RULES

1. This is the **version 3.1**. In case there are any corrections for the solutions of Exercise 3, we will post an updated version on our website. You can follow the changes in the exercises by the **Version History** section

Version History

v3.0 Solutions of Exercise 3 are released.

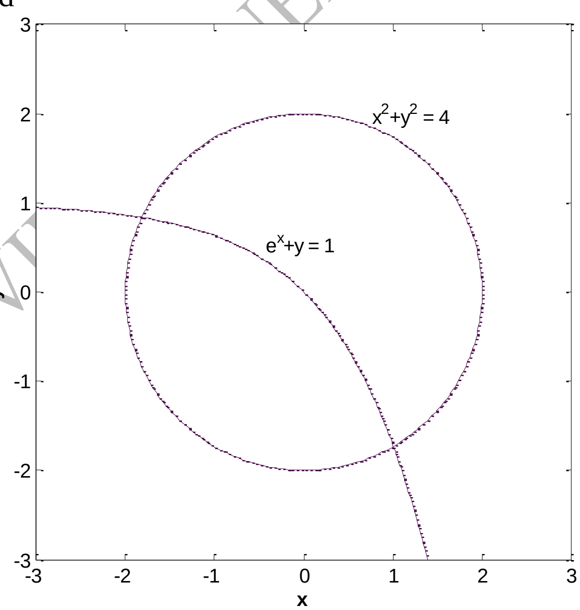
v3.1 In the solution of question 1 typing mistake **"Δx_k= - J^{-1}*x_k"** was changed to its true form **"Δx_k= - J^{-1}*F "**, results in the table is still same and true.

1.

$$x^2 + y^2 = 4$$
$$e^x + y = 1$$

Solve this system using

a. graphical method

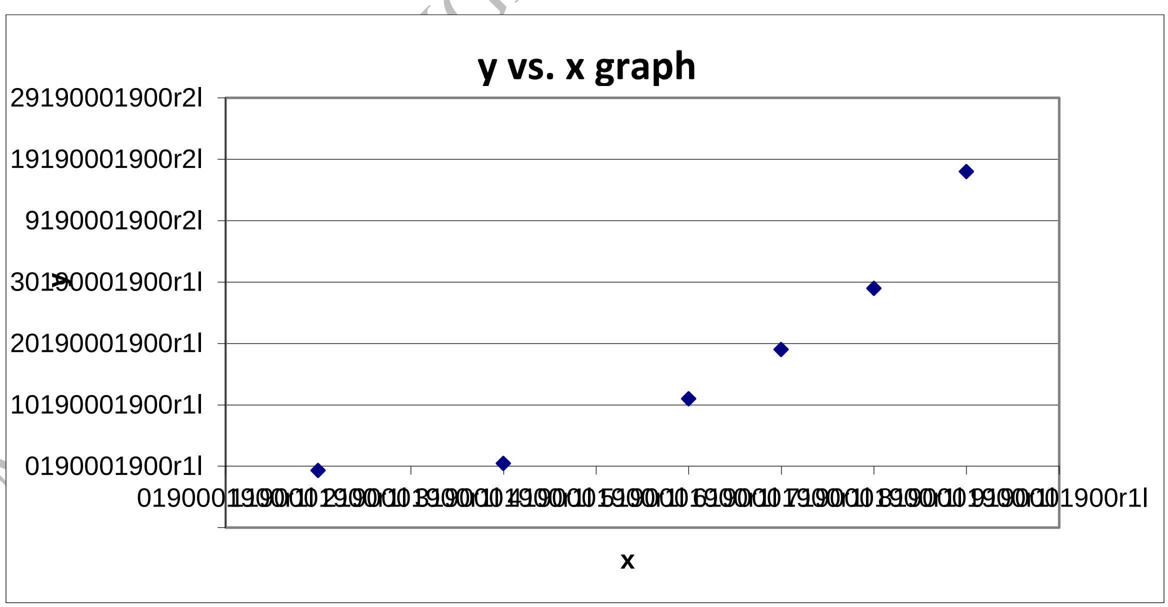


b. Newton-Jacobi method using $x_0 = 1$ and $y_0 = -1.7$, and error tolerance with respect to maximum norm as 10^{-4}.

