You are responsible for all material covered in class, on the homework, and on all quizzes. One question on the midterm may come from a written quiz, so study those. Below is a study guide.

L'Hopital's Rule

- Know how to apply L'Hopitals rule in normal and in indeterminate forms.
- Examples: Be able to do the following problems:
  1. $\lim_{x\to 0} \frac{\sin(x)}{x}$.
  2. $\lim_{x\to\infty} x\sin\left(\frac{1}{x}\right)$.
  3. $\lim_{x\to\infty} (x - \sqrt{x^2-3x})$.
  4. $\lim_{x\to 0} x^x$.
  5. $\lim_{x\to\infty} \left(1+\frac{a}{x}\right)^x$ for a constant a.

Sequences

- Know the definition of a sequence.
- Know what it means for a sequence to converge.
- Know how to use functions to show the convergence of a sequence (p. 607).
- Know the properties of limits (p. 607).
- Know the definitions for increasing, decreasing, strictly increasing, strictly decreasing, monotonic and bounded sequences.
- Know what a geometric sequence is and when it converges/diverges.
- Know the statement of the squeeze theorem.
- Know that bounded monotonic sequences converge.
- Review problems from Section 8.2.

Series

- Know the definition of an infinite series.
- Know what the sequence of partial sums for a series is.
- Know what it means for an infinite series to converge.
- Know what a geometric series is and when it converges/diverges.
- Know how to use the geometric series to change a repeating decimal into a fraction (see Example 2 on p. 622).
- Know what a p-series is and for what value of p it converges.
- Know what an alternating series is and under what conditions it converges.
- Know how to handle telescoping series, for example:
  1. $\sum_{k=1} \left(\frac{1}{3^k} - \frac{1}{3^{k+1}}\right)$,
  2. $\sum_{k=1} \ln\left(\frac{k+1}{k+3}\right)$.
- Know properties of convergent series (p. 636).
- Know the statement of and how to apply the divergence test.
- Know the statement of and how to apply the ratio test.
- Know the statement of and how to apply the root test.
- Know the statement of and how to apply the comparison and limit comparison test.
- We wont give a list of problems to practice, Chapter 8 is full of excellent examples (try the odd version of the assigned homework problems).

Linear Approximation

- Know how to find the linear approximation of a function at a point.
- Know under what conditions a linear approximation is a "good" approximation for a function.
- For example, use linear approximations to estimate the values of:
  1. $\sqrt{1.003}$
  2. $\tan^{-1}(1.001)$

Newton's Method

- Know what the sequence of Newton iterations is for a given function (See Section 4.8, particularly Figure 4.86).

- Know how the method is derived using linear approximations.
- Be able to explain with the use of a graph, whether using a given starting guess will lead to a convergent or divergent sequence.

Taylor polynomials/series

- Know the definition of and how to compute an n-th degree Taylor polynomial (p. 664).
- Look over example 2 on p. 664.
- Know how to find bounds for the error terms of Taylor polynomials (p. 668-669).
- Look over problems in Section 9.1.
- Examples: Give the Taylor polynomials for the following.
  1. $f(x) = e^x$ centered at 0 of degree n.
  2. $f(x) = \ln(x)$ centered at 1 of degree n.
  3. $f(x) = \sin(x)$ centered at π of degree 5 and of degree 6.