

Grade: check + (nice job)

Nan's and Infs

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

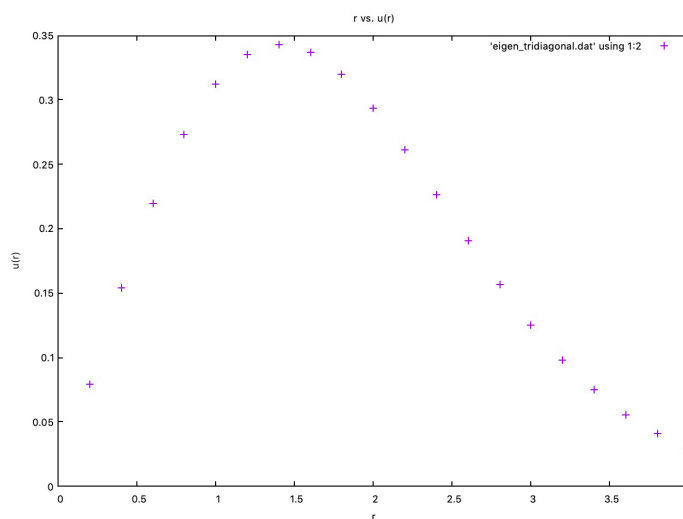
Both $0 * (\text{numerator} / \text{denominator}) = \text{nan}$
and
 $\text{denominator} * (\text{numerator} / \text{denominator}) = \text{nan}$

Bound States by Matrix Diagonalization

1) Compare with classmates, or check online

Rmax	N	Eig V_1	Eig V_2
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)

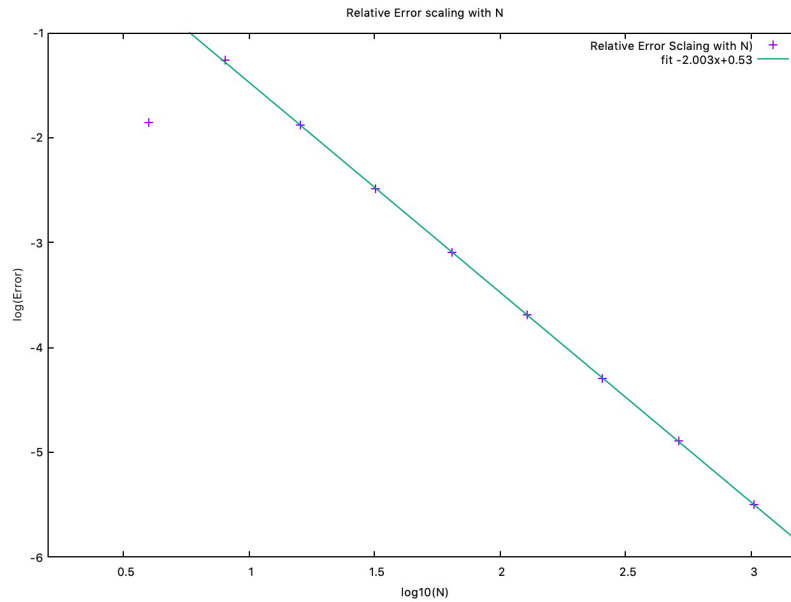


The value at $r=0$ should be 0 because it is a bound.

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

You actually want it a little bigger to make sure the wf "tail" isn't cut off too aggressively.

4)



error:
slope ≈ 2

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

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

Yup!

Bound States from Diag. Hamiltonian

1) $E_1 = -45.93207286$

$E_2 = -33.8732994$

$E_3 = -14.52481776$

3) Coulomb/Square Well Potential: 2

$b: 1$

dimension: 40

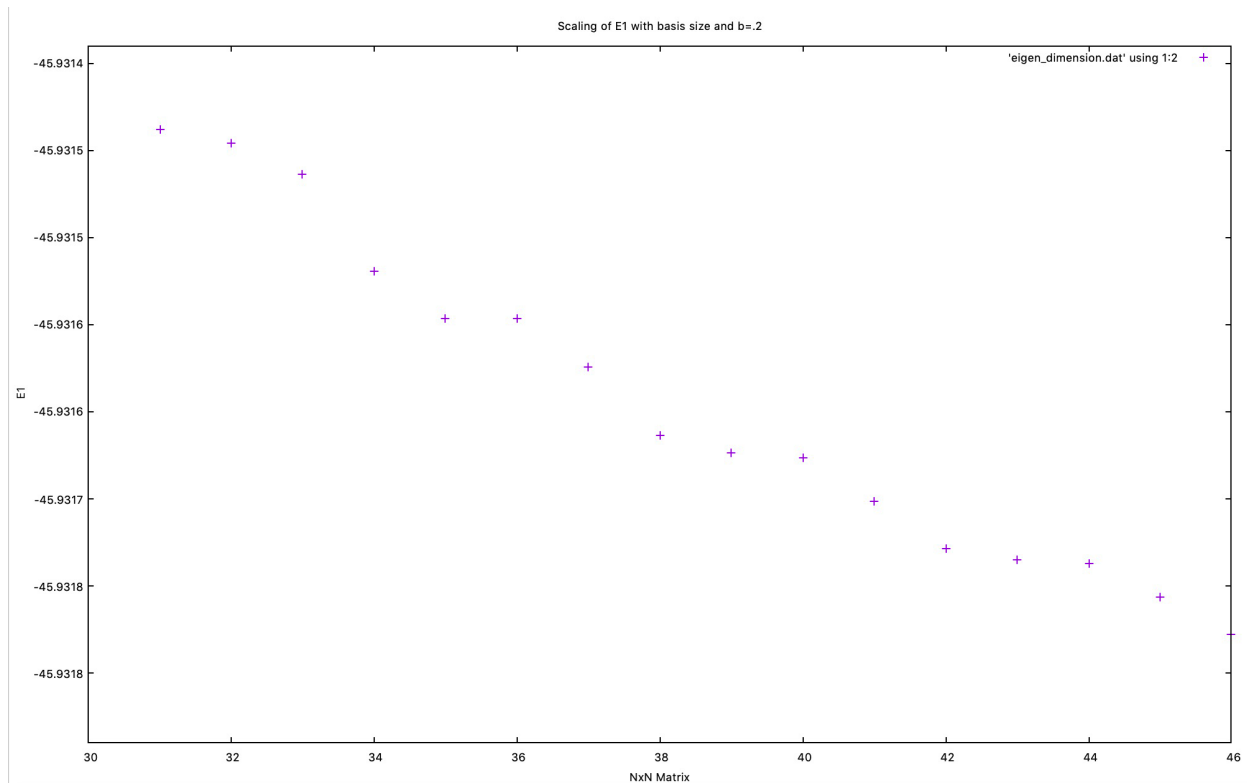
give the closest results to the "exact" values from mathematica. b is close to the same order as

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

5) Square Well, fixed dimension = 40

b	Lowest Eval	\longleftrightarrow <u>Actual</u> $E_1 = -45.93207286$ closest @ $b = 2$
.09	-45.854	
.1	-45.925	
.2	-45.931	
.3	-45.930	
.5	-45.927	
1	-45.893	
2	-45.668	

b) Square Well fixed @ $b=.2$



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

7)