Quiz #13 (Functions and Dirac Notation)

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Quantum Mechanics
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Prob.1(1)

$|f\rangle = \begin{bmatrix} 2+3i \\ -1 \\ -4-i \end{bmatrix}$ and $|g\rangle = \begin{bmatrix} 5i \\ 3+2i \\ -4i \end{bmatrix}$. Determine $\langle f|g\rangle$.

Prob. 2(2)

$|f\rangle = 0.6i|\psi_1\rangle + 0.8|\psi_2\rangle$, where $|\psi_1\rangle$ and $|\psi_2\rangle$ are orthonormal. Determine

(a) $\langle \psi_1|f\rangle$

(b) $\langle f|f\rangle$

Prob. 3(2)

An electron having mass M is in a one-dimension quantum well of width L with infinitely large potential barriers. Assume it is in a state represented by $|\phi\rangle = |\psi_1\rangle + |\psi_2\rangle$, where $|\psi_1\rangle$ is the lowest energy eigen state and $|\psi_2\rangle$ is the second lowest energy eigen state. Determine $\hat{H}|\phi\rangle$, where $\hat{H}$ is the Hamiltonian operator. Express with answer with $|\psi_1\rangle, |\psi_2\rangle$ and parameters given in the problem along with fundamental constants.