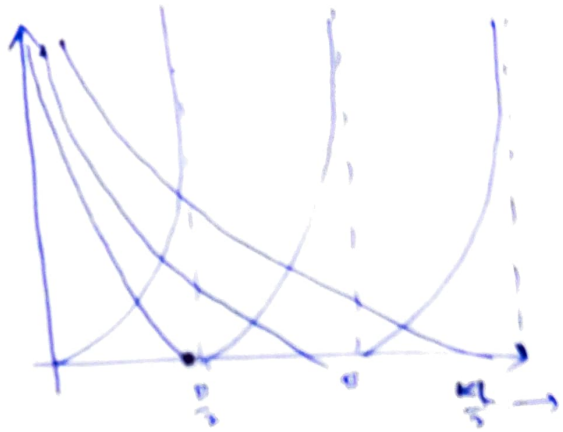
① A finite potential box has atleast 1 bound state.

② The bound states conditions are the intersection of curves $f(kl) = \sqrt{\frac{(k_0 l)^2}{(\frac{kl}{2})^2} - 1}$, $\tan(\frac{kl}{2})$ and $-\cot(\frac{kl}{2})$



as we look at the graph, no matter what the value of k_0 is, it always intersects the curves at atleast 1 point.

For 2 bound states, $f(kl)$ should become zero after

$$\frac{kl}{2} = \frac{\pi}{2}$$

i.e. $$\frac{k_0 l}{2} > \frac{\pi}{2}$$

$$\sqrt{\frac{2mV_0}{\hbar^2}} > \frac{\pi}{2} \Rightarrow V_0 > \frac{\hbar^2 \pi^2}{2mL^2}$$

for 3 states $\frac{k_0 L}{2} > \pi \Rightarrow V_0 > \frac{2\hbar^2 \pi^2}{mL^2}$