

Phase Estimation Exercise – Math 4440

Suppose we have a state

$$|\Psi\rangle = \frac{1}{\sqrt{2}} |0\rangle + \frac{e^{i\theta}}{\sqrt{2}} |1\rangle.$$

1. First, determine the possible measurements (with probabilities of each) if we measure in the basis $|0\rangle, |1\rangle$.
2. Next, determine the same for the basis $|+\rangle, |-\rangle$.
3. For your answers above, show that with trig identities, the two probabilities simplify to $\cos^2(\theta/2)$ and $\sin^2(\theta/2)$. Which is which?