QF602 - Homework 3

Question 1

- What happens to the price of a vanilla call option as the volatility tends to infinity? How about put option?
- What happens to the price of a vanilla call option as the volatility tends to 0? How about put option?
- What are the upper and lower bounds of the price of a call and put option on a non-dividend paying stock?

Question 2

- Black Scholes Vega is given as $e^{-qT}S_0\phi(d_1)\sqrt{T}$, can you find the strike that gives the maximum vega for a given maturity T?

Question 3

- Consider a digital option with a payoff at maturity $T = 1$

  $$1_{L<S_T<U}$$

  where $L = 80$ and $U = 120$ are the lower and upper barriers.
- Explain how to replicate the digital option using European options.
- Draw the Black Scholes delta profile of the digital option. Assume the implied vol is 0.2, risk free rate and dividend yield are 0.
- Draw the Black Scholes vega profile of the digital option.

Question 4

- If the delta of a call with maturity T and strike K is x, what is the delta of a put with the same maturity and strike?
- If the vega of a call with maturity T and strike K is y, what is the vega of put with the same maturity and strike?