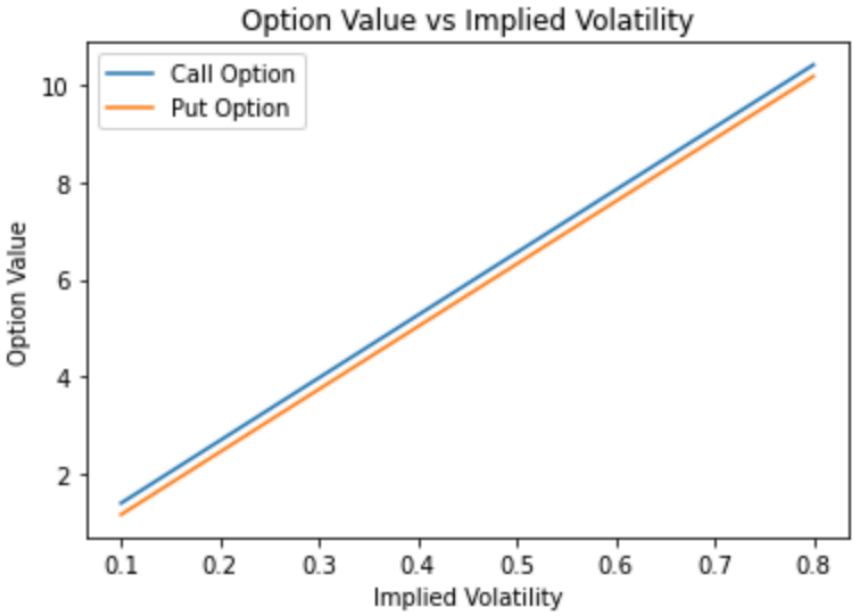
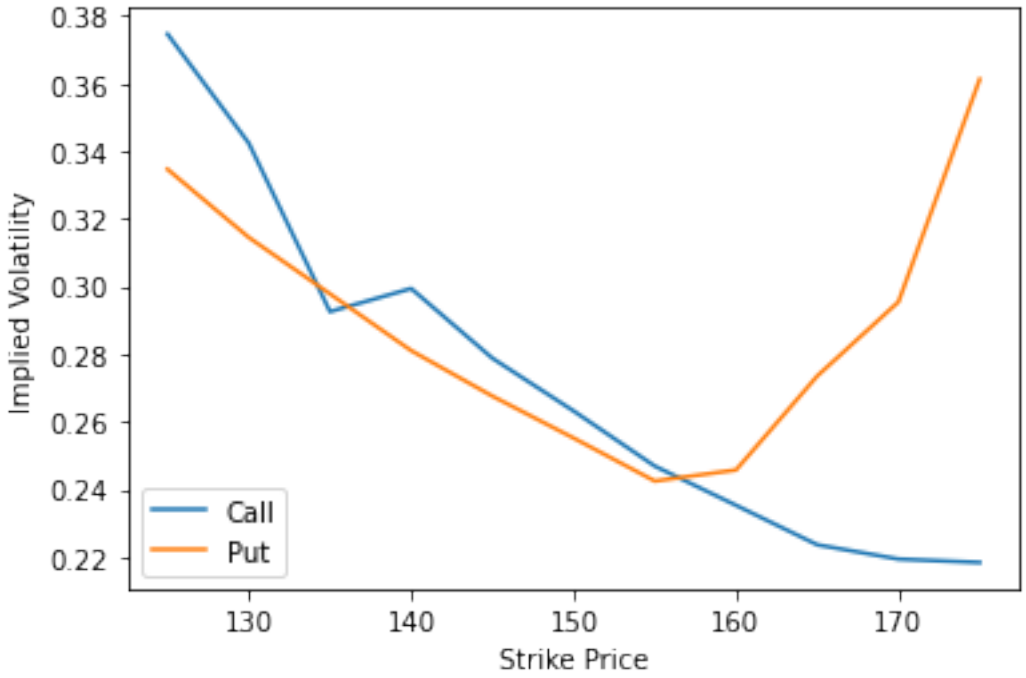
Problem 1

Time to Maturity = 14 / 365 = 0.0383



For this question, I assume that the strike price is 165.
As the implied volatility goes up, option value of both call option and put option will increase accordingly. Increase in demand and decrease in supply will increase the implied volatility; decrease in demand and increase in supply will decrease the implied volatility.

