For these questions, use the simulation "Comparison of one particle in a two-dimensional well and two particles in a one-dimensional well" and work through the simulation, including the step-by-step exploration.

1) Consider the case of a **single particle** confined to a **two-dimensional** infinitely deep square well of width L along x and y as shown. Assume the particle has the ground state energy along x and the third excited state energy along y. Write down explicit expressions for the energies along x and y, the total energy and the wave function of the particle. How can you see in the graphs that the kinetic energy along one axis is greater than along the other?

2) Consider the case of **two distinguishable particles** confined in the same **one-dimensional** infinitely deep well of width L as shown. Assume particle 1 has the ground state energy and particle 2 the third excited state energy. Write down explicit expressions for the energies of the two particles, the total energy and the total wave function for the two particles.

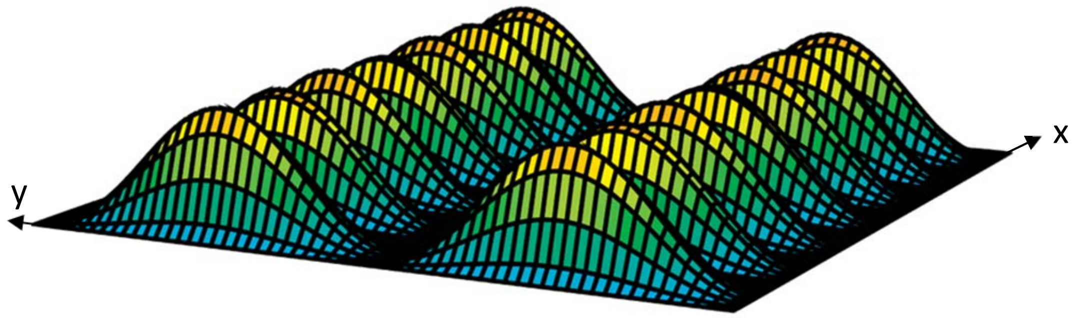
3) Explain the differences in the physical situations of your solutions to questions 1 and 2.

4) Consider the same situation as in question 2, namely **two distinguishable particles** confined in the same **one-dimensional** infinitely deep well of width L with particle 1 in the ground state and particle 2 in the third excited state. From the graphs shown, what is/are the most likely locations to find particle 1 and particle 2 if a measurement of position were made?

5) Consider the case of a **single particle** confined to a **two-dimensional** infinitely deep square well of width L along x and y.

a) From the images shown in the simulation, how does the spacing between adjacent energy levels individually along x and y change as you increase the quantum number n? Calculate $E_{n+1} - E_n$ explicitly and interpret your result graphically.

b) Shown below is the graph of the probability distribution for a particle in this well. Determine the total energy of the particle, and write down an explicit expression for the probability distribution shown below.



c) Assume the particle is in the ground state. Using the graphs shown in the simulation, what is the probability of finding the ground state particle in the region $0 \leq x, y \leq L/2$, i.e., a square region with corners $(0,0), (0, L/2), (L/2, 0)$ and $(L/2, L/2)$? No calculation is necessary. Explain your reasoning.

6) Consider the case of a **single particle** confined to a **two-dimensional** infinitely deep **rectangular** well of **width $\boldsymbol{L}$ along $\boldsymbol{x}$ and $\boldsymbol{L/2}$ along $\boldsymbol{y}$**.

a) Make a sketch of the energy levels along x and y similar to the one shown in the simulation for this situation.

b) By what factor will the amplitude of the probability distribution change compared with the square well of width L along both axes? Justify your answer.