Nan's and Inf's

1) I would guess nan because you are dividing by 0.

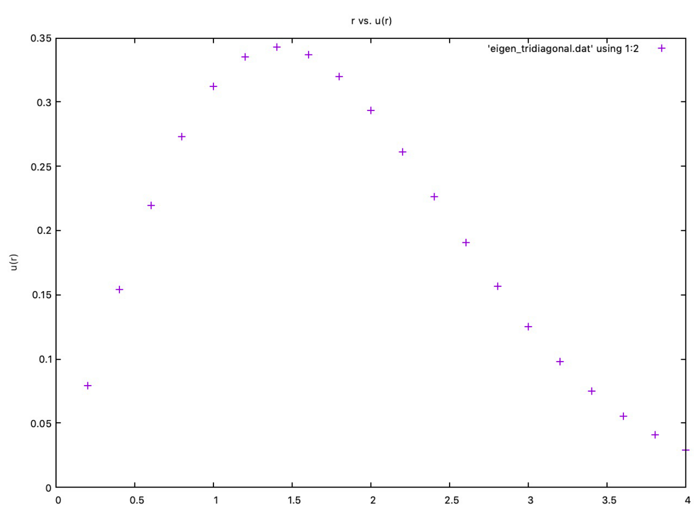
Both 0.* (numerator / denominator) = nan
and
denominator * (numerator / denominator) = nan

Bound States by Matrix Diagonalization

1) Compare with classmates, or check online

Rmax	N	EigV1	EigV2
3	20	1.681778	5.083030
3	35	1.683614	5.107588
3	50	1.684067	5.113673
4	20	1.510321	3.757758
4	50	1.512485	3.777574
4	100	1.513459	3.781109

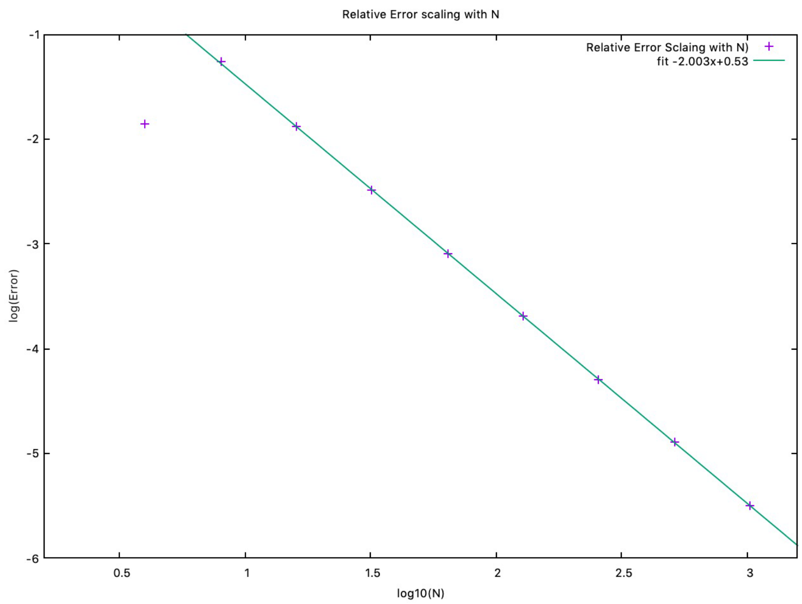
2)



The value at r=0 should be 0 because it is a bound.

3) The maximum $\mu(r)$ is at $r=1.5$. 4 is sufficiently large, but not too large.