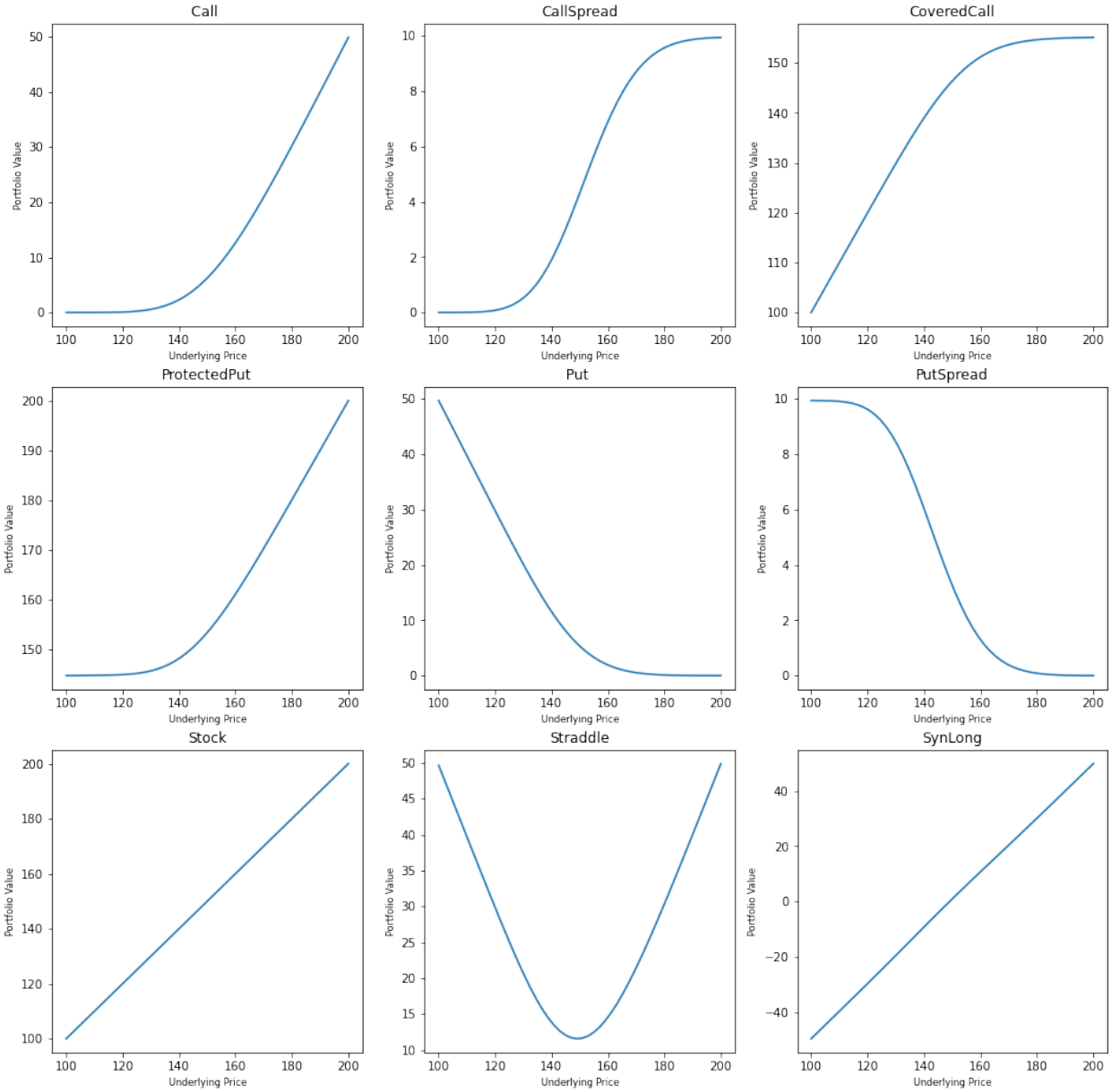
Problem 2



The shape of call option graph is downward sloping, and the shape of put option graph is like a smile, which means that the implied volatility increases as the strike price moves away from the current underlying price, with higher implied volatilities at both the lowest and highest strike prices. The smile indicates that options at extreme strike prices are more expensive relative to the Black-Scholes price, which assumes constant volatility, than options with strike prices closer to the underlying price.

This phenomenon implies deficiencies in Black–Scholes model. The volatility smile can be attributed to several factors. Firstly, market participants may overestimate the likelihood of significant price fluctuations, which results in them seeking greater compensation for the associated risks. Secondly, institutional investors or market makers may use options as a means of hedging, which can alter option prices and cause the smile-like pattern. Lastly, the smile may arise due to model inadequacies or other market obstacles.

Problem 3


Call
CallSpread
CoveredCall
ProtectedPut
Put
PutSpread
Stock
Straddle
SynLong
Portfolio Value
Underlying Price

We can classify the 9 portfolio into five group.

Group1: Call and Put
They are acting like a normal option, with the normal graph. The amount of risk is fine.

Group2: CallSpread and PutSpread
They have both the upper and lower bound for portfolio value, which means that the amount of risk can be controlled.

Group3: CoveredCall and ProtectedPut
They have the amount of risk between stock and option, and the graphs are similar to call and put graph.
Group4: SynLong and Stock:
They have straight line on the graph, with higher risk.

Group5: Straddle
The portfolio value of straddle will increase as underlying price move away from the current price, with low risk.