Lab 9

Problem 1:

Part a:
By central difference:

n	x(i)	Approximation
5	0.040000	1.074373
10	0.090000	1.167743
15	0.140000	1.261653
20	0.190000	1.356191
25	0.240000	1.451436
30	0.290000	1.547453
35	0.340000	1.644299
40	0.390000	1.742014
45	0.440000	1.840625
50	0.490000	1.940149
55	0.540000	2.040582
60	0.590000	2.141913
65	0.640000	2.244110
70	0.690000	2.347134
75	0.740000	2.450927
80	0.790000	2.555422
85	0.840000	2.660541
90	0.890000	2.766192
95	0.940000	2.872277
100	0.990000	2.978688

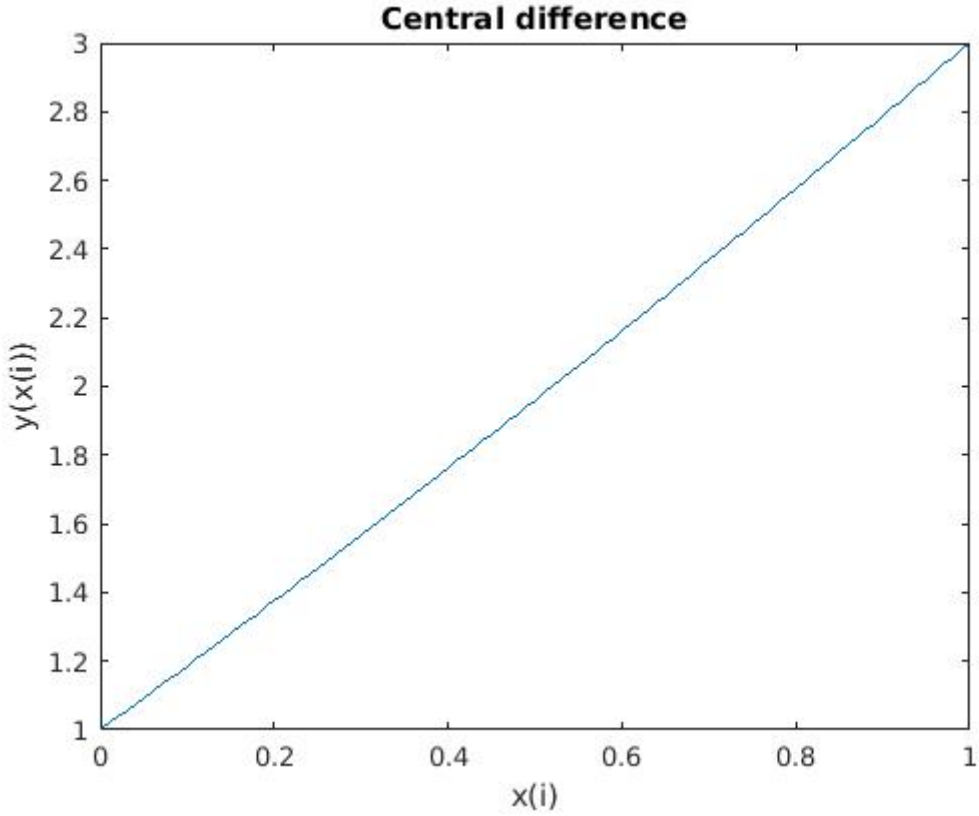
By forward difference:

