Problem 2

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The equation * is a generic brownian motion and assumes that both te E[return] and σ^2 are proportional to the stock. It assumes that the dift $\mu S \Delta t$ is the expected return is constant in short intervals. It also accounts for that both are dependent on the stock price, which intuitfy makes sense as both dift diffusion shold be dependent on S.

Alternative 1: $\Delta S = \mu \Delta t + \sigma \Delta W_t$.

This models drift term assumes the expected return is a constant amount independent of the current stocks price S. As is the diffusion term (randomness) is also constant, not scaled by S. This implies that both the expected increas in stock price and variability are constant and not effected by the stock price, which is incorrect. As stocks with higher prices typically have lower volitility compared to smaller stocks and this model would also predict negativ stock prices which makes no sense.

Alternative 2: $\Delta \mu S \Delta t + \sigma \Delta W$

Here the diffusion term as mentioned in alternative 1 does not consider the stock price, and is a constant amount, The drift term is better as it now considers the stock price, Still it is not perfect, This model has the same problem as 1 that the variability in the stocks price regardless of stock price meaning that larger stocks have same variablity as smaller.

Alternativ 3:

Here the drift term is independent of the S stock price, this is better than Alternativ 1 but suffers from the problem that the drift is constant. This implies that the expected dolle. return is the same regardless of stock price