Exercise 3.2.1

A general single qubit state $|\psi\rangle$ corresponds one point on the Bloch sphere with parameter (θ, φ), and the relation is given by

$$|\psi\rangle = \cos\frac{\theta}{2}|0\rangle + \sin\frac{\theta}{2}e^{i\varphi}|1\rangle \tag{1}$$

We can use the relation to find the (θ, φ) for a single qubit state.

- For $|+\rangle$, we have

$$|+\rangle = \frac{1}{\sqrt{2}}|0\rangle + \frac{1}{\sqrt{2}}|1\rangle = \cos\left(\frac{1}{2}\cdot\frac{\pi}{2}\right)|0\rangle + \sin\left(\frac{1}{2}\cdot\frac{\pi}{2}\right)e^{i0}|1\rangle \tag{2}$$

  Thus, the corresponding parameter for $|+\rangle$ is $(\pi/2, 0)$.

- For $|-\rangle$, we have

$$|-\rangle = \frac{1}{\sqrt{2}}|0\rangle - \frac{1}{\sqrt{2}}|1\rangle = \cos\left(\frac{1}{2}\cdot\frac{\pi}{2}\right)|0\rangle + \sin\left(\frac{1}{2}\cdot\frac{\pi}{2}\right)e^{i\pi}|1\rangle \tag{3}$$

  where $e^{i\pi} + 1 = 0$. Thus, the corresponding parameter for $|-\rangle$ is $(\pi/2, \pi)$.