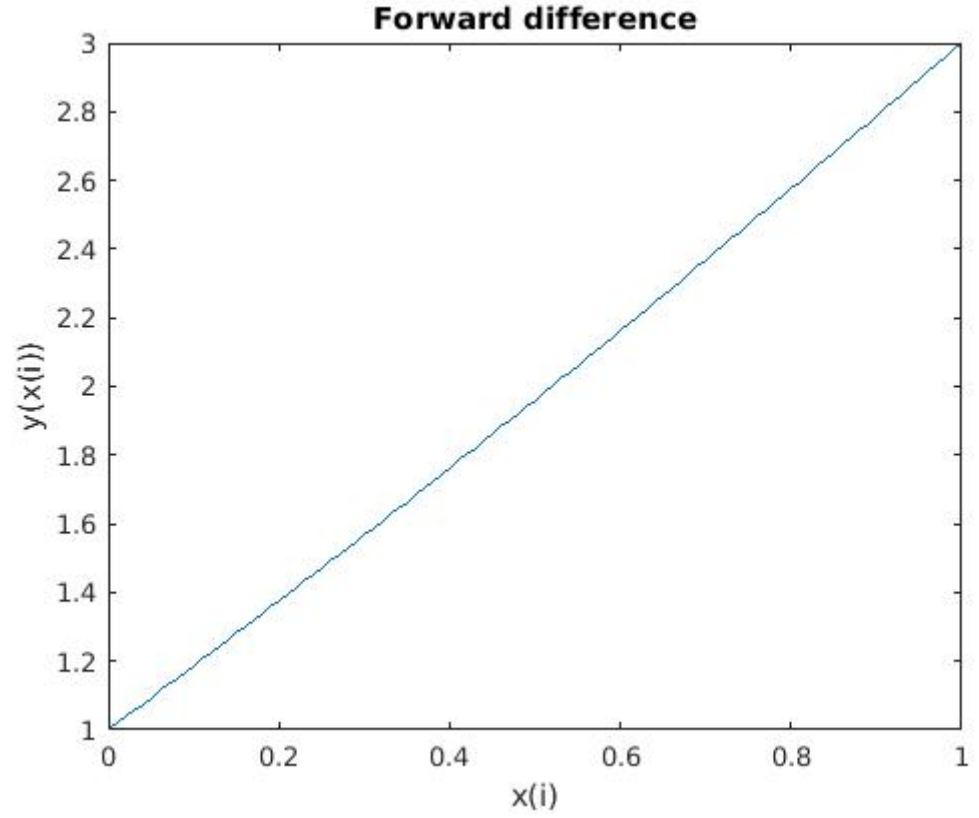
n	x(i)	Approximation
5	0.040000	1.074413
10	0.090000	1.167830
15	0.140000	1.261781
20	0.190000	1.356355
25	0.240000	1.451630
30	0.290000	1.547672
35	0.340000	1.644535
40	0.390000	1.742262
45	0.440000	1.840880
50	0.490000	1.940402
55	0.540000	2.040830
60	0.590000	2.142148
65	0.640000	2.244328

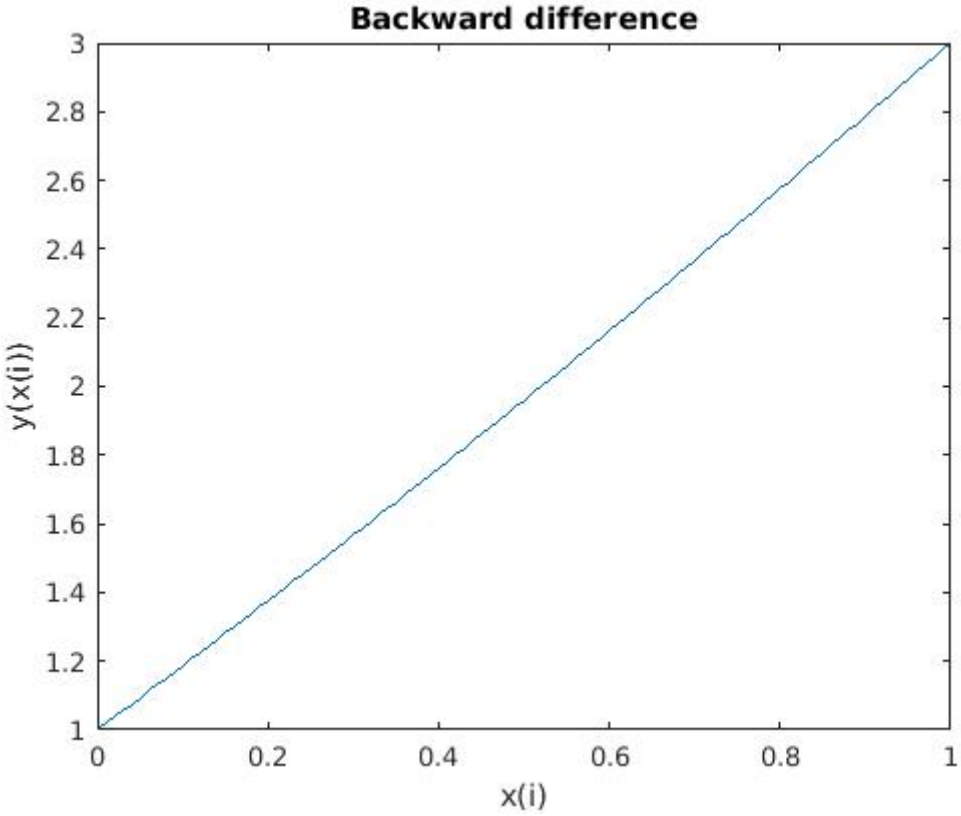
70	0.690000	2.347330
75	0.740000	2.451097
80	0.790000	2.555563
85	0.840000	2.660649
90	0.890000	2.766267
95	0.940000	2.872318
100	0.990000	2.978695

