**FE 520**
**MIDTERM 2**
**May 6, 2023**
**Duration: 100 minutes**

1. (25 points) Suppose that a stock price, S, follows geometric Brownian motion with drift $\mu$, and volatility $\sigma$:

$$dS(t) = \mu S(t)dt + \sigma S(t)dW(t).$$

Let $S(0) = 100$, $\mu = 0.125$, and $\sigma = 0.5$ be given. Find the probability that the stock price exceeds 120 after one year.

2. (25 points) Define

$$X(t) = (W(t) - t)e^{\{W(t) - \frac{t}{2}\}}$$

Find $dX(t)$.

3. (25 points) Define

$$X = W(2) + W(3)$$

Find $\Pr\{X \geq 2\}$.

4. (25 points) Define

$$X(t) = 1 + 0.1t + 0.3W(t)$$

Find $\Pr\{X(10) > 1 | X(2) = 1\}$.