

24. Show $(\hat{A}\hat{B})^\dagger = \hat{B}^\dagger\hat{A}^\dagger$.

Recall $\langle \psi_1 | A^\dagger | \psi_2 \rangle = \langle \psi_2 | A | \psi_1 \rangle^*$.

$$\langle n | (\hat{A}\hat{B})^\dagger | m \rangle = \langle m | \hat{A}\hat{B} | n \rangle^*$$

$$= \langle \hat{A}^\dagger m | \hat{B} | n \rangle^*$$

$$= \langle \hat{B} n | \hat{A}^\dagger | m \rangle$$

$$\langle n | (\hat{A}\hat{B})^\dagger | m \rangle = \langle n | \hat{B}^\dagger \hat{A}^\dagger | m \rangle$$