

$$\begin{aligned}
 2. \quad \begin{pmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{pmatrix} \begin{pmatrix} -\sin \theta \\ \cos \theta \end{pmatrix} &= \begin{pmatrix} -\sin \theta \cos \theta - \sin \theta \cos \theta \\ -\sin^2 \theta + \cos^2 \theta \end{pmatrix} \\
 &= \begin{pmatrix} -2\sin \theta \cos \theta \\ \cos^2 \theta - \sin^2 \theta \end{pmatrix} = \begin{pmatrix} -\sin 2\theta \\ \cos 2\theta \end{pmatrix}
 \end{aligned}$$

$$3. \quad R^k = \begin{pmatrix} \cos k\theta & -\sin k\theta \\ \sin k\theta & \cos k\theta \end{pmatrix}$$

$$\begin{pmatrix} \cos n\theta & -\sin n\theta \\ \sin n\theta & \cos n\theta \end{pmatrix} \begin{pmatrix} \cos 2\theta & -\sin 2\theta \\ \sin 2\theta & \cos 2\theta \end{pmatrix}$$

$$\begin{aligned}
 4. \quad &\begin{pmatrix} \cos 2\theta_1 & \sin 2\theta_1 \\ \sin 2\theta_1 & -\cos 2\theta_1 \end{pmatrix} \begin{pmatrix} \cos \theta_2 \\ \sin \theta_2 \end{pmatrix} \\
 &= \begin{pmatrix} \cos 2\theta_1 \cos \theta_2 + \sin 2\theta_1 \sin \theta_2 \\ \sin 2\theta_1 \cos \theta_2 - \cos 2\theta_1 \sin \theta_2 \end{pmatrix} = \begin{pmatrix} \cos (2\theta_1 - \theta_2) \\ \sin (2\theta_1 - \theta_2) \end{pmatrix}
 \end{aligned}$$

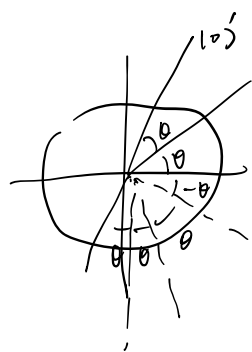
$$5. \quad \begin{pmatrix} \cos 2\theta & -\sin 2\theta \\ -\sin 2\theta & -\cos 2\theta \end{pmatrix} \begin{pmatrix} \cos 2\theta & \sin 2\theta \\ \sin 2\theta & -\cos 2\theta \end{pmatrix} =$$

$$10. \quad \cos(35) = 0.71 \times 10^{-3}$$

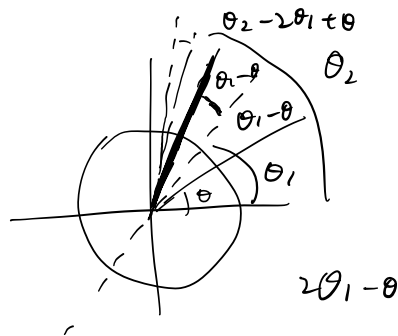
$$\text{thus } \theta = \pm 35$$

$$H \begin{pmatrix} 1 \\ -1 \end{pmatrix} = \begin{pmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \end{pmatrix} \begin{pmatrix} 1 \\ -1 \end{pmatrix} = \begin{pmatrix} 0 \\ \frac{2}{\sqrt{2}} \end{pmatrix}$$

$\Rightarrow$  increases so  $+35$



$-4\theta$



$\theta_2 + \theta_2 - 2\theta_1 + \theta$

$-2\theta_1 + 2\theta_2 + \theta$

$$8. -\frac{5}{7} + \frac{2}{7} = -\frac{3}{7}$$

$$-\frac{\sqrt{10}}{7} + \frac{\sqrt{10}}{7} = 0 \quad \left( \sqrt{\frac{5}{7}} |0\rangle - \sqrt{\frac{2}{7}} |1\rangle, -\sqrt{\frac{2}{7}} |0\rangle - \sqrt{\frac{5}{7}} |1\rangle \right)$$

-1

$$-\frac{\sqrt{10}}{7} - \frac{\sqrt{10}}{7} = -\frac{2\sqrt{10}}{7}$$

$$\frac{5}{7} - \frac{2}{7} = \frac{3}{7}$$

$$1. \begin{pmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix}$$

$$2. \begin{pmatrix} -\sin 2\theta \\ \cos 2\theta \end{pmatrix}$$

$$3. (20, 7)$$

$$7. |1\rangle \text{ and } -|1\rangle$$

$$9. -63$$

$$10. 35$$