By backward difference:

n	x(i)	Approximation
5	0.040000	1.074332
10	0.090000	1.167655
15	0.140000	1.261523
20	0.190000	1.356025
25	0.240000	1.451239
30	0.290000	1.547232
35	0.340000	1.644059
40	0.390000	1.741762
45	0.440000	1.840368
50	0.490000	1.939892
55	0.540000	2.040332
60	0.590000	2.141675
65	0.640000	2.243890
70	0.690000	2.346936
75	0.740000	2.450755
80	0.790000	2.555280
85	0.840000	2.660431
90	0.890000	2.766116
95	0.940000	2.872236
100	0.990000	2.978682


Central difference
y(x(i))
x(i)
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0
0.2
0.4
0.6
0.8
1


Forward difference
y(x(i))
x(i)
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0
0.2
0.4
0.6
0.8
1



Part b:

By central difference:

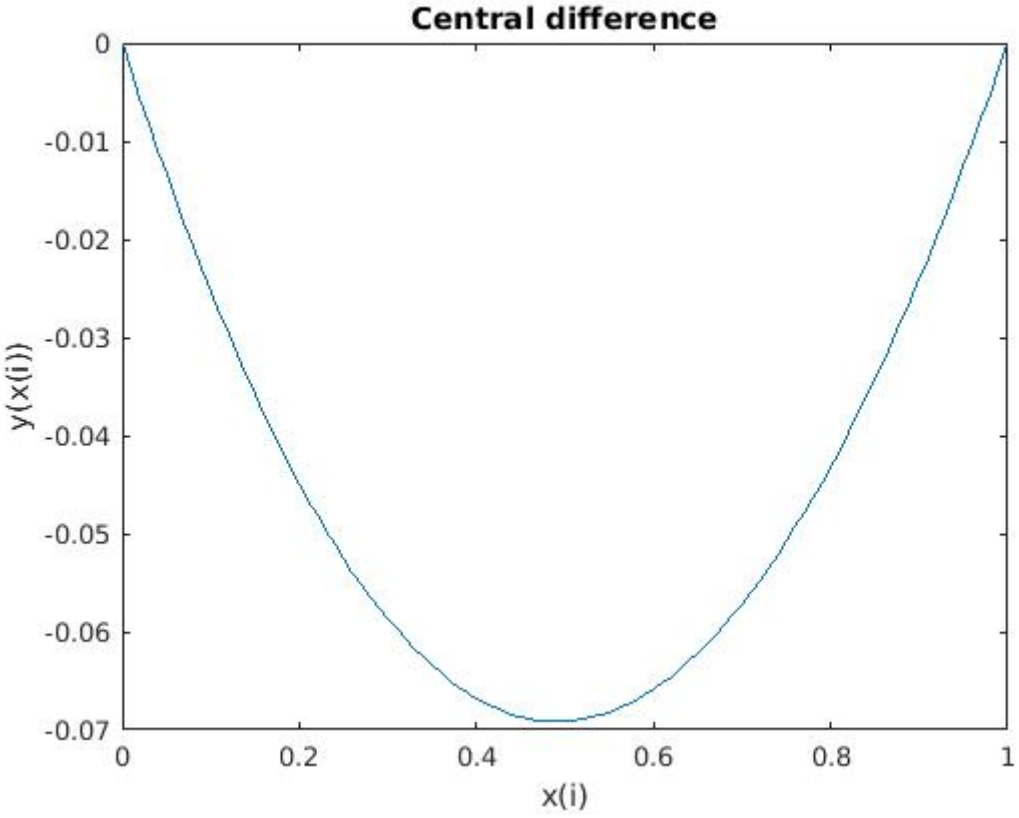
n	x(i)	Approximation
5	0.040000	-0.010817
10	0.090000	-0.023057
15	0.140000	-0.033862
20	0.190000	-0.043224
25	0.240000	-0.051140
30	0.290000	-0.057609
35	0.340000	-0.062635
40	0.390000	-0.066223
45	0.440000	-0.068384
50	0.490000	-0.069129
55	0.540000	-0.068472
60	0.590000	-0.066430
65	0.640000	-0.063019
70	0.690000	-0.058260
75	0.740000	-0.052173
80	0.790000	-0.044780
85	0.840000	-0.036104
90	0.890000	-0.026169
95	0.940000	-0.014998
100	0.990000	-0.002619