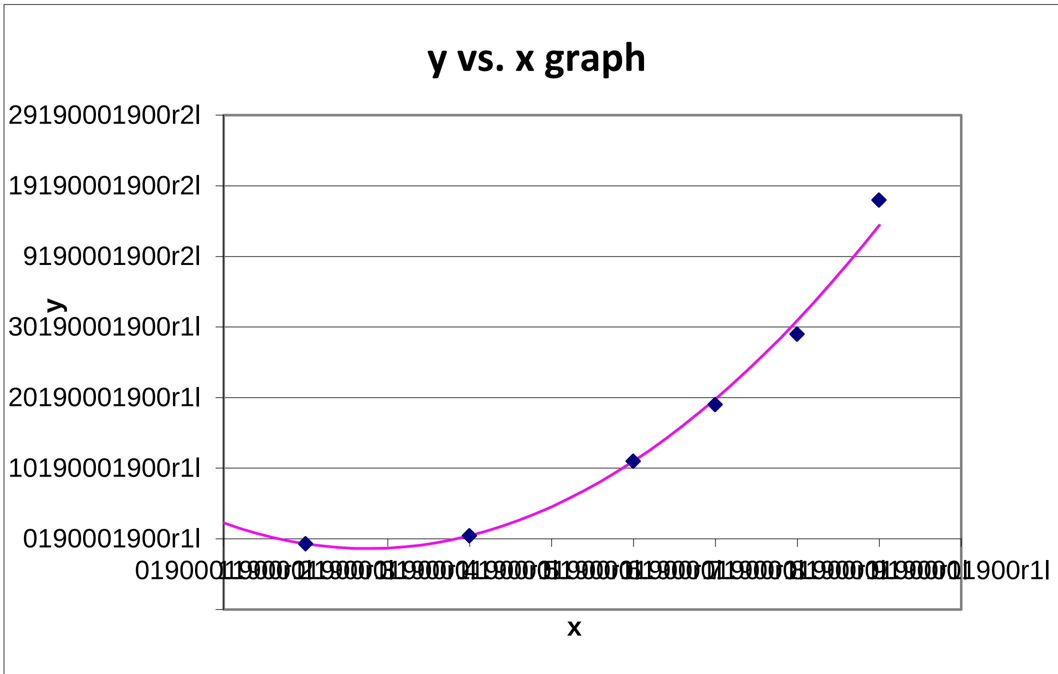
Iteration #	x_k	$f(x_k)$	J		J^{-1}		$\Delta x_k = -J^{-1} * F$	x_{k+1}	ε_{max}
1	1.0000000	-0.1100000	2.0000000	-3.4000000	0.0889509	0.3024330	0.0042556	1.0042556	2.98E-02
	-1.7000000	0.0182818	2.7182818	1.0000000	-0.2417936	0.1779018	-0.0298497	-1.7298497	
2	1.0042556	0.0009091	2.0085111	-3.4596993	0.0873129	0.3020765	-0.0000868	1.0041687	2.12E-04
	-1.7298497	0.0000246	2.7298743	1.0000000	-0.2383534	0.1753690	0.0002124	-1.7296373	
3	1.0041687	0.0000001	2.0083375	-3.4592746	0.0873294	0.3020962	0.0000000	1.0041687	1.07E-08
	-1.7296373	0.0000000	2.7296373	1.0000000	-0.2383775	0.1753868	0.0000000	-1.7296373	

2.

a.



b.



