

$$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} \cos \alpha & -i \sin \alpha \\ -i \sin \alpha & \cos \alpha \end{pmatrix} \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} \cos \alpha & i \sin \alpha \\ i \sin \alpha & \cos \alpha \end{pmatrix} = \\ = \begin{pmatrix} i \sin \alpha & \cos \alpha \\ \cos \alpha & -i \sin \alpha \end{pmatrix} \begin{pmatrix} i \sin \alpha & \cos \alpha \\ \cos \alpha & i \sin \alpha \end{pmatrix} = \begin{pmatrix} i^2 + \cos^2 & -i \sin + i \sin \\ -i \sin + i \sin & \cos^2 + \sin^2 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} //$$

$$\sin(2\theta) = 2 \sin \theta \cos \theta$$

$$\cos(2\theta) = \cos^2 \theta - \sin^2 \theta$$

$$\begin{pmatrix} 0 & i \\ -i & 0 \end{pmatrix} \begin{pmatrix} c & -is \\ -is & c \end{pmatrix} \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix} \begin{pmatrix} c & is \\ is & c \end{pmatrix} = \begin{pmatrix} -s & -ic \\ ic & s \end{pmatrix} \begin{pmatrix} s & -ic \\ ic & -s \end{pmatrix} = \begin{pmatrix} s^2 + c^2 & -is - i \cos \\ -ic - i \cos & -c^2 + s^2 \end{pmatrix} = \begin{pmatrix} \cos \phi & -i \sin \phi \\ -i \sin \phi & \cos \phi \end{pmatrix}$$

$$\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} c & -is \\ -is & c \end{pmatrix} \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} c & is \\ is & c \end{pmatrix} = \\ = \begin{pmatrix} c & -is \\ is & -c \end{pmatrix} \begin{pmatrix} c & is \\ -is & -c \end{pmatrix} = \begin{pmatrix} c^2 - s^2 & is \cos + i \sin \\ is \cos + i \sin & -s^2 + c^2 \end{pmatrix} = \begin{pmatrix} \cos \phi & i \sin \phi \\ i \sin \phi & \cos \phi \end{pmatrix}$$

$$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} c & -is \\ -is & c \end{pmatrix} \begin{pmatrix} 0 & i \\ -i & 0 \end{pmatrix} \begin{pmatrix} c & is \\ is & c \end{pmatrix} = \begin{pmatrix} -is & c \\ c & -is \end{pmatrix} \begin{pmatrix} -s & ic \\ -ic & s \end{pmatrix} = \begin{pmatrix} is^2 - ic^2 & sc + cs \\ -sc - sc & ic^2 - is^2 \end{pmatrix} = \\ = \begin{pmatrix} -i \cos \phi & \sin \phi \\ \sin \phi & i \cos \phi \end{pmatrix}$$

$$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} c & -is \\ -is & c \end{pmatrix} \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} c & is \\ is & c \end{pmatrix} = \begin{pmatrix} -is & c \\ c & -is \end{pmatrix} \begin{pmatrix} c & is \\ -is & -c \end{pmatrix} = \begin{pmatrix} -isc - ic & s^2 - c^2 \\ c^2 - s^2 & is \cos + i \sin \end{pmatrix} = \\ = \begin{pmatrix} -i \sin \phi & -\cos \phi \\ \cos \phi & +i \sin \phi \end{pmatrix}$$

$$\begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix} \begin{pmatrix} c & -is \\ -is & c \end{pmatrix} \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} c & is \\ is & c \end{pmatrix} = \begin{pmatrix} -s & -ic \\ ic & s \end{pmatrix} \begin{pmatrix} c & is \\ -is & -c \end{pmatrix} = \begin{pmatrix} -sc - sc & -is^2 + ic^2 \\ ic^2 - is^2 - sc - cs \end{pmatrix} = \begin{pmatrix} -\sin \phi & i \cos \phi \\ i \cos \phi & -\sin \phi \end{pmatrix}$$

$$\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} c & -is \\ -is & c \end{pmatrix} \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix} \begin{pmatrix} c & is \\ is & c \end{pmatrix} = \begin{pmatrix} c & -is \\ is & -c \end{pmatrix} \begin{pmatrix} s & -ic \\ ic & -s \end{pmatrix} = \begin{pmatrix} cs + sc & -ic^2 + is^2 \\ is^2 - ic^2 & sc + cs \end{pmatrix} = \begin{pmatrix} \sin \phi & -i \cos \phi \\ i \cos \phi & \sin \phi \end{pmatrix}$$