Math 1432 Spring 2018: Exam 3 Review
Professor William Ott

Exam 3 will cover the material in Sections 11.1–11.10 of *Calculus: Early Transcendentals* (Edition 8E) by James Stewart. Possible exercise types include true/false questions, statements of definitions and major results, computational exercises, and exercises requiring theoretical arguments. At least one of the exercises from Section 8 and at least one of the theoretical arguments in Section 7 will appear on Exam 3.

1. Definitions (background)

You should be able to define and use the following.

(1) Antiderivative
(2) Riemann sums, Riemann definite integral
(3) Indefinite integral

2. Definitions (specific)

You should be able to define and use the following.

(1) Sequences
- Limit of a sequence
- Convergent sequence, divergent sequence
- Increasing sequence, decreasing sequence, monotonic sequence
- Bounded above, bounded below
- Recursively defined sequence

(2) Series
- Sequence of partial sums
- Convergent series, divergent series
- Geometric series
- Harmonic series, p-series
- Alternating series

(3) Absolute convergence of a series, conditional convergence of a series
(4) Power series
- Radius of convergence, interval of convergence

(5) Taylor series, Maclaurin series
(6) Taylor polynomial $T_M(x)$

3. Computational techniques (background)

(1) Compute two-sided limits and one-sided limits
(2) Compute limits at infinity
(3) Compute derivatives using the differentiation rules (power rule, sum rule, difference rule, constant multiple rule, product rule, quotient rule, chain rule)
(4) Differentiation of exponential functions, logarithms, trigonometric functions, and inverse trigonometric functions
(5) Integration techniques
- Integrands with easily recognizable antiderivatives
- Substitution
- Integration by parts
- Trigonometric integrals (involving sine, cosine, tangent, and secant)
- Trigonometric substitution (involving sine, cosine, tangent, and secant)
- Integration of rational functions by partial fraction decomposition (only consider the case of no repeated linear or quadratic factors)

(6) Compute improper integrals
- Integrals involving infinite limits of integration ($-\infty$, ∞, or both)
- Integrands with a discontinuity at the left or right limit of integration

4. Computational techniques (specific)

(1) Compute limits of sequences

(2) Show that a recursively defined sequence is bounded above and increasing. Find the limit of such a sequence.

(3) Testing series for convergence/divergence
- Test for divergence
- Integral test
- Comparison test, limit comparison test
- Alternating series test
- Ratio test
- Root test

(4) Compute the radius and interval of convergence of a power series

(5) Derive new power series from known power series using the techniques of Section 11.9. Similarly, derive new Taylor/Maclaurin series from known Taylor/Maclaurin series.

(6) Compute Taylor series/Maclaurin series using the definitions

(7) Use Taylor series/Maclaurin series to evaluate limits

5. Theoretical results (background)

You should know and be able to apply the following.

(1) Rolle's theorem, mean value theorem

(2) Properties of the Riemann integral (see pgs. 385–388)

(3) Fundamental theorem of calculus, parts I and II

6. Theoretical results (specific)

You should know and be able to apply the following.

(1) Monotonic sequence theorem (pg. 702)

(2) If the series $\sum_{n=1}^{\infty} a_n$ converges, then $\lim_{n\to\infty} a_n = 0$.

(3) Three possible behaviors of a power series (Theorem 4, pg. 749)

(4) Taylor's theorem (as stated in class)

7. Proofs/Derivations

(1) If a series $\sum_{i=1}^{\infty} a_n$ is absolutely convergent, then it is convergent.

(2) If the series $\sum_{n=1}^{\infty} a_n$ converges, then $\lim_{n\to\infty} a_n = 0$.

8. Suggested problems

Study Assignments 7–9. Focus on exercises that are not too computationally involved and that are at most moderately difficult.