Homework 12:

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1. Given a stock ($S(t)$) that follows GBM, come up with a hedging strategy for a derivative security, whose payout at maturity is given by $V(T) = S^2(T)$.

2. For a derivative security which pays $V(T) = S(T) - KS(T) + K^2$ at maturity, determine the value of this security at time t for the parameters: $S(t) = 100, \alpha = .03, \sigma = .1, r = .02, K = 75, T = .5,$ and $t = .25$.

3. Using the Girsanov theorem, for $\theta(t) = \alpha(t) - \cos(\alpha(t))$ where $\alpha(t)$ is an adapted process, determine:

   (a)
   $$\widetilde{\mathbb{P}}(\widetilde{W}(t) \geq 1)$$

   (b)
   $$\widetilde{\mathbb{P}}(\widetilde{W}(1) \geq 1)$$

4. Assume that you are working in a market that has a risk-free interest rate of $r = .05$. Given a stock $S(t)$ that follows GBM, with parameters $\alpha = .2, \sigma = .1$, and $S(0) = 45$, find the value of a European call and put option both with strike $K = 44$ and maturity of six months at times

   (a) t=0;

   (b) t=.25, given that $S(.25) = S(0)$

   Make sure that you confirm that the values you get for this problem satisfy the put-call parity.