Problem 1 (10 points)

Show that the following formula holds for the dependence of the price of a call option V on the volatility σ in the Black-Scholes setting:

$$\frac{\partial V}{\partial \sigma} = S_0 \sqrt{T} \Phi'(d_1)$$

Problem 2 (10 points)

Compute the empirical volatility for the time series of the SPY below.

Day	1	2	3	4	5	6	7	8	9	10	11
SPY	208.55	209.04	208.47	206.72	206.92	204.99	205.56	204.06	205.57	206.72	208.20

Problem 3 (10 points)

Assume that one share of SPY is worth today 208.20 on 5/11/2016 that the value of a European call option with maturing on 6/16/2017 and strike price \$205 is quoted as \$14.54. Assume an interest rate of 1%. Use Newton's method (2 iterations) to find the corresponding implied volatility.