**Problem 1**

% solve implied volatility of PUT option

S = [100,100,100];

K = [95,100,105];

P = [3.8715, 6.1210, 8.9830];

r = 0.05;

q = 0.02;

T = 0.3;

vol = [0.2, 0.2, 0.2];

vol\_ = [0,0,0];

while norm(vol - vol\_) > 10^-6

vol\_ = vol;

d1 = (log(S ./ K) + (r - q + vol.^2 ./ 2) \* T) ./ (vol \* sqrt(T));

d2 = d1 - vol \* sqrt(T);

fx = P - normcdf(-d2) .\* K \* exp(-r \* T) + normcdf(-d1) .\* S \* exp(-q \* T);

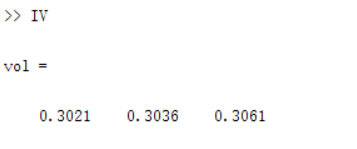
fpx = -1.0 \* 2 \* S \* exp(-q\*T) .\* (1 / sqrt(2 \* pi) \* exp(-d1.^2 / 2)) \* (sqrt(T) / 2);

vol = vol - fx ./ fpx;

end;

vol

**output:**



**Problem 2**

% minimize

K = [95,100,105];

P = [3.8715, 6.1210, 8.9830];

r = 0.05;

q = 0.02;

T = 0.3;

vol = 0.2;

vol\_ = 0;

while norm(vol - vol\_) > 10^-6

vol\_ = vol;

d1 = (log(S ./ K) + (r - q + vol.^2 ./ 2) \* T) ./ (vol \* sqrt(T));

d2 = d1 - vol \* sqrt(T);

put = normcdf(-d2) .\* K \* exp(-r \* T) - normcdf(-d1) .\* S \* exp(-q \* T);

put1 = 2 \* S \* exp(-q\*T) .\* (1 / sqrt(2 \* pi) \* exp(-d1.^2 / 2)) \* (sqrt(T) / 2);

put2 = 2 \* S \* (sqrt(T) / 2) \* exp(-q\*T) .\* (exp(-d1.^2 / 2) / sqrt(2 \* pi)) .\* d1 .\* d2 ./ vol;

fx = sum(2 \* (P - put) .\* put1);

fxp = sum(2 \* P .\* put2 - 2 \* put1.^2 - 2 \* put .\* put2);

vol = vol - fx ./ fxp;

end;

vol

**output:**

