

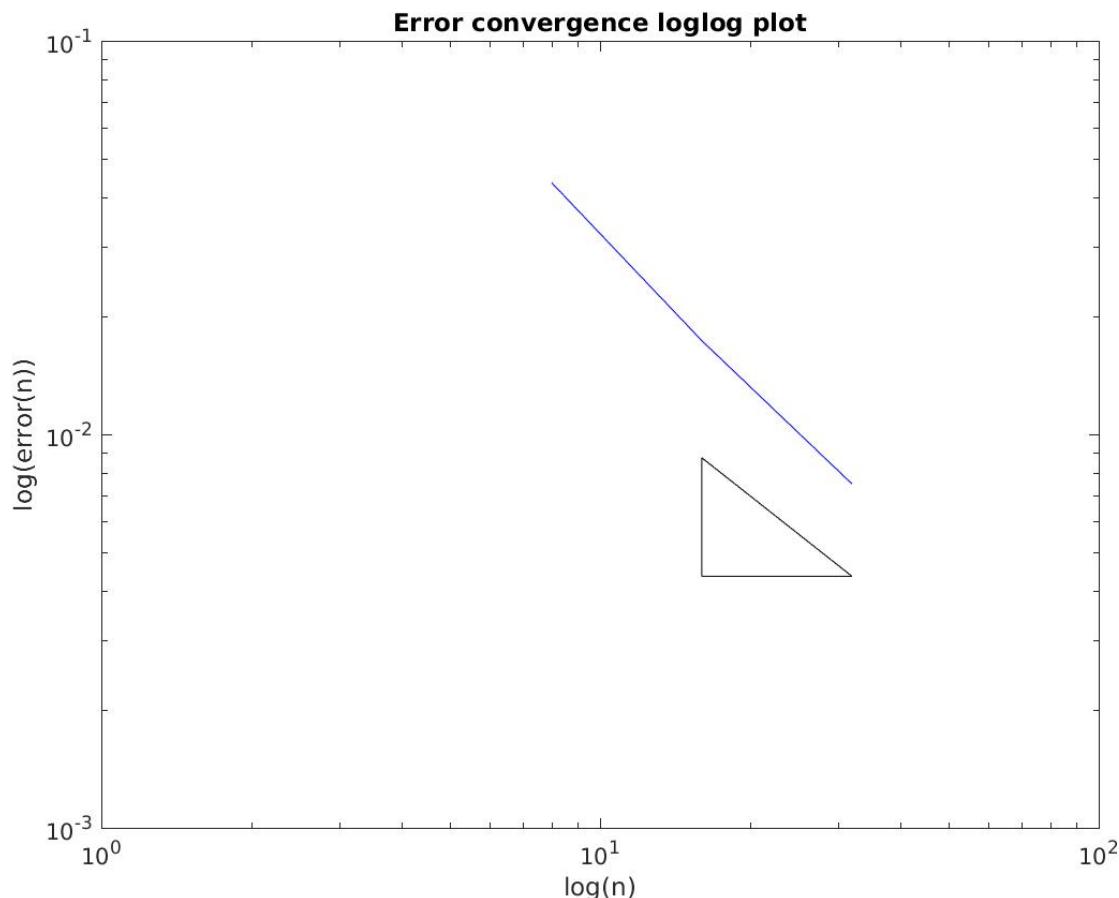
MA 322: Scientific Computing
LAB 10 Report
Abheek Ghosh - 140123047

NOTE: The right angled triangle is for comparison of the slope. It has been made with the hypotaneuse slope as expected for respective methods.