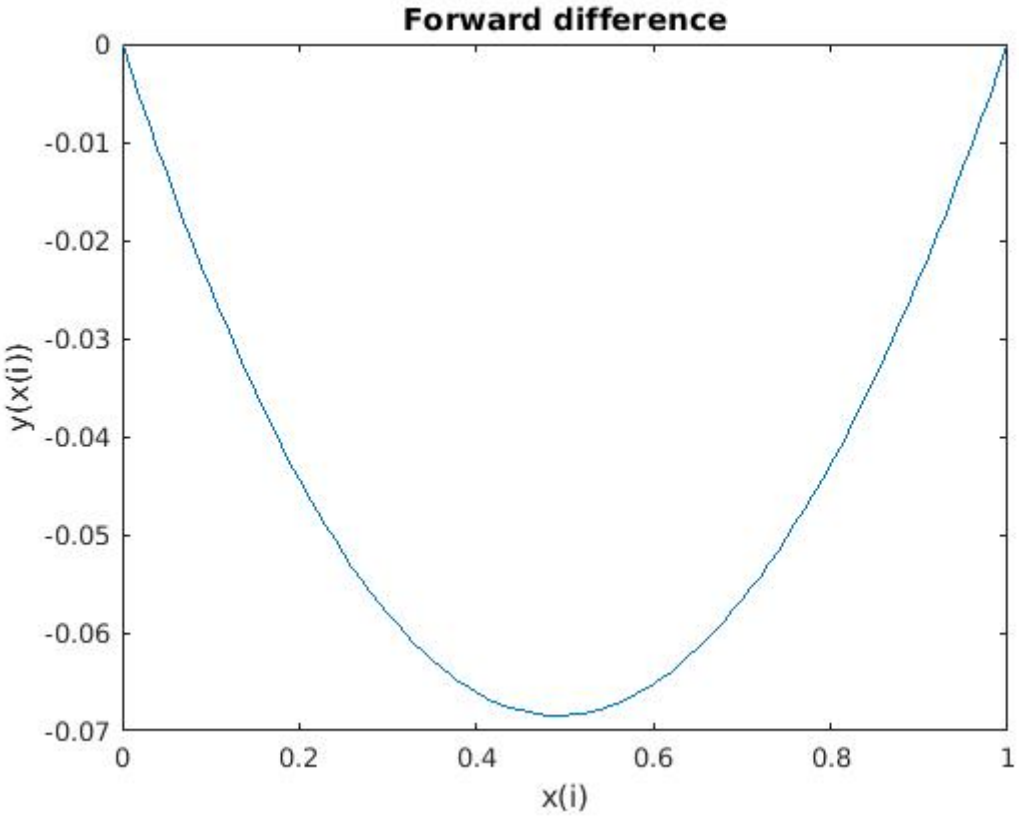
By forward difference:

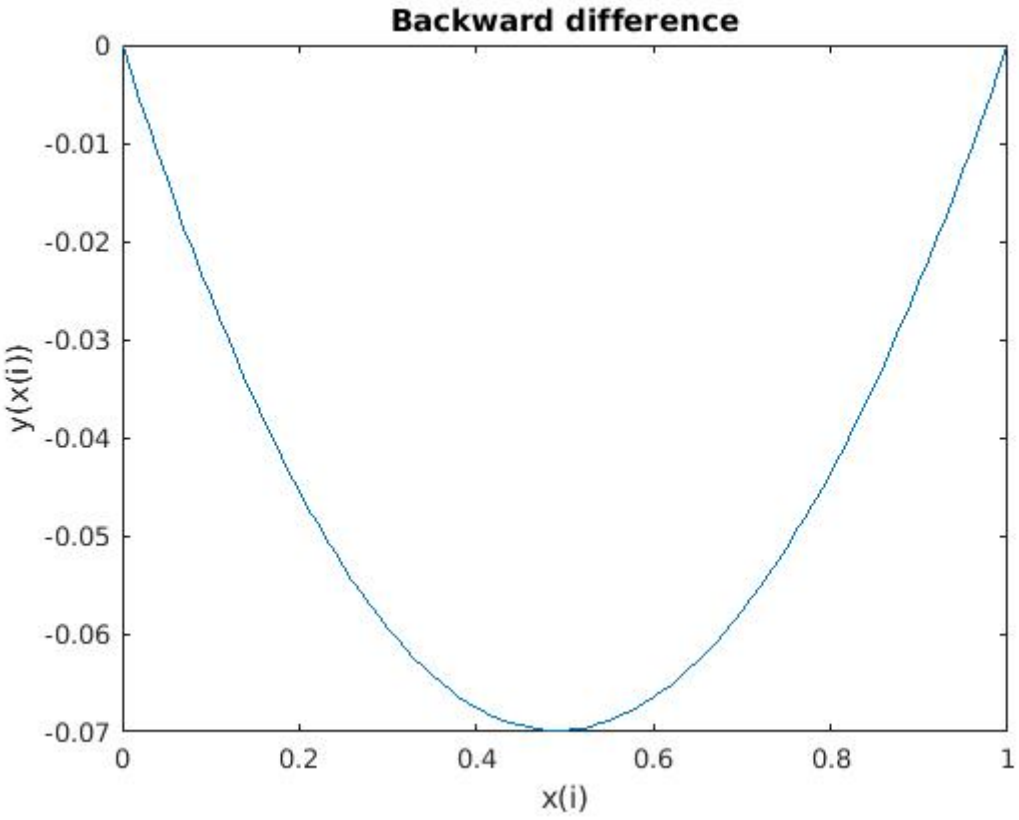
n	x(i)	Approximation
5	0.040000	-0.010669
10	0.090000	-0.022752
15	0.140000	-0.033429
20	0.190000	-0.042691
25	0.240000	-0.050530
30	0.290000	-0.056944
35	0.340000	-0.061936
40	0.390000	-0.065509
45	0.440000	-0.067670
50	0.490000	-0.068431
55	0.540000	-0.067804
60	0.590000	-0.065802
65	0.640000	-0.062443
70	0.690000	-0.057745
75	0.740000	-0.051727
80	0.790000	-0.044409
85	0.840000	-0.035815
90	0.890000	-0.025966
95	0.940000	-0.014886
100	0.990000	-0.002600

