Ex. 2-14.

(a). $\langle\phi|\hat{A}|\psi\rangle\langle\psi|$ is a bra.

$(\langle\phi|\hat{A}|\psi\rangle\langle\psi|)^\dagger = |\psi\rangle\langle\psi|\hat{A}^\dagger|\phi\rangle$. a ket.

(b). $\hat{A}|\psi\rangle\langle\phi|$ is an operator.

$(\hat{A}|\psi\rangle\langle\phi|)^\dagger = |\phi\rangle\langle\psi|\hat{A}^\dagger$ which is an operator again.

(c). $\langle\phi|\hat{A}|\psi\rangle \neq |\psi\rangle\langle\phi|\hat{A}$ is an operator.

$(\langle\phi|\hat{A}|\psi\rangle|\psi\rangle\langle\phi|\hat{A})^\dagger$ (number)

$= \hat{A}^\dagger|\phi\rangle\langle\psi|\langle\psi|\hat{A}^\dagger|\phi\rangle$

$= \langle\psi|\hat{A}^\dagger|\phi\rangle\,\hat{A}^\dagger|\phi\rangle\langle\psi|$ which is an operator again.

(d) $\langle\psi|\hat{A}|\phi\rangle|\phi\rangle + i\hat{A}|\psi\rangle$ is a ket.

$(\langle\psi|\hat{A}|\phi\rangle\langle\phi|\psi\rangle + i\hat{A}|\psi\rangle)^\dagger$

$= \langle\phi|\langle\phi|\hat{A}^\dagger|\psi\rangle - i\langle\psi|\hat{A}^\dagger$, a bra.

(e). $|\phi\rangle\langle\phi|\hat{A} - i\hat{A}|\psi\rangle\langle\psi|$ is an operator.

$(|\phi\rangle\langle\phi|\hat{A} - i\hat{A}|\psi\rangle\langle\psi|)^\dagger$

$= \hat{A}^\dagger|\phi\rangle\langle\phi| + i|\psi\rangle\langle\psi|\hat{A}^\dagger$, ~~which is an~~ which is an operator.