Question 1 (FTCS)

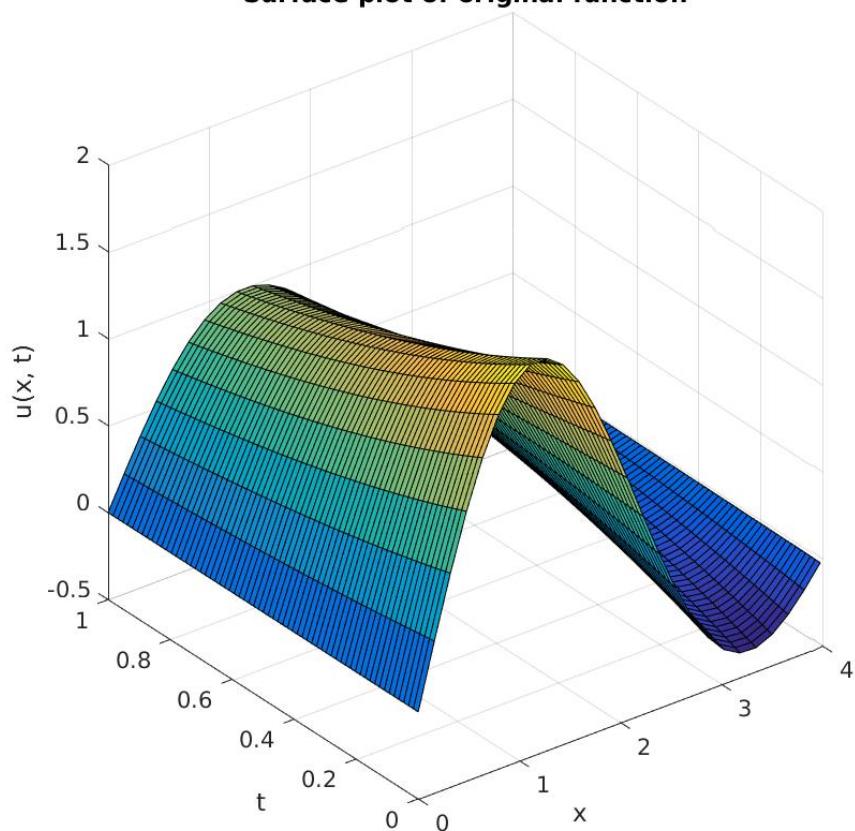
(A)

N	Error	Order
8	4.358656e-02	1.333256
