Quiz #15 (Types of Linear Operators)

Prob.1(1)

For
$$|f\rangle = \begin{bmatrix} i \\ 2 \\ -3 \end{bmatrix} \text{ and } |g\rangle = \begin{bmatrix} 4 \\ -5i \\ 6 \end{bmatrix},$$
determine $|f\rangle\langle g|$.

Prob. 2(2)

Determine whether
$$\hat{A} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$
is a unitary operator or not.

Prob. 3(2)

Show that the trace of an operator, $\hat{A}$, is independent of the orthonormal bases used for representing the operator. Use two different set of orthonormal bases $|\psi_n\rangle$ and $|\phi_n\rangle$.