Math 274A Asymptotic Methods
Spring 2008.
Lectures: MWF 11:00 a.m.—11:50 p.m. 6201 MS
Instructor: Michael Hitrik

Mathematical Sciences 6901
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Recommended Literature:

P. D. Miller, *Applied Asymptotic Analysis*, Graduate Studies in Mathematics, 75. American Mathematical Society, Providence, RI, 2006.

A. Erdélyi, *Asymptotic expansions*, Dover Publications, Inc., New York, 1956.

M. V. Fedoryuk, *Asymptotic analysis*, Springer-Verlag, Berlin, 1993.

F. W. J. Olver, *Asymptotics and special functions*, Academic Press, New York–London, 1974.

Preliminary Syllabus:

Asymptotic sequences and series: general concepts. Asymptotic power series. Uniform asymptotic expansions. Asymptotic expansions in spaces of smooth and holomorphic functions. Borel's lemma.

Asymptotic analysis of integrals. Exponential integrals and Watson's lemma. Laplace's method in dimension one. Morse lemma and Laplace's method in higher dimensions. The method of steepest descent in dimension one. Paths of steepest descent and saddle points. Asymptotic behavior of the Airy function. Asymptotics for the Fourier-Laplace transforms. Oscillatory integrals and the method of stationary phase. Semiclassical asymptotics for the free Schrödinger equation.

Perturbation theory in linear algebra and asymptotic expansions for eigenvalues.

Asymptotics for second order linear ordinary differential equations with a small parameter. Asymptotic solutions and the WKB formalism. Turning points and asymptotic solutions near a turning point. Matching of asymptotic expansions. Uniform asymptotics near turning points and Langer transformations. Semiclassical Schrödinger equation with a potential well and the Bohr-Sommerfeld quantization condition in dimension one.

Grading:

In this course, we will have several homework assignments, distributed in class periodically. Your final grade will be determined based entirely on your performance on the homework. There will be no final written examination.