16	1.729826e-02	1.208817
32	7.483632e-03	1.000000



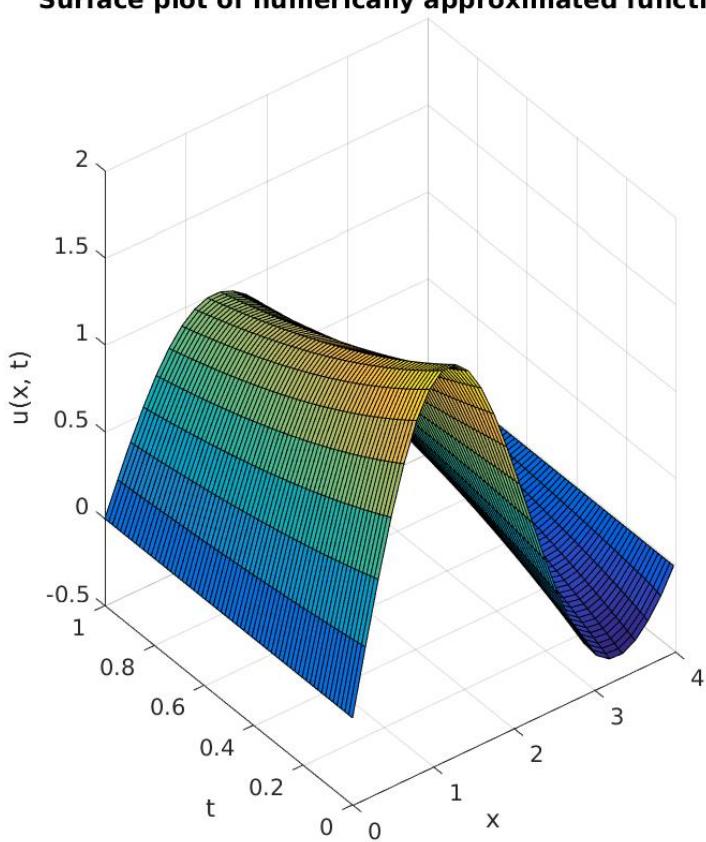
