Answer on Question#37533, Physics, Quantum Mechanics.

Bra and ket vectors are notations for quantum states in quantum mechanics, introduced by Dirac. It is known, that in Schrodinger's picture of quantum mechanics, quantum state is given by wave function $\psi(x,t)$, where $|\psi(x)|^2=\bar{\psi}(x)\psi(x)$ is the probability density of a quantum object (particle) in coordinate space.
The inner product $\psi\psi$ might be rewritten as $<\psi|\psi>$, where $|\psi>$ is the ket vector and $<\psi|$ bra vector.
More generally, in Hilbert space, the inner product (in bra-ket notation) is $<\psi|\varphi>=\int dx\,\bar{\psi}\varphi$.
If one fixates a basis for wave function, its ket vector $|\psi>$ is simply the vertical column with its components in this basis: $\begin{pmatrix} a_1 \\ a_2 \\ \ldots \\ a_n \end{pmatrix}$ and bra vector $<\psi|$ is the transposed and complex conjugate to ket vector: $\begin{pmatrix} \bar{a}_1 & \bar{a}_2 & \ldots & \bar{a}_n \end{pmatrix}$. Hence, inner product is then $<\psi|\psi>=\sum_{i=1}^{n}\bar{a}_i a_i=\sum|a_i|^2=1$.
The outer product $|\psi><\psi|$ is an operator and is equal to tensor product $\psi\otimes\psi$.

The matrix element of an operator in bra-ket notation is , for example $<\varphi|A|\psi>$. For spin operators commonly used notations are $|\uparrow>$ and $|\downarrow>$ for spin $s=\frac{1}{2}$ states (up and down respectively).