series (but, 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
- 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 a polynomial that estimates a function, and use the error formula in Taylor's inequality to determine the error in the estimation

Derivatives and Integrals To Know.

- You should definitely still have the following memorized:

  (i) $\dfrac{d}{dx}\left(x^n\right) = nx^{n-1}$ $\qquad\qquad$ $\displaystyle\int x^n\ dx = \dfrac{x^{n+1}}{n+1} + C$

  (ii) $\dfrac{d}{dx}\left(\sin(x)\right) = \cos(x)$ $\qquad\qquad$ $\displaystyle\int \cos(x)\ dx = \sin(x) + C$

  (iii) $\dfrac{d}{dx}\left(\cos(x)\right) = -\sin(x)$ $\qquad\qquad$ $\displaystyle\int \sin(x)\ dx = -\cos(x) + C$

  (iv) $\dfrac{d}{dx}\left(e^x\right) = e^x$ $\qquad\qquad$ $\displaystyle\int e^x\ dx = e^x + C$

  (v) $\dfrac{d}{dx}\left(\ln(x)\right) = \dfrac{1}{x}$ $\qquad\qquad$ $\displaystyle\int \dfrac{1}{x}\ dx = \ln(|x|) + C$

  (vi) $\dfrac{d}{dx}\left(\tan^{-1}(x)\right) = \dfrac{1}{1+x^2}$ $\qquad\qquad$ $\displaystyle\int \dfrac{1}{1+x^2}\ dx = \tan^{-1}(x) + C$

- Additionally, you should know:

  $\quad - \dfrac{d}{dx}\left(\tan(x)\right) = \sec^2(x)$ $\qquad\qquad$ $\dfrac{d}{dx}\left(\sec(x)\right) = \sec(x)\tan(x)$

- Finally, you may want to either memorize or remember the process of finding the integrals of the following functions:

  $\tan(x),\ \sec(x),\ b^x,\ \log_b(x).$