Surface plot of original function

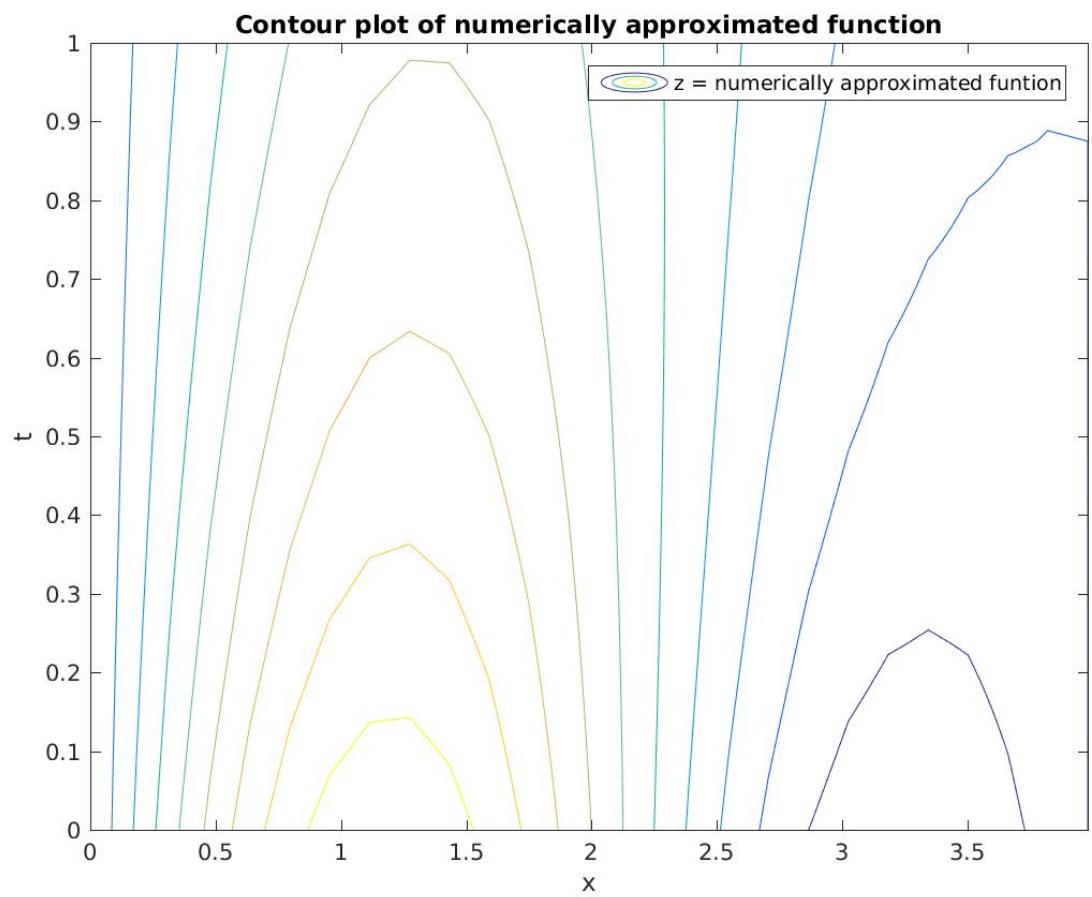
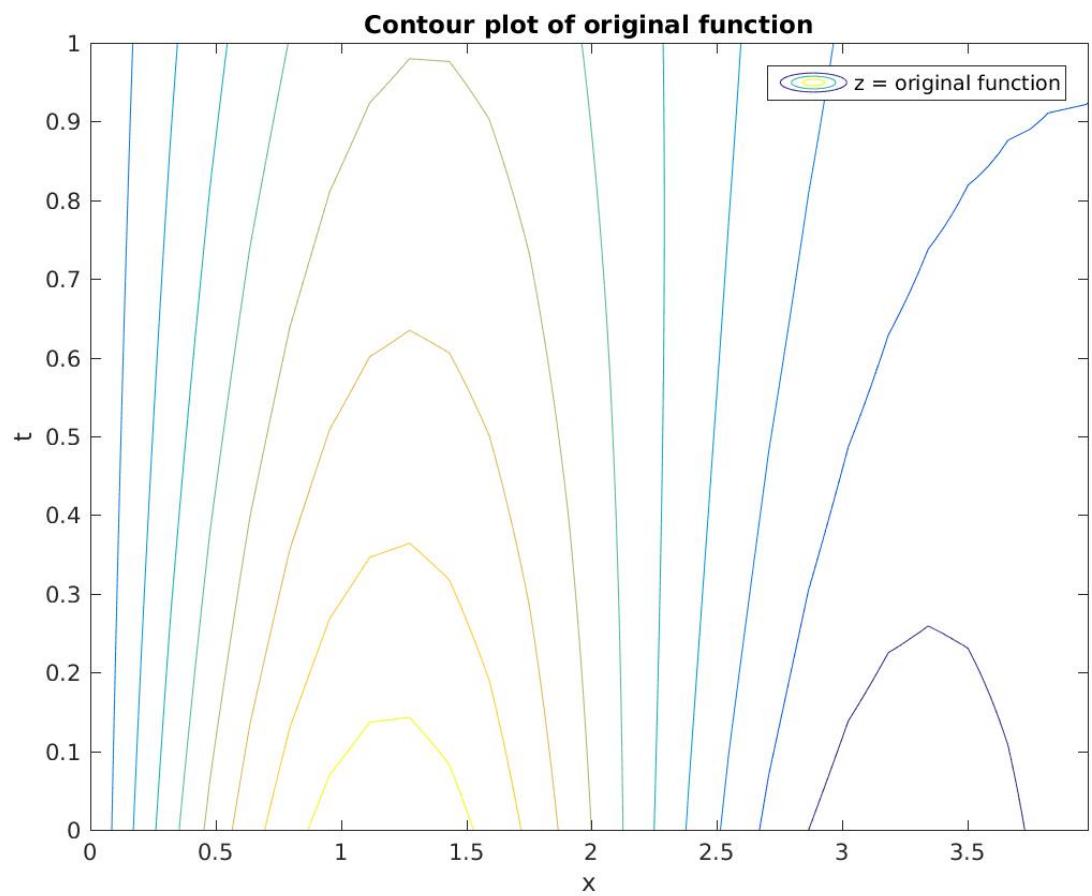
