

Exercise Sheet 1

MTH6120 Further Topics in Mathematical Finance

due: Wednesday, 27 January 2010, 10am

*You should try all questions, but only the * question will be marked.*

1. Suppose some share price $S(t)$ evolves according to geometric Brownian motion with drift parameter μ and volatility parameter σ . Calculate the moments $\langle S(t)^m \rangle$ for all m . Also, calculate the variance of $S(t)$.
2. Derive a formula that converts an interest rate r_m which is compounded with frequency m to a rate r_n that is compounded with frequency n , assuming that both yield the same total interest.
3. You receive from source A a cash flow a_1, a_2, a_3 and from source B a cash flow b_1, b_2, b_3 at the end of year 1,2,3. Find a general formula for the interest rate r where both cash flows have the same present value.
4. *
 - (a) Derive the relation between nominal and effective interest rate if constant nominal interest r is paid continuously.
 - (b) Bank A offers to pay continuous interest on your savings with the time dependent interest rate $r_A(t) = \frac{1}{100}(1 + \sin \pi t)$, bank B with the time dependent rate $r_B(t) = \frac{1}{70}e^{\frac{1}{10}t}$, and bank C with the constant rate $r_C(t) = \frac{1}{68}$, where t denotes time in units of years. You want to fix your savings for one year. Which offer should you choose? For the best offer, what do you have on your account after 1 year if you initially deposited £1000?
 - (c) Explain in a few sentences why currently the interest rate in the UK is at a historic low.