**CQF January 2009**
**Module 3.3**
**Live Class: March 12**
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## Martingales II: Black-Scholes All Over Again

In this lecture:

We apply probabilistic and martingale methods to the pricing of European stock and index options in complete markets.

- How to compute the price of a derivative as an expectation;
- Girsanov's theorem and change of measures;
- the fundamental asset pricing formula;
- the Black-Scholes Formula;
- the Feynman-Kac formula;
- extensions to Black-Scholes: dividends and time-dependent parameters;
- Black's formula for options on futures;


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3. The Black-Scholes Call Option Problem 54
4. The Feynman-Kac Formula 76
5. Extensions of the Basic Framework 81


Summary:

In this lecture we have seen

- the probabilistic approach to solving the Black-Scholes problem;
- Girsanov's theorem and how to use it to change measure;
- What an equivalent martingale measure is;
- The derivation of the fundamental asset pricing formula;
- How to get the Black-Scholes fromula from the fundamental asset pricing formula;
- How to use the Feynman-Kac formula to go from the fundamental asset pricing formula to a the Black-Scholes PDE;
- Extensions to the original Black-Scholes pricing problem: dividends; time-dependent coefficient and options of futures.