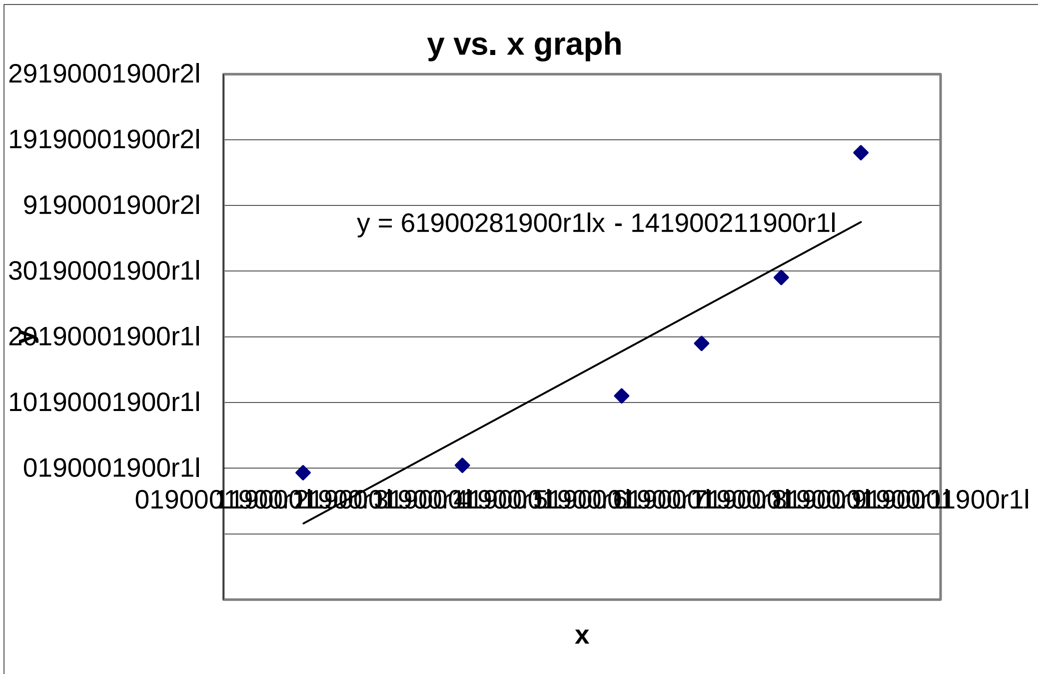
c.

x	y	y'	err %
1	-0,7	-0,7	0
6	19	19,8	4,0404
8	48	44,45	7,9865

d.

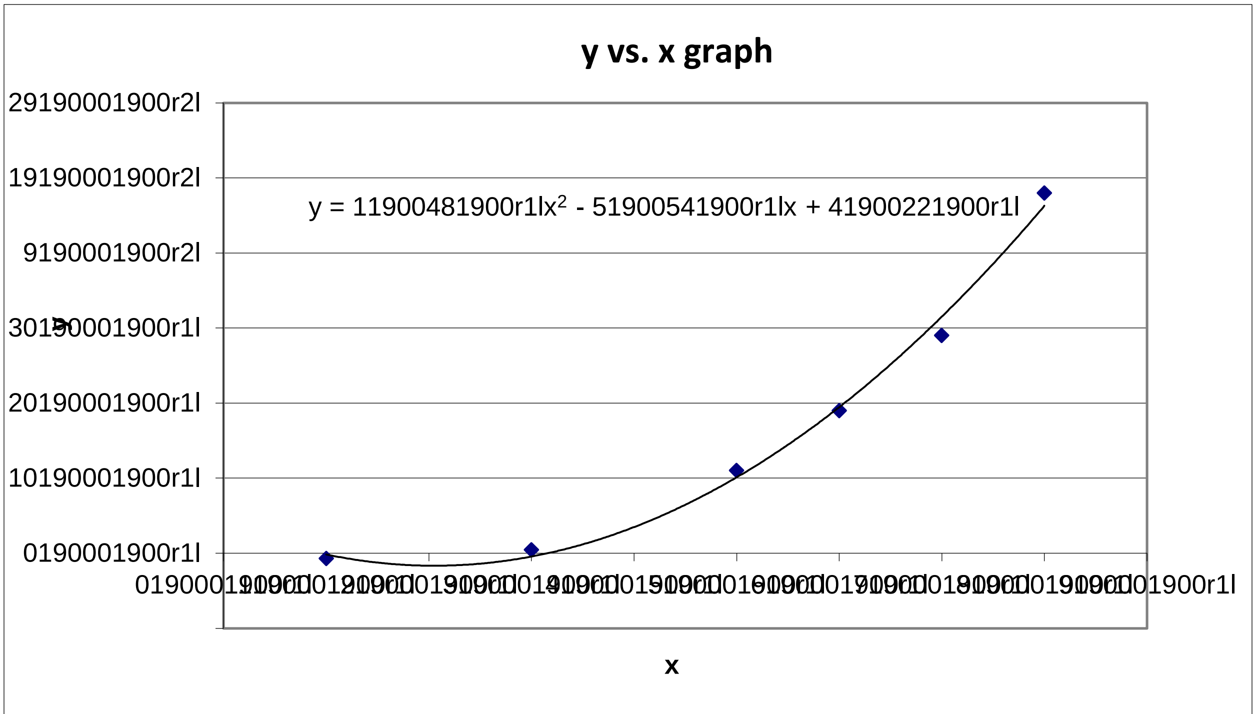
x	y'
3,6	2,628
9	60,3

e.



