# 10.2: Superposition of time-dependent solutions

There has been an example problem, where I asked you to show "that if $\psi_1(x,t)$ and $\psi_2(x,t)$ are both solutions of the time-dependent Schrödinger equation, than $\psi_1(x,t)+\psi_2(x,t)$ is a solution as well." Let me review this problem

$$\begin{aligned}
-\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2}\psi_1(x,t)+V(x)\psi_1(x,t) &= \frac{\hbar i\partial}{\partial t}\psi_1(x,t)\\
-\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2}\psi_2(x,t)+V(x)\psi_2(x,t) &= \frac{\hbar i\partial}{\partial t}\psi_2(x,t)\\
-\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2}[\psi_1(x,t)+\psi_2(x,t)]+V(x)\left[\psi_1(x,t)+\psi_2(x,t)\right] &= \frac{\hbar i\partial}{\partial t}[\psi_1(x,t)+\psi_2(x,t)]
\end{aligned}$$

where in the last line I have use the sum rule for derivatives. This is called the superposition of solutions, and holds for any two solutions to the same Schrödinger equation!

### Question: Why doesn't it work for the time-independent Schrödinger equation?