By backward difference:

n	x(i)	Approximation
5	0.040000	-0.010968
10	0.090000	-0.023369
15	0.140000	-0.034305
20	0.190000	-0.043770
25	0.240000	-0.051764
30	0.290000	-0.058288
35	0.340000	-0.063348
40	0.390000	-0.066952
45	0.440000	-0.069112
50	0.490000	-0.069840
55	0.540000	-0.069153
60	0.590000	-0.067068
65	0.640000	-0.063605
70	0.690000	-0.058784
75	0.740000	-0.052626
80	0.790000	-0.045156
85	0.840000	-0.036397
90	0.890000	-0.026374
95	0.940000	-0.015112
100	0.990000	-0.002638


Central difference
0
-0.01
-0.02
-0.03
-0.04
-0.05
-0.06
-0.07
y(x(i))
0
0.2
0.4
0.6
0.8
1
x(i)


Forward difference
0
-0.01
-0.02
-0.03
-0.04
-0.05
-0.06
-0.07
y(x(i))
0
0.2
0.4
0.6
0.8
1
x(i)

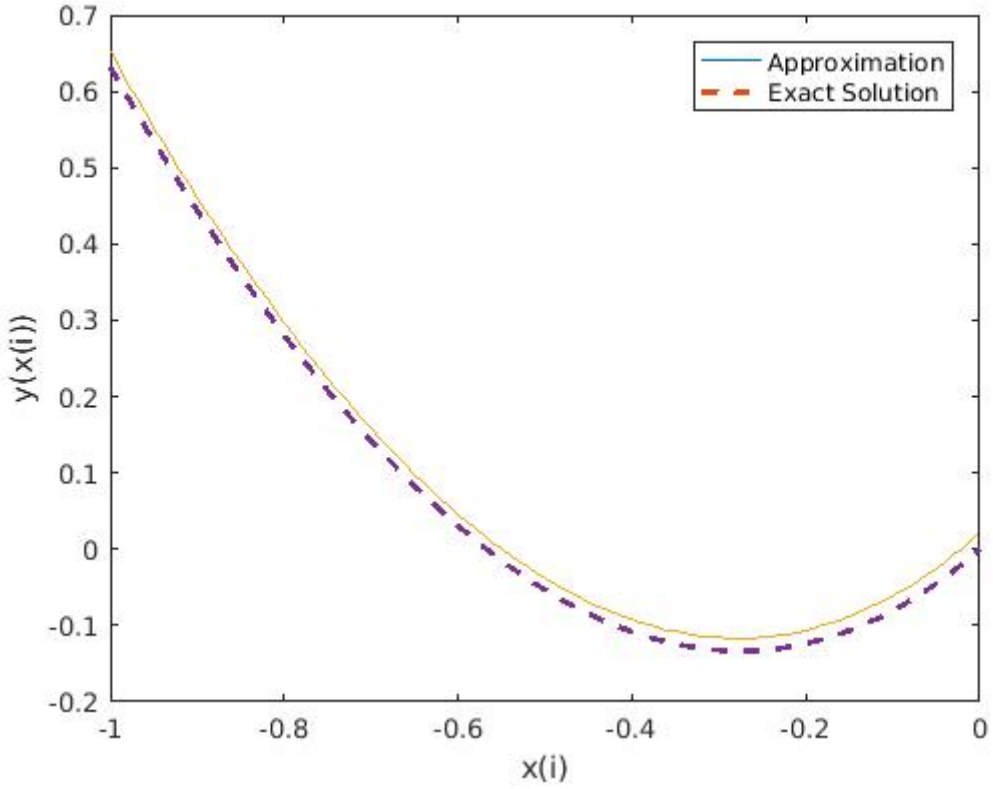


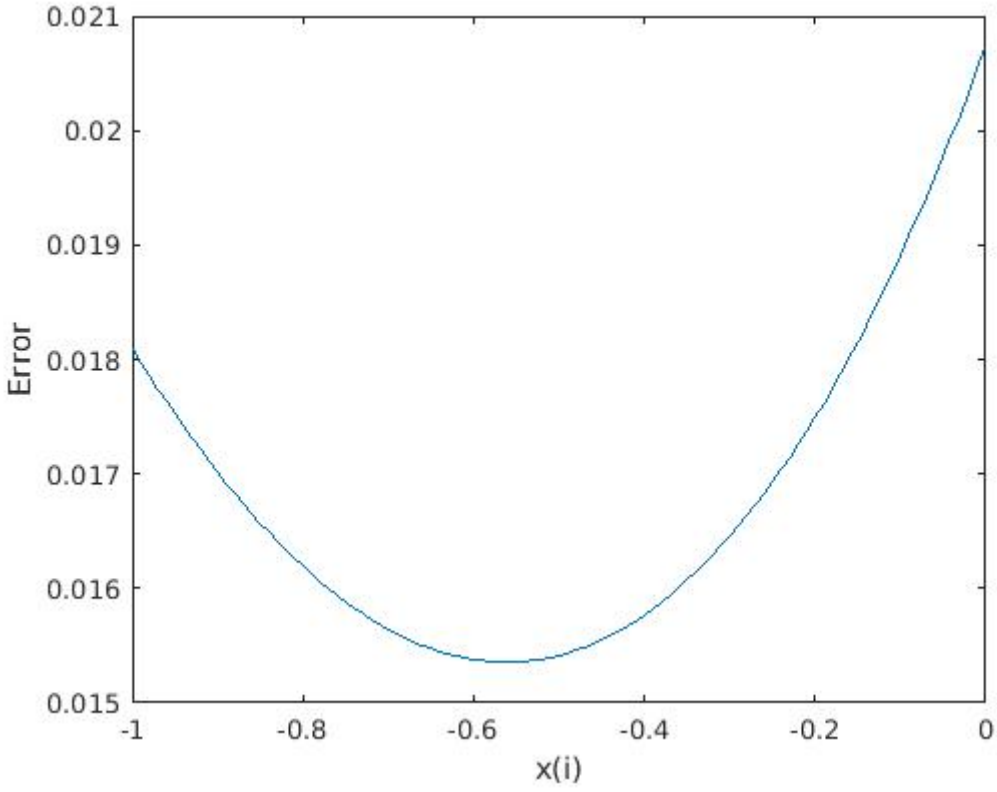
Problem 2:

Part a)

x	Approx	Exact	Error
-0.960000	0.571652	0.554023	1.762894e-02
-0.910000	0.478913	0.461803	1.711035e-02
-0.860000	0.392336	0.375681	1.665516e-02
-0.810000	0.312030	0.295765	1.626507e-02
-0.760000	0.238115	0.222174	1.594186e-02
-0.710000	0.170720	0.155033	1.568738e-02
-0.660000	0.109982	0.094478	1.550355e-02
-0.610000	0.056048	0.040656	1.539236e-02
-0.560000	0.009079	-0.006277	1.535587e-02
-0.510000	-0.030757	-0.046153	1.539621e-02
-0.460000	-0.063275	-0.078790	1.551554e-02
-0.410000	-0.088280	-0.103997	1.571611e-02
-0.360000	-0.105563	-0.121563	1.600020e-02
-0.310000	-0.114898	-0.131269	1.637015e-02
-0.260000	-0.116045	-0.132873	1.682834e-02
-0.210000	-0.108746	-0.126123	1.737717e-02
-0.160000	-0.092724	-0.110743	1.801909e-02