 z = original function

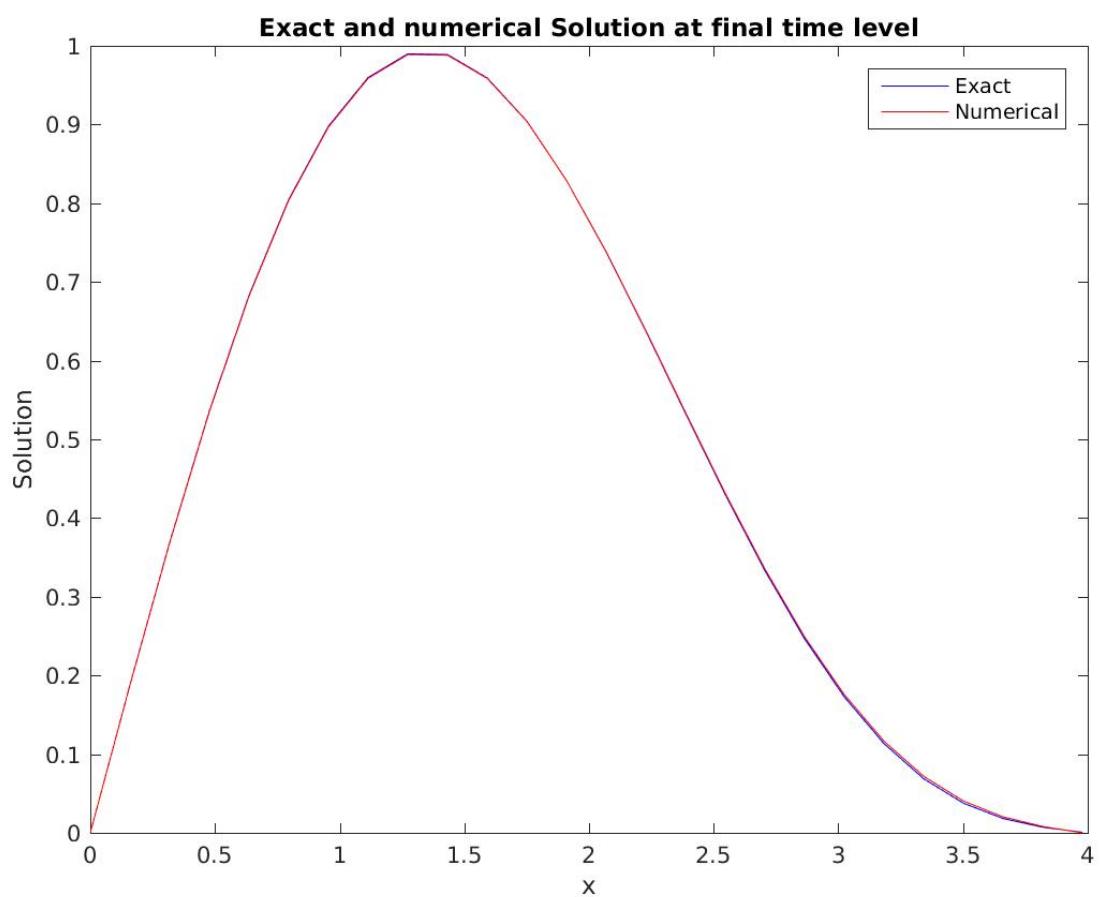


Surface plot of numerically approximated function

