Introduction to Quantum Mechanics 1
Quiz 1

Name:

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Using

$$\sigma_x \sigma_y = -\sigma_y \sigma_x = i\sigma_z,$$

evaluate

$$e^{-i\theta\sigma_x/2} \sigma_y e^{i\theta\sigma_x/2}.$$

What is the interpretation of this quantity? What is the physical significance of $e^{i\theta\sigma_x/2}$?

Solution: This represents a rotation about the x axis through an angle θ.

$$e^{-i\theta\sigma_x/2} \sigma_y e^{i\theta\sigma_x/2} = \sigma_y e^{i\theta\sigma_x} = \sigma_y(\cos\theta + i\sigma_x \sin\theta) = \sigma_y \cos\theta + \sigma_z \sin\theta = \sigma_{y'}.$$