Mid Semester Examination

Solve all problems while demonstrating each step clearly. The Exam is worth a total of 20 points.

(3 pts) 1. Define sample space, measurable space and probability measure and give examples in each case. Explain their significance in mathematical finance.

(3 pts) 2. Completely characterize a normal distribution. Explain in details the significance of a normal distribution in the pricing of options.

(4 pts) 3. Simulate paths of Brownian motion and visualize them in Python. (choose your own parameters)

(3 pts) 4. Give a detailed relationship between a martingale and a filtration. How are the two useful in mathematical finance?

(3 pts) 5. Give the statement of Ito's lemma. Hence apply Ito's Lemma to $f(W_t, t) = W_t^2$.

(4 pts) 6. Give a simulation of stock prices using Brownian motion in Python. Hence choose one of the parameters and explain the impact of varying it.