***11.7 Solve the following nonlinear equations using the least squares method.**

Use initial approximations of x0 = 2.1 and y0 = 0.45.

$$x^2 + 3xy - y^2 = 7.0 + v_1$$
$$7x^3 - 3y^2 = 55.2 + v_2$$
$$2x - 6xy + 3y^2 = -1.2 + v_3$$

```
% x^2 + 3xy − y2 = 7.0
% 7x^3 − 3y2 = 55.2
% 2x − 6xy + 3y2 =−1.2
% Approximate values
x0 = 2.1; y0 = 0.45;
% Linearized equations
% dx+(2x0+3y0) dy= 7.0-(3x0-2y0)
for i=1:1
J=[2*x0+3*y0 3*x0-2*y0; 21*x0^2 -6*y0; 2-6*y0 -6*x0+6*y0];

K= [7.0-(x0^2+3*x0*y0-y0^2); 55.2-(7*x0^3-3*y0^2); -1.2-(2*x0-6*x0*y0+3*y0^2)];

X = inv(J'*J)*J'*K

x0=X(1)+x0

y0=X(2)+y0
end
```

****

```
>> homework_09
```

Iteration 1	**Iteration 2**	**Iteration 3**	**Iteration 4**	**Iteration 5**
X =	X =	X =	X =	**X =**
-0.0957	-0.0044	1.0e-04 *	1.0e-06 *	**1.0e-09 ***
0.0525	0.0055			
		-0.0669	0.0057	**0.0171**
		0.5046	0.1862	**0.6507**
x0 =	x0 =			
2.0043	1.9998	x0 =	x0 =	**x0 =**
		1.9998	1.9998	**1.9998**
y0 =	y0 =			
0.5025	0.5080	y0 =	y0 =	**y0 =**
		0.5080	0.5080	**0.5080**

11.12 Using the conditional equations, what are the most probable values for the three angles observed to close the horizon at station Red. The observed values and their standard deviations are:

		Value				
Angle	**d**	**m**	**s**		**S(")**	
1	114	23	5	114.3847	6.5	0.001806
2	138	17	59	138.2997	3.5	0.000972
3	107	19	3	107.3175	4.9	0.001361
			closure=>	360.0019		

Angle=	**L1**	**+**	**L2**	**+**	**L3**		
	114.384722	+	138.2997222	+	107.3175	=	360.0019
losing eror	7						
	C1+C2+C3	=	42.25	12.25	24.01		**78.51**
C1=	3.77	]==>	0.001046399				
C2=	1.09	]==>	0.000303394				
C3=	2.14	]==>	0.000594652				

		D	M	S
L1=	114.3836758	114.0	23.000	1.232964
L2=	138.2994188	138.0	17.000	57.90778
L3-=	107.3169053	107.0	19.000	0.859254
Closure	360.0000000	359.0	59.000	60.000

M_temp
23.021
17.965
19.014
60.000

Seconds become 0, minutes become 0 and degrees become 360.