J06Q.3 - Magnetic Resonance

Problem

A particle of spin $1/2$ and magnetic moment μ is at rest in the time-dependent magnetic field

$$\vec{B} = B_0 \hat{z} + B_1 \hat{x} \cos \omega t - B_1 \hat{y} \sin \omega t,$$

which is often employed in magnetic resonance experiments. If the particle has the z component of its spin up (pointing along the positive z direction) at time $t = 0$, what is the probability that a measurement will find the z component of its spin down at time $t > 0$?