Step-1

Suppose $A+iB$ is a Hermitian matrix, where *A, B* are real.

We have to show that $Q=\begin{bmatrix} A & -B \\ B & A \end{bmatrix}$ is symmetric.

Step-2

Since the matrices *A, B* are real.

So $A^H = A^T$ and $B^H = B^T$

Since $A+iB$ is a Hermitian matrix.

$$\begin{aligned}
&\Rightarrow (A+iB)^H = A+iB \\
&\Rightarrow A^H - iB^H = A+iB \\
&\Rightarrow A^T - iB^T = A+iB \qquad \left(\text{since } A^H = A^T, B^H = B^T\right)
\end{aligned}$$

Step-3

Comparing the real and imaginary parts on both sides, we get

$A^T = A$ and $B^T = -B$

Now we have $Q=\begin{bmatrix} A & -B \\ B & A \end{bmatrix}$

Therefore,

$$\begin{aligned}
Q^T &= \begin{bmatrix} A^T & B^T \\ -B^T & A^T \end{bmatrix} \\
&= \begin{bmatrix} A & -B \\ B & A \end{bmatrix} \\
&= Q
\end{aligned}$$

Since $Q^T = Q$

So $Q=\begin{bmatrix} A & -B \\ B & A \end{bmatrix}$ is symmetric matrix.