x	y	y'	diff	RMS
1	-0,7	-8,425	7,725	6,672406
3	0,45	4,685	-4,235	
5	11	17,795	-6,795	
6	19	24,35	-5,35	
7	29	30,905	-1,905	
8	48	37,46	10,54	

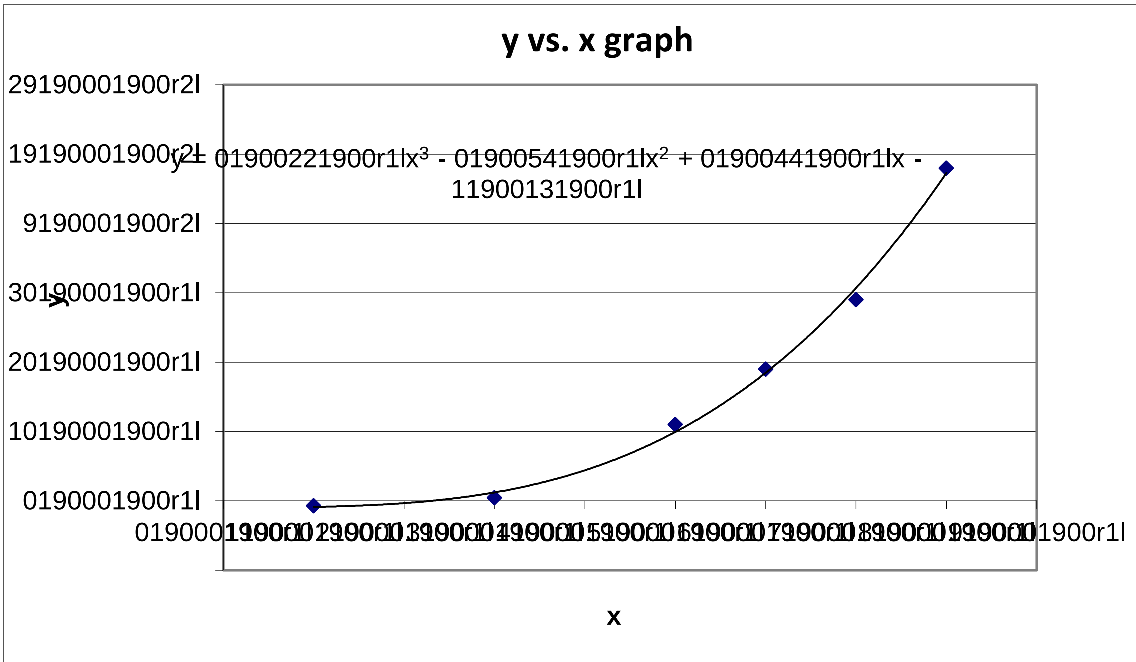
f.



x	y	y'	diff	RMS
1	-0,7	-0,167	-0,533	1,37641
3	0,45	-0,453	0,903	
5	11	10,101	0,899	
6	19	19,443	-0,443	
7	29	31,495	-2,495	
8	48	46,257	1,743	

x	y	y'
3,6	-0,7	1,575
9	0,45	63,729

g.



x	y	y'	diff	RMS
1	-0,7	-0,8881	0,1881	0,95043
3	0,45	1,2161	-0,7661	
5	11	9,9483	1,0517	
6	19	18,4919	0,5081	
7	29	30,7229	-1,7229	
8	48	47,3181	0,6819	

x	y	y'
3,6	-0,7	2,893465
9	0,45	68,9543

h. Cubic estimation worked better than the others and gave the smallest RMS error because of the nature of function.

i. Quadratic regression function works better than the Lagrange polynomial as the whole data points were considered while applying quadratic regression. However for Lagrange polynomial only the three data points given were used to plot the graph.