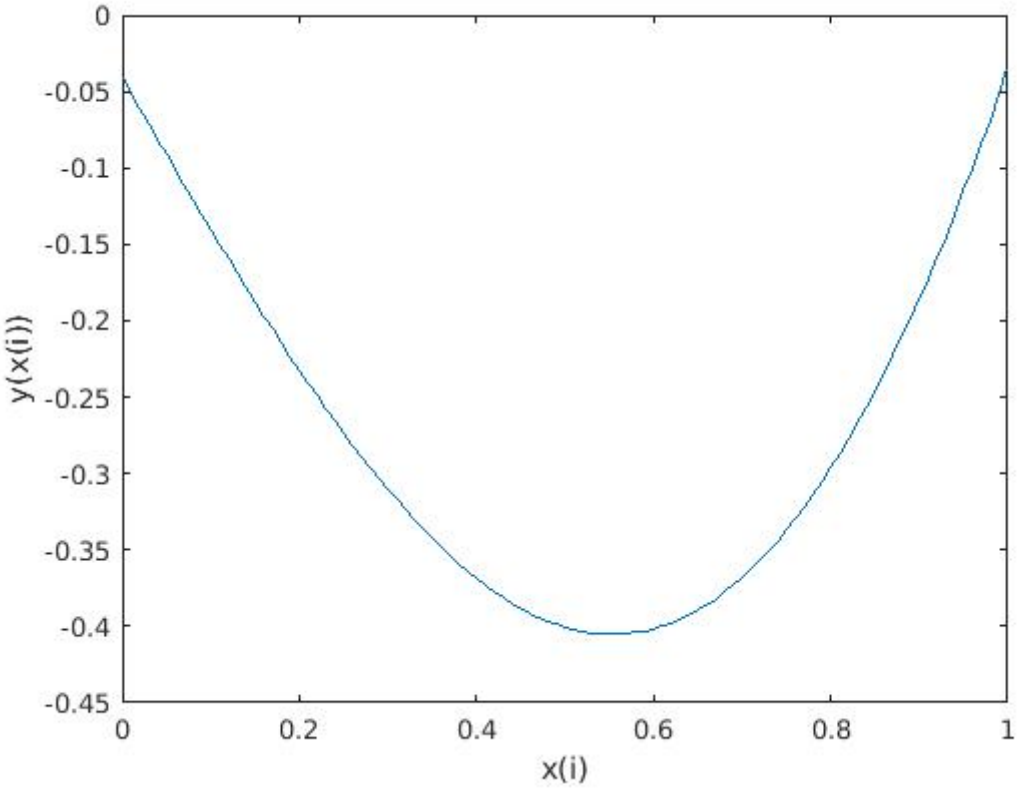
-0.110000 -0.067685 -0.086442 1.875658e-02
-0.060000 -0.033314 -0.052906 1.959211e-02
-0.010000 0.010728 -0.009800 2.052819e-02





Part b)

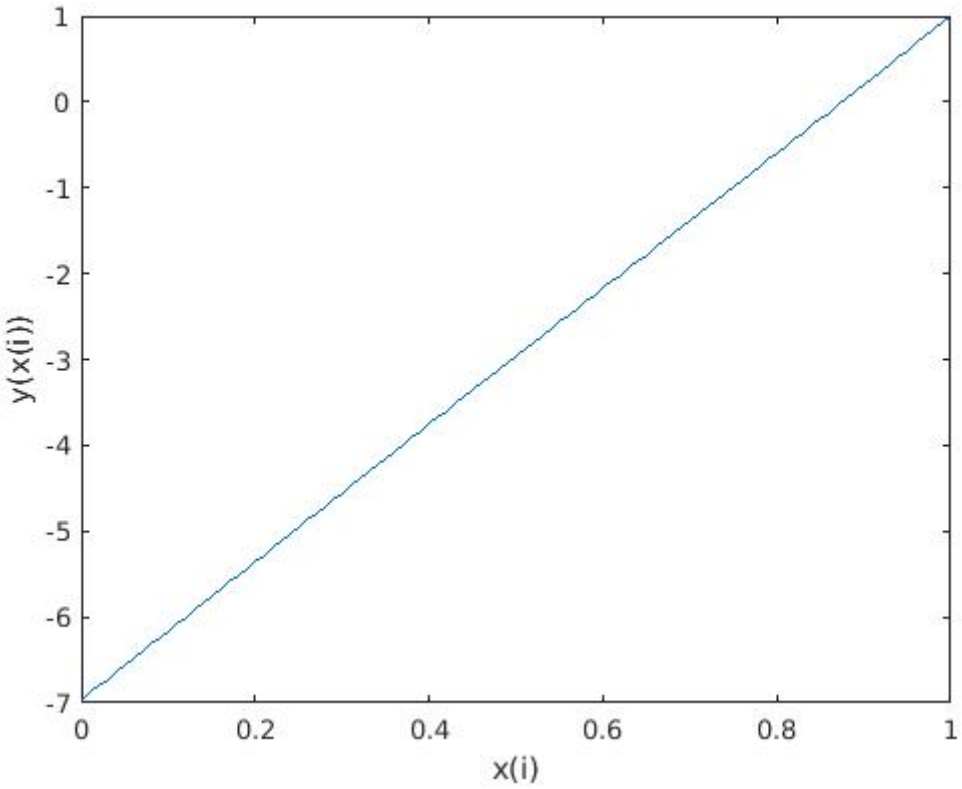
x	Approx
0.040000	-0.081519
0.090000	-0.130745
0.140000	-0.178395
0.190000	-0.223605
0.240000	-0.265532
0.290000	-0.303357
0.340000	-0.336292
0.390000	-0.363585
0.440000	-0.384527
0.490000	-0.398459
0.540000	-0.404776
0.590000	-0.402930
0.640000	-0.392439
0.690000	-0.372889
0.740000	-0.343939
0.790000	-0.305325
0.840000	-0.256863
0.890000	-0.198450
0.940000	-0.130071
0.990000	-0.051798



