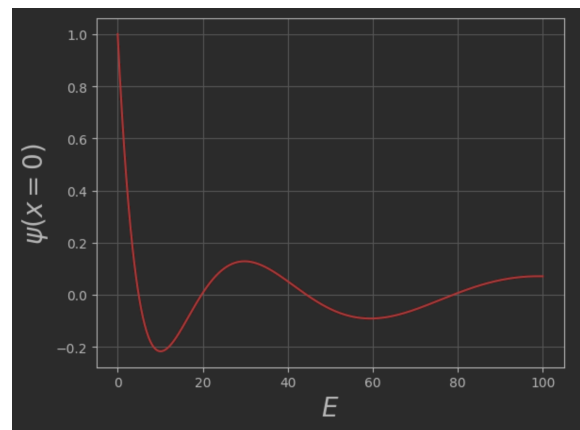
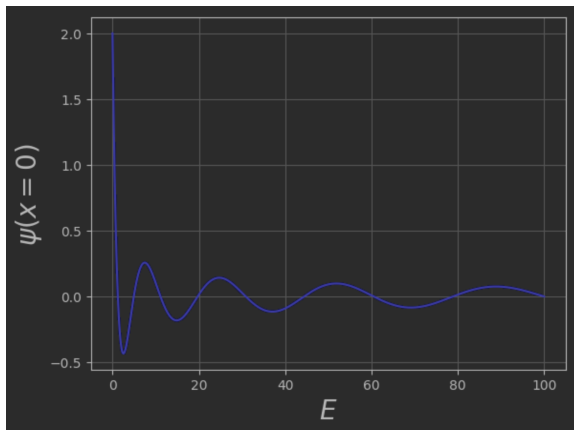


1)



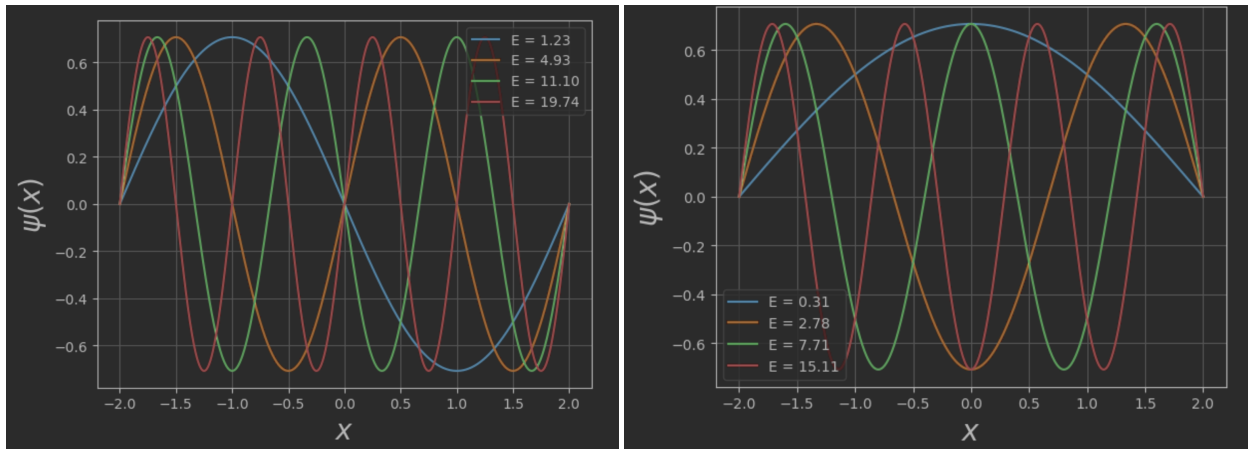
What happens when we double a ? Well, $\Psi(x)$ is scaled by a factor of 2 across the board, and it appears that the $\Psi(x)$ is horizontally compressed by a factor of 4. (ie, 2^2)

2)

Recall, the allowed energies of a particle in an infinite well are given by $E = \frac{\hbar^2 \pi^2 n^2}{2ma^2}$. Recall that we are using units where $\frac{\hbar^2}{m} = 1$. So $E = \frac{\pi^2 n^2}{2a^2}$.

Energy levels predicted by shooting	Numerically calculated
1.2337006	1.23370055
4.9348024	4.934802201
11.1033051	11.10330495
19.7392093	19.7392088
30.8425142	30.84251375
44.4132187	44.4132198
60.4513239	60.45132696
78.9568328	78.95682521
99.929744	99.92974456

3)



Energies for even solutions (the calculated solutions give numbers that are very close to these, much like the chart above for even odd solutions)

```
✓    Energies for the bound states are:
      0.3084252
      2.7758264
      7.7106286
     15.1128322
     24.9824365
     37.3194425
     52.1238464
     69.3956554
     89.1348621
```

4)

If the chip is 7 nm, then a must be 3.5nm. Recall that $\frac{\hbar^2}{m}$ is set to 1, where m is the mass of the electron.

Then to calculate our energy levels, we need only sub in $a = 3.5 \times 10^{-9}$ m, and then multiply each of our calculations by $\frac{\hbar^2}{m}$, and then convert to eV.

Odd Solutions			Even Solutions		
Shooting Method	In eV	Calculated	Shooting Method	In eV	Calculated
402841041240758080	0.03077 eV	0.03077 eV	100710375668287136	0.00769 eV	0.00769 eV
1611364027805915648	0.12308 eV	0.12308 eV	906392303217097088	0.06923 eV	0.06923 eV
3625568910838534656	0.27693 eV	0.27693 eV	2517756229349429248	0.19231 eV	0.19231 eV
6445455634638121984	0.49232 eV	0.49232 eV	4934802065603139584	0.37694 GeV	0.37694 GeV
10071024298587344896	0.76926 eV	0.76926 eV	8157529740936124416	0.62310 GeV	0.62310 GeV

They are precisely the same!!

5) Now we have 'fun.'

The first two energies are 10.3301867, 29.7239682 (in $\frac{\hbar^2}{m} = 1$ units)

For $E = 10.33$, the particle is most likely to be found in either the center of the well and $x = \pm \frac{2}{3}$.

For $E = 29.72$, the particle is most likely to be found in the middle $\pm \frac{2}{3}$ and $\pm \frac{2}{3}$.

These are the most probable locations because Ψ reaches a local maximum or minimum at those points.

