REQUIREMENTS FOR AN ACCEPTABLE WAVEFUNCTION

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

2. The wave function $\psi$ 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 \[ \int_{-\infty}^{\infty} \psi_i^* \psi_j \, d\tau = \delta_{ij} \] where $\delta_{ij} = 1$ when $i = j$ and $\delta_{ij} = 0$ when $i \neq j$

5. The wave function must be finite everywhere.

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