PHYS 451: Quantum Mechanics I – Spring 2017
Quiz #7

An electron is placed in a static uniform magnetic field B along the positive direction of the x-axis. Initially (at $t = 0$) it is in a state with a positive projection of its spin on the z-axis. Find $\langle S_z \rangle$ at $t > 0$.

Some information that might be useful

Electron's magnetic moment is proportional to its spin, i.e. $\boldsymbol{\mu} = \gamma \mathbf{S}$, where $\gamma = -\frac{e}{m}$ is the gyromagnetic ratio.

Pauli matrices: $\quad \sigma_x = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \qquad \sigma_y = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix} \qquad \sigma_z = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$