Math 1431 Fall 2017: Exam 1 Review
Professor William Ott

Exam 1 will cover the material in Sections 2.2–2.3, 2.5–2.8, and 3.1–3.4 of *Calculus: Early Transcendentals* (Edition 8E) by James Stewart. Possible exercise types include true/false questions, statements of definitions, computational exercises, and exercises requiring theoretical arguments. At least one of the exercises from Section 5 and at least one of the theoretical arguments in Section 4 will appear on Exam 1.

1. Definitions

You should be able to define and use the following.

(1) Vertical asymptote
(2) Continuity of a function at a point, continuity of a function on an interval
(3) Removable discontinuity, jump discontinuity
(4) Horizontal asymptote
(5) Derivative of a function f at a point a, differentiable function on an interval

2. Computational techniques

(1) Compute two-sided limits and one-sided limits by inspection
(2) Find the vertical asymptotes of a function
(3) Comute limits using the limit laws
(4) Find limits using continuity
(5) Use the intermediate value theorem to show that a given continuous function has a root on a certain interval
(6) Compute limits at infinity
(7) Find the horizontal asymptotes of a function
(8) Compute the tangent line to a curve at a point on the curve
(9) Computation of derivatives using the limit definition
(10) Interpretation of the derivative as an instantaneous rate of change (If $s(t)$ gives position at time t, then $s'(t) = v(t)$ gives velocity at time t and $s''(t) = v'(t) = a(t)$ gives acceleration at time t.)
(11) Computation of higher derivatives
(12) Compute derivatives using the differentiation rules (power rule, sum rule, difference rule, constant multiple rule, product rule, quotient rule, chain rule)
(13) Differentiation of exponential functions, logarithms, and trigonometric functions

3. Theoretical results

You should know and be able to apply the following.

(1) $\lim_{x\to a} f(x) = L$ if and only if $\lim_{x\to a^+} = \lim_{x\to a^-} = L$. In other words, the overall limit exists if and only if the two one-sided limits exist and are equal. This result can be used to show that a given limit exists or that a given limit does not exist.
(2) Squeeze theorem
(3) Continuity laws (Theorem 4 in Section 2.5)
(4) Many common functions are continuous wherever defined (Theorem 7 in Section 2.5)
(5) Intermediate value theorem
(6) If f is differentiable at a, then f is continuous at a. The converse is false.

4. Proofs

(1) Prove that if f is differentiable at a, then f is continuous at a.

(2) Prove the product rule.

5. Suggested problems

3.1: 3–30 (every third), 35	**3.2:** 3–24 (every third), 33
3.3: 1–15 (odd), 18	**3.4:** 7–34 (every third), 50