**Probability**

Structured way to think about uncertainty

**Random Walk**

Prices move in such a way that is random and independent of the change the previous day

**Sigma algebra**

Rulebook for organising sets (imagine sorting a collection in a library)

**Filtrations**

Capture accumulation of information in a formal mathematical way.

Example

* 1st month – company’s past performance data
* 15th – press release new product
* End – quarterly earnings report

Capture all the information at each point in time, in sets, get a filtration

**Wiener process**

Mathematical representation of seemingly random motion – continuous random walk

**Martingale**

Conditional expectation of next value is the present value

Coin toss – win £100 lose £100 expected winnings always zero, don’t care if it is £1 or £1000

Submartingale – winning bias

Supermartingale – losing bias

**Ito’s Lemma**

A way to differentiate a stochastic process (that chain rule for stochastic process)

**P-Q Measure**

P measure – real world, Q measure – risk neutral world (all assets grow at risk free rate?)

**Monte Carlo Simulation**

**Stochastic Differential Equation**

**Geometric Brownian Motion**

**Local Volatility Model**

Road trip – terrain weather, speed varies, price depends on stock price and time (1 D markhovain process)

**Stochastic Volatility Model**

Open sea – journey (2D markhovian process)

**Girsanov Theorem**

Mathematical framework to transition between P and Q measures

**Jump Diffusion models**

**Levy Models**

Combine continuous paths with discontinuous jumps