Phys604/F12/Hassam

Specific methods in ODE solving, cross-referenced with postings:

- “Energy” method (post #4)
- Method of reduction of order by integral transform (highest d/dx order > highest x power) (example, post #5)
- Frobenius’ method (two examples done in class, Legendre posted in PS7)
- Asymptotic behaviour of ODE near singular point at x=0 (Bessel example in post#6, to 1st order, including self-consistent check)
- Asymptotic behaviour of ODE for x>>1, WKB method (Bessel example in post#6, to 1st order, including self-consistent check)
- “Extrapolation” from small x to large x to guess at structure of full solution (Bessel example in post#6)
- Asymptotic behaviour of ODE near singular point at nonzero x (Legendre example in PS6, to 1st order, including self-consistent check)
- Standard (regular) perturbation theory solution of ODE (example in post#7)
- Perturbative solution of ODE using “scaling” method compared with formal expansion (example in post#7)
- Failure mode of standard perturbation theory, illustrating regular vs singular perturbation theory and necessity of WKB approach (example, in post#7)
- Asymptotic limit at large x from exact integral representation (Airy integral example, post#8)
- WKB example for harmonic oscillator, also illustrating region of failure of WKB and matched asymptotic solution (post #9) NOT INCLUDED FOR MIDTERM

Common ODEs - Harmonic, Airy, Bessel, Legendre

Other well-known ODEs - Hermite, Harmonic oscillator (Parabolic cylinder), Laguerre