Relatives of Brownian Motion

1. Suppose that the price (dollars) of a stock can be reasonably modeled as a Geometric Brownian motion with drift $\mu = 0.05$ per year and scale parameter $\sigma = 0.20$ per year. Compute the probability that the stock price 2 years from now is 10% greater than the stock price 1 year from now.

2. Let $U(t)$ represent the difference (in percentage points) between an interest rate and some benchmark. (For example, U is 0 when the interest rate is equal to the benchmark, U is -1 if the interest rate is 1 percentage point below the benchmark, etc.) Assume that $U(t)$ follows an Ornstein-Uhlenbeck process. If the interest rate is currently 3 percentage points below the benchmark, find the probability that the interest rate is more than 1.5 percentage point below the benchmark 2 units of time from now.