4)



error: slope ≈ 2

5) Scales error around 2, which goes along with our chapter 5 notes. Equation 5.13) has

$$\frac{d^2u}{dr^2} = \frac{u(r+h) - 2u(r) + u(r-h)}{h^2} + O(h^2)$$

Bound States from Diag. Hamiltonian

1) E1 =-45.93207286

E2 =-33.8732994

E3 =-14.52481776

3) Coulomb/Square Well Potential: 2

b: 1

dimension: 40

give the closest results to the "exact" values from mathematica. b is close to the same order as

4) The square well potential is most effective at estimating the lowest 3 eigenvalues correctly

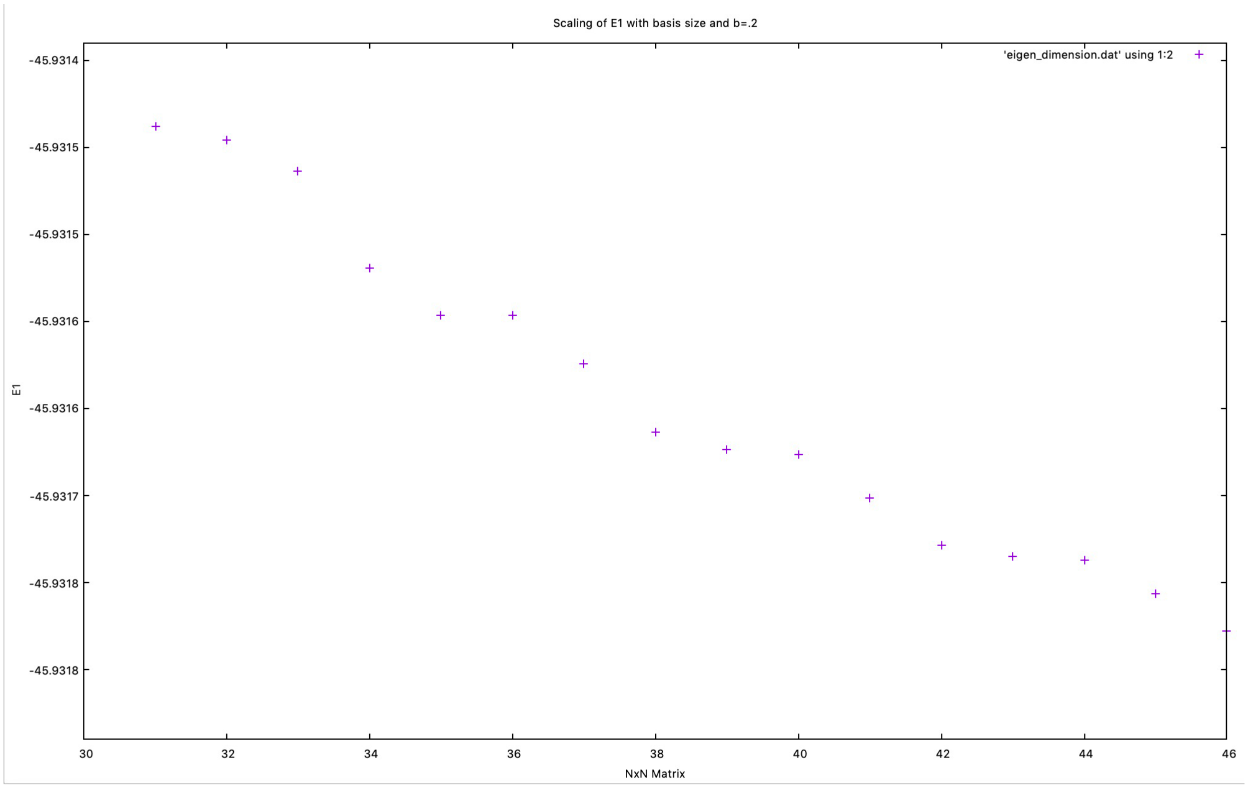
5) Square Well, fixed dimension = 40

b	Lowest Eval
.09	-45.854
.1	-45.925
.2	-45.931
.3	-45.930
.5	-45.927
1	-45.893
2	-45.668

Actual

E1 =-45.93207286
closest @ b=.2

6) Square Well fixed @ b=.2



As the dimension increases, the E1 estimation gets closer to the exact value.

7)