REQUIREMENTS FOR AN ACCEPTABLE WAVEFUNCTION

1. The wave function **ψ must be continuous**. All its **partial derivatives must also be continuous** (partial derivatives are $\dfrac{\partial \psi}{\partial x}, \dfrac{\partial \psi}{\partial y}$ etc.). This makes the wave function "smooth".

2. The wave function ψ must be **quadratically integrable**. This means that the integral $\int \psi^* \psi \, d\tau$ must exist.

3. Since $\int \psi^* \psi \, d\tau$ is the probability density, **it must be single valued**.

4. The wave functions must form an **orthonormal set**. This means that
   - the wave functions must be **normalized.**

$$\int_{-\infty}^{\infty} \psi_i^* \, \psi_i \, d\tau = 1$$

   - the wave functions must be **orthogonal**.

$$\int_{-\infty}^{\infty} \psi_i^* \, \psi_j \, d\tau = 0$$

OR $\quad \int_{-\infty}^{\infty} \psi_i^* \, \psi_j \, d\tau = \delta_{ij}$ where $\delta_{ij} = 1$ when $i = j$ and $\delta_{ij} = 0$ when $i \neq j$

δ_{ij} is called Kronecker delta

5. The wave function must be **finite everywhere**.

6. The wave function must satisfy the **boundary conditions** of the quantum mechanical system it represents.