Implied Volatility

In the lecture we mentioned that the volatility of stock can not be directly observed. Given option prices observed in the market, the volatility can be computed using Black-Scholes formula. Write a Python function **impVol($\cdots$)** which solves for the implied volatility using the Newton-Raphson method. Let $S = 129$, $r = 0$, $T = 30/360$, **Test** your code using the given market prices of European calls in the following table.

K	124	125	126	127	128	129	130	131	132	133	134	135	136
C	6.03	5.23	4.49	3.79	3.14	2.55	2.02	1.59	1.26	1.00	0.81	0.67	0.55

Table: Option prices for different strikes

Plot a graph of your results and **what** can you observe about your graph? **Will** the implied volatilities using the corresponding market prices of European puts be same?

In the lecture we have seen that the Black-Scholes (BS) model can be extended by including a time-dependent volatility function. Given the volatility function

$$\sigma(t) = \sigma_0 \exp(-at) + b(1 - \exp(-at)),$$

find the optimal value of parameters σ_0, a, b by fitting the prices of the extended BS-formula to the market prices given in the following table, where $S = 129$, $r = 0$, $K = 129$. For the fitting you can use any optimization method, e.g., *least squares.*

T	1/12	1/4	1/2	1
C	2.55	4.49	6.70	10.13

Table: Option prices for different maturities

Plot a graph of the volatility function using the obtained optimal parameter values and **compare** it to the corresponding implied volatility for different maturities. You must comment your code.