Problem 3:

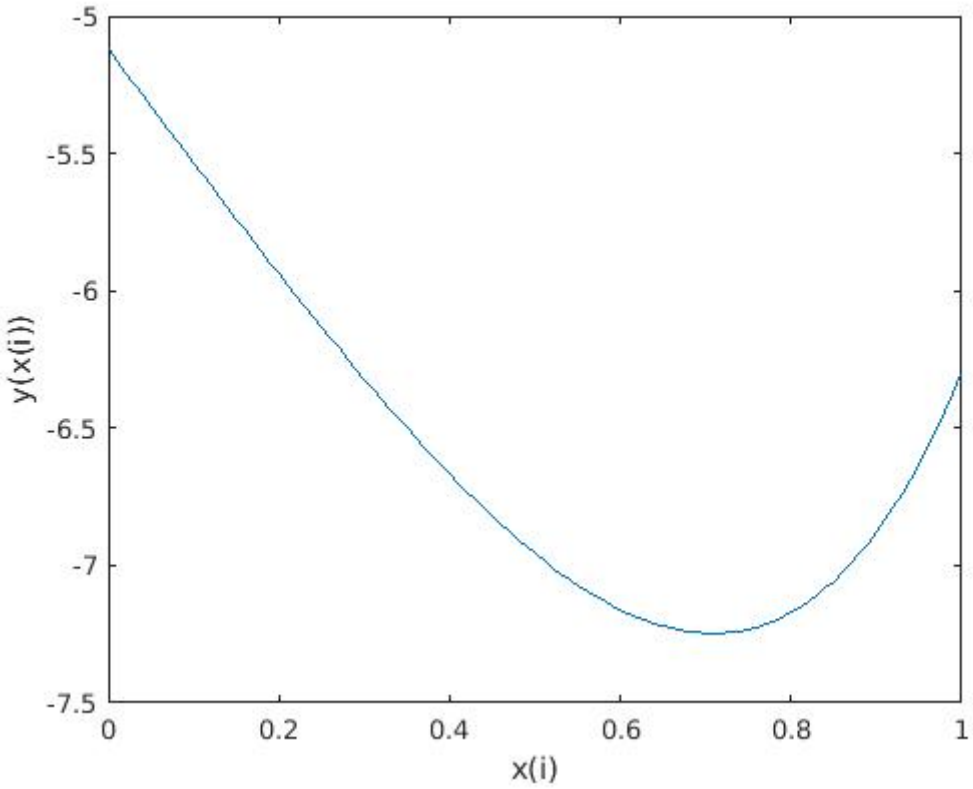
Part a)

n	x(i)	Approximation
5	0.040000	-6.642942
10	0.090000	-6.242569
15	0.140000	-5.841092
20	0.190000	-5.439152
25	0.240000	-5.037287
30	0.290000	-4.635937
35	0.340000	-4.235440
40	0.390000	-3.836035
45	0.440000	-3.437862
50	0.490000	-3.040963
55	0.540000	-2.645282
60	0.590000	-2.250664
65	0.640000	-1.856858
70	0.690000	-1.463515
75	0.740000	-1.070188
80	0.790000	-0.676334
85	0.840000	-0.281307
90	0.890000	0.115637
95	0.940000	0.515346
100	0.990000	0.918776



Part b)

n	x(i)	Approximation
5	0.040000	-5.288170
10	0.090000	-5.493765
15	0.140000	-5.697615
20	0.190000	-5.898340
25	0.240000	-6.094350
30	0.290000	-6.283826
35	0.340000	-6.464688
40	0.390000	-6.634568
45	0.440000	-6.790770
50	0.490000	-6.930239
55	0.540000	-7.049516
60	0.590000	-7.144688
65	0.640000	-7.211341
70	0.690000	-7.244499
75	0.740000	-7.238564
80	0.790000	-7.187240
85	0.840000	-7.083457
90	0.890000	-6.919286
95	0.940000	-6.685836
100	0.990000	-6.373156


-5
-5.5
-6
-6.5
-7
-7.5
y(x(i))
0
0.2
0.4
0.6
0.8
1
x(i)