 z = numerically approximated funtion

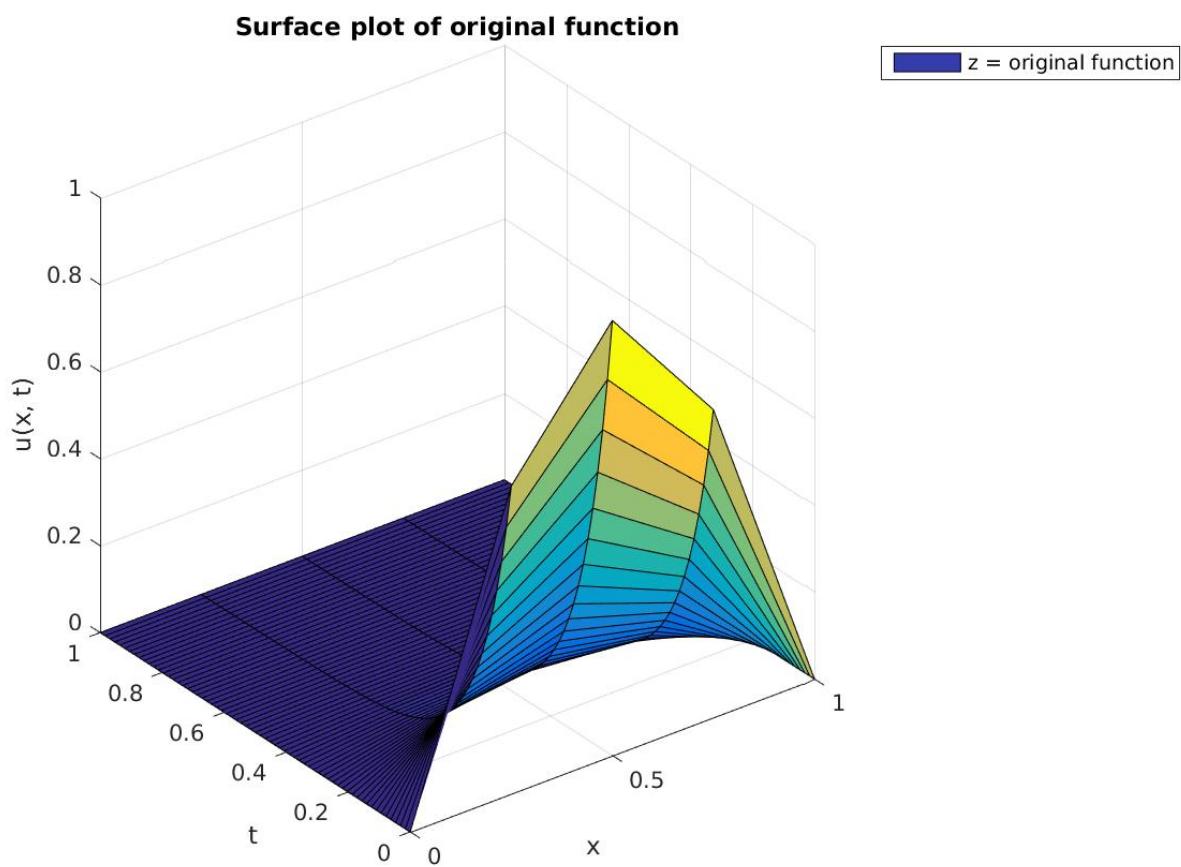
