**What is a Tensor Product? | Maths of Quantum Mechanics"**

* **Tensor Product Spaces:** The video explains that tensor product spaces, denoted as V=V1​⊗V2​, are used in quantum mechanics to describe more complex systems, such as those with multiple particles.
* **Dimension:** The dimension of the combined space is the product of the dimensions of the individual spaces.
* **Entangled States:** Not all states can be expressed as a simple tensor product; those that can't are called **entangled states**.
* **Operators:** The video also covers how operators work in these spaces, showing that an operator acting on one subspace can be represented as a tensor product of that operator and the identity operator for the other subspace.

**2What is an inner product? | Maths of Quantum Mechanics"**

* **Inner Product as a Foundation:** This video defines the **inner product** as a generalization of the dot product, used to find the length and orthogonality of vectors.
* **Rules:** The inner product is defined by a set of rules, including linearity, a complex conjugate condition, and positive definiteness.
* **Applications:** It is used to define the magnitude of a "ket" (a state vector) and to determine if two vectors are orthogonal.

**3. What is a Unitary Operator? | Maths of Quantum Mechanics"**

* **Definition:** A **unitary operator** is an operator that preserves the inner product of vectors.
* **Intuition:** You can think of unitary operators as "generalized rotations" because they move vectors around while preserving their lengths and the angles between them.
* **Significance:** They are crucial in quantum mechanics because they ensure the conservation of probability. Therefore, important transformations like the time evolution operator must be unitary to ensure the total probability of a quantum state remains one.