Math 19 Midterm Topics
Fall 2016
Brown University
Samuel S. Watson

Note: you should have memorized the appendix (the last **two** pages of the course notes).

Separable differential equations. Be able to solve non-linear differential equations which separate, including initial value problems involving separable DEs.

Nonhomogeneous differential equations. Be able to solve linear constant-coefficient differential equations which are not homogeneous, using the method of undetermined coefficients.

Improper integrals. Be able to evaluate improper integrals by taking a limit as one bound goes to $-\infty$ or ∞, AND be able to recognize when an integrand does not converge at an endpoint of integration take an appropriate limit to evaluate the improper integral.

Convergence of sequences. Be able to identify whether a sequence converges, including using the bounded monotone sequence theorem

Geometric series. Be able to solve problems involving sums of geometric series. Know the formula "first term over one minus the common ratio" for the sum of an infinite geometric series with common ratio strictly between -1 and 1, and know that infinite geometric series converge if and only if the common ratio is strictly between -1 and 1.

Integral test. Be able to recognize infinite-sum convergence questions to which the integral test is applicable, apply the integral test. Be sure to explicitly address the "decreasing" assumption you have to use to apply this test (this might require taking a derivative and showing that it's negative), and recognize when it does not apply.

Comparison test. Be prepared to apply the comparison test to prove convergence or divergence of a series.

Ratio test. Be prepared to recognize that infinite sums involving factorials are amenable to the ratio test, and be able to apply the ratio test to demonstrate convergence or divergence.

Alternating series. Know and be able to apply the alternating series test, and be prepared to recognize when the test does not apply. Also, recognize both $(-1)^n$ and $\cos(n\pi)$ as "sign alternators" (i.e., expressions which evaluate to $+1, -1, +1, -1, \ldots$). Be able to apply the absolute convergence test and characterize a series as divergent, conditionally convergent, or absolutely convergent.

General series skills. Be ready to throw away the first several terms of a series if the test you need to use to demonstrate convergence or divergence does not apply to those terms. Practice applying the nth term test before subjecting a series to any of the more sophisticated tests above.

Taylor series. Be able to calculate Taylor series of a given function at a given point.