

# Math 56 Compu & Expt Math, Spring 2013: Topics Weeks 1,2

## 1 Week 1

Relative error

Big  $O$ , little  $o$ . Know definitions, be able to test if one func is  $O$  or  $o$  of another, as some parameter goes large or small.

Algebraic convergence, order. Know how to bound tail of algebraic series by integral.

Exponential convergence, rate. How to bound tail by pulling out a geometric series. Thm that rate is asymptotically (dist from center to eval pt)/(dist from center to singularity)

How to choose good axes for a plot so data spread and linear, interpret slope.

Definition of superexponential convergence.

Basic complex arithmetic, magnitude-phase notation.

## 2 Week 2

Taylor's theorem with correct remainder term, using it to bound err. eg using to prove super-exp conv for  $\exp(x)$

Newton's iteration. Definition of quadratic convergence (ie  $\varepsilon_{n+1}/\varepsilon_n^2 \leq C$ ), sketch of proof that Newton's is quad conv. Newton's for computing sqrt. Bisection alg from HW.

Set of floating point numbers, their gaps, error due to rounding ie  $fl(x)$ . Defn of  $\varepsilon_{mach}$ . Rules of floating point arithmetic (rounding combined with  $+$   $-$   $\times$   $/$ )

Sum numbers small to large, and why.

Catastrophic cancellation, spotting it, and using math to rewrite the formula to avoid it.

Relative condition number of a problem  $\kappa(x)$ , defn, how to compute.

Finite differencing to approximate derivatives. One-sided, centered, and 3-pt stencil. How to get their orders and estimating CC error associated with finite-precision evaluation of the function.

Multiple roots of a complex number, understood via magnitude-phase.