Math 1431 Fall 2017: Exam 3 Review
Professor William Ott

Exam 3 will cover the material in Sections 4.9, 5.1–5.5, 6.1–6.3, and 7.1 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 5 and at least one of the theoretical arguments in Section 4 will appear on Exam 3.

1. Definitions/Models

You should be able to define and use the following.

(1) Derivative of a function f at a point a; differentiable function on an interval
(2) Antiderivative
(3) Riemann sums, Riemann definite integral
(4) Indefinite integral

2. Computational techniques

(1) Compute two-sided limits and one-sided limits
(2) Compute limits at infinity
(3) 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.)
(4) Compute derivatives using the differentiation rules (power rule, sum rule, difference rule, constant multiple rule, product rule, quotient rule, chain rule)
(5) Differentiation of exponential functions, logarithms, trigonometric functions, and inverse trigonometric functions
(6) Relate behavior of f' and f'' to behavior of f (increasing/decreasing test, concavity test)
(7) First derivative test and second derivative test for critical points
(8) Rectilinear motion (see Sections 4.9 and 5.4)
(9) Write a definite integral as a limit of Riemann sums
(10) Integrate by direct methods, substitution, and integration by parts
(11) Area between curves
(12) Volumes of solids of revolution by disks, washers, and shells

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) Rolle's theorem, mean value theorem
(4) Theorem 1, pg. 351
(5) Properties of the Riemann integral (see pgs. 385–388)
(6) Fundamental theorem of calculus, parts I and II
(7) Net change theorem
(8) Integrals of symmetric functions (see pg. 417)

4. Proofs

(1) Fundamental theorem of calculus, part II

(2) Substitution rule for definite integrals (pg. 416)

5. Suggested problems

Study Assignments 8–9. Focus on exercises that are not too computationally involved and that are at most moderately difficult.