$$|\psi\rangle = \begin{pmatrix} -1+i \\ 3 \\ 2+3i \end{pmatrix}, \langle\phi| = \begin{pmatrix} 6 & -i & 5 \end{pmatrix}, A = \begin{pmatrix} 5 & 3+2i & 3i \\ -i & 3i & 8 \\ 1-i & 1 & 4 \end{pmatrix} \quad (1)$$

$$A|\psi\rangle = \begin{pmatrix} 5 & 3+2i & 3i \\ -i & 3i & 8 \\ 1-i & 1 & 4 \end{pmatrix} \begin{pmatrix} -1+i \\ 3 \\ 2+3i \end{pmatrix} = \begin{pmatrix} -5+17i \\ 17+34i \\ 11+14i \end{pmatrix} \quad (2)$$

$$\langle\phi| A|\psi\rangle = \begin{pmatrix} 6 & -i & 5 \end{pmatrix} \begin{pmatrix} 5 & 3+2i & 3i \\ -i & 3i & 8 \\ 1-i & 1 & 4 \end{pmatrix} \begin{pmatrix} -1+i \\ 3 \\ 2+3i \end{pmatrix} = 59+155i \quad (3)$$

$$\langle\psi|\phi\rangle = \begin{pmatrix} -1-i & 3 & 2-3i \end{pmatrix} \begin{pmatrix} 6 \\ i \\ 5 \end{pmatrix} = 4-18i \quad (4)$$

$$\langle\phi|\psi\rangle = \begin{pmatrix} 6 & -i & 5 \end{pmatrix} \begin{pmatrix} -1+i \\ 3 \\ 2+3i \end{pmatrix} = 4+18i \quad (5)$$

$$\langle\psi|\psi\rangle = \begin{pmatrix} -1-i & 3 & 2-3i \end{pmatrix} \begin{pmatrix} -1+i \\ 3 \\ 2+3i \end{pmatrix} = 24 \quad (6)$$

$$\langle\phi|\phi\rangle = \begin{pmatrix} 6 & -i & 5 \end{pmatrix} \begin{pmatrix} 6 \\ i \\ 5 \end{pmatrix} = 62 \quad (7)$$