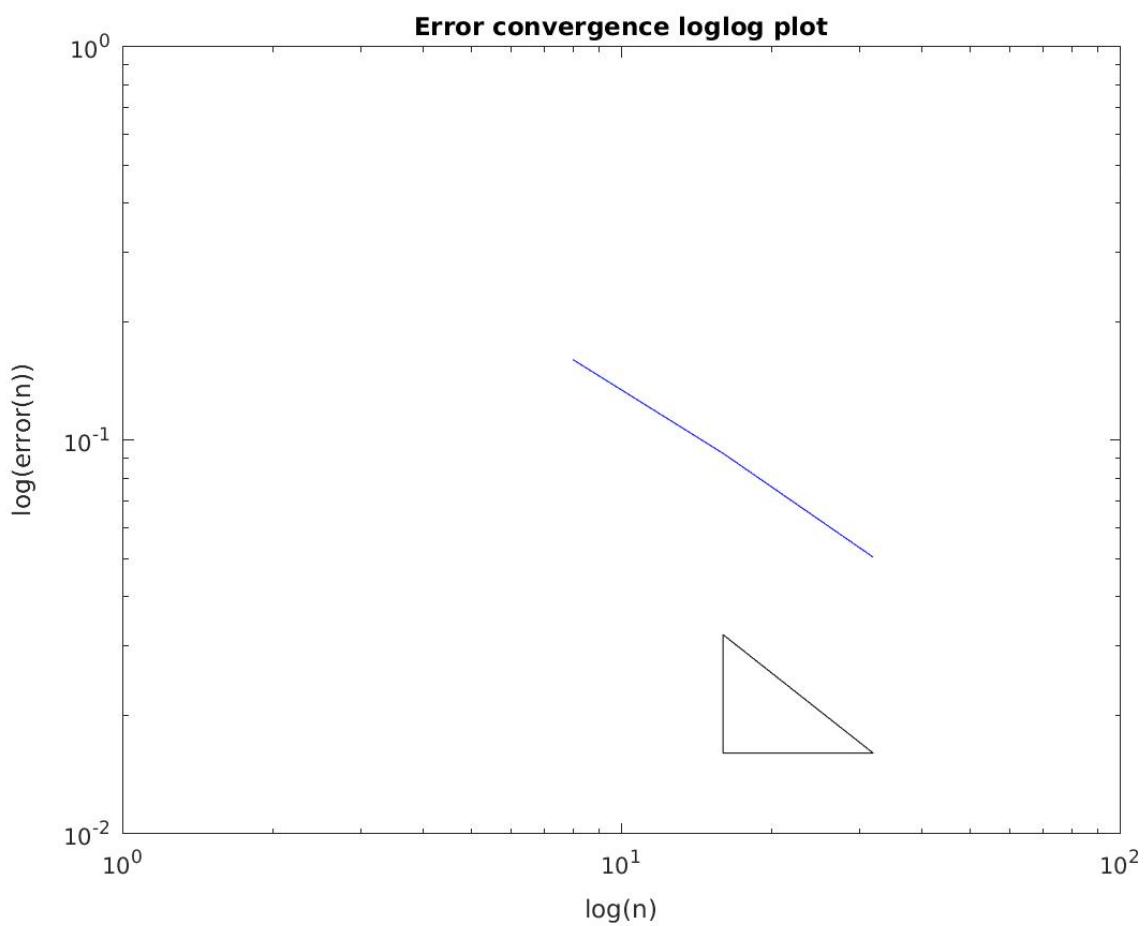




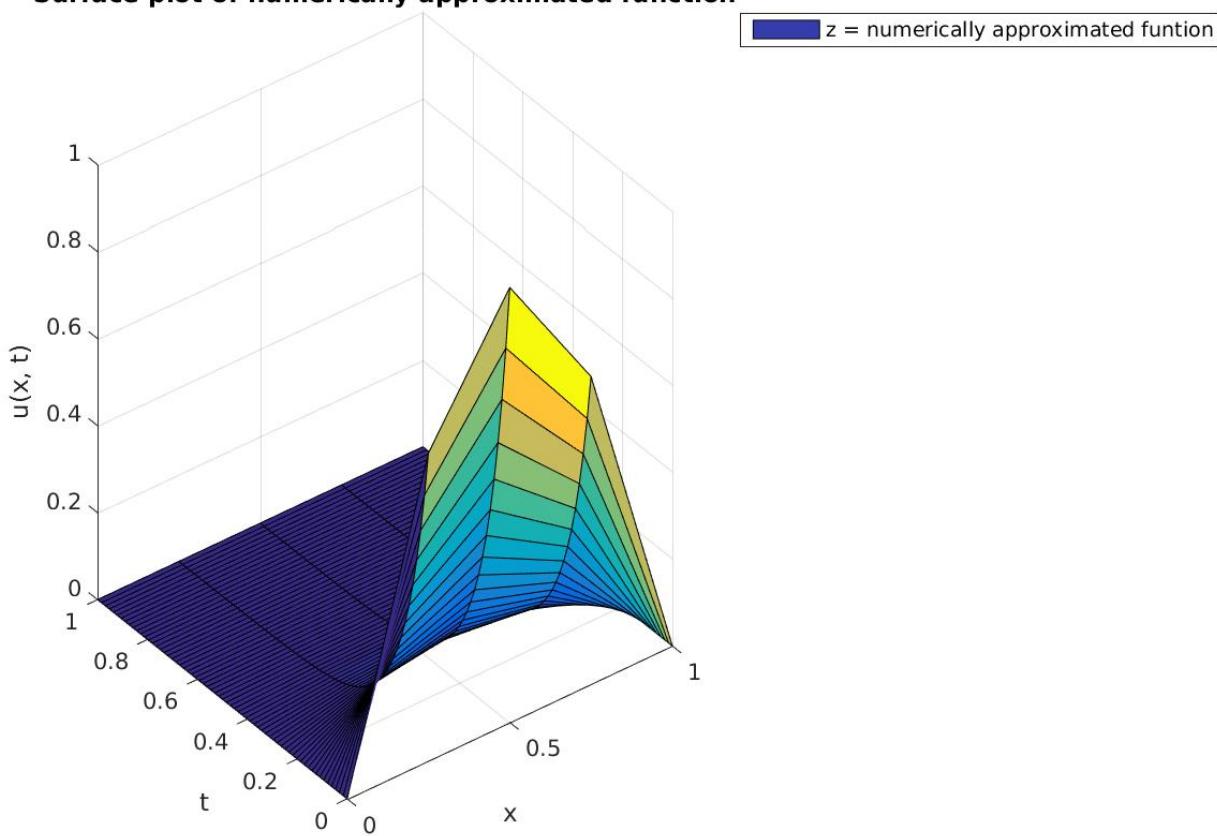


(B)

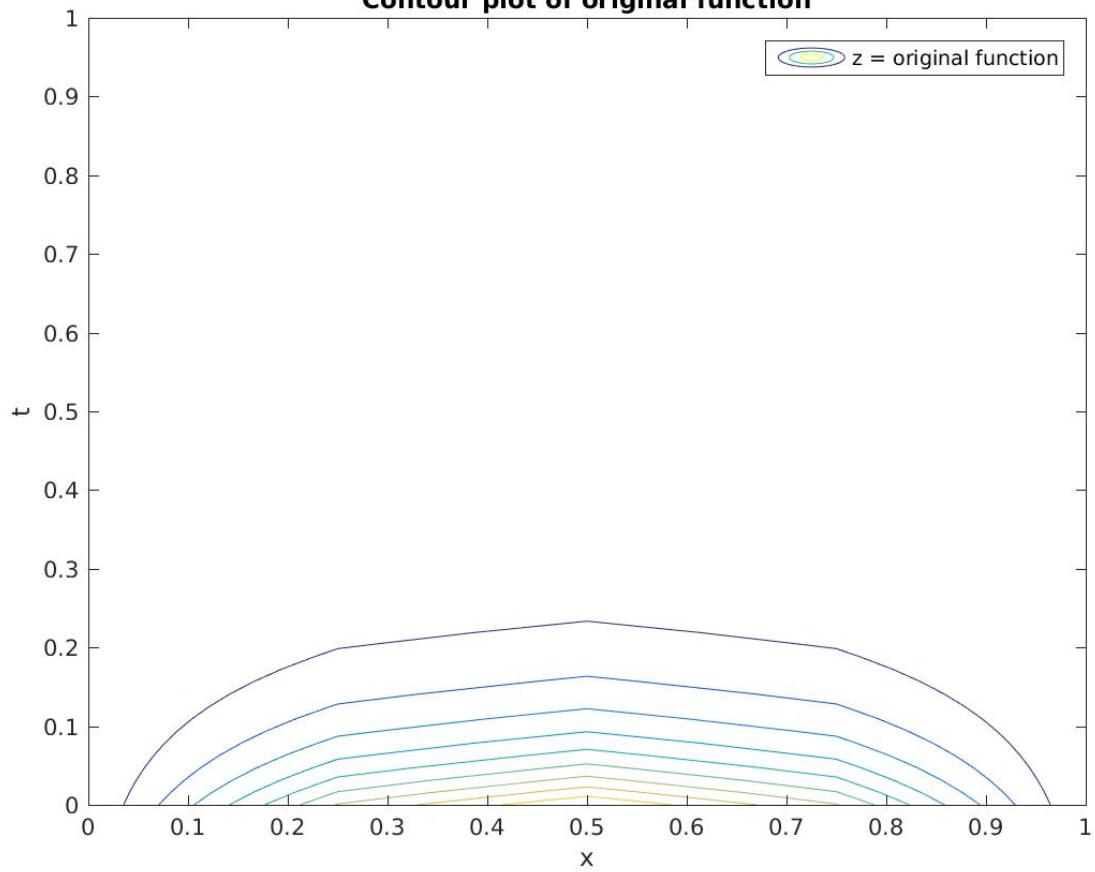
N	Error	Order
8	1.596584e-01	0.791355
16	9.225082e-02	0.876112
32	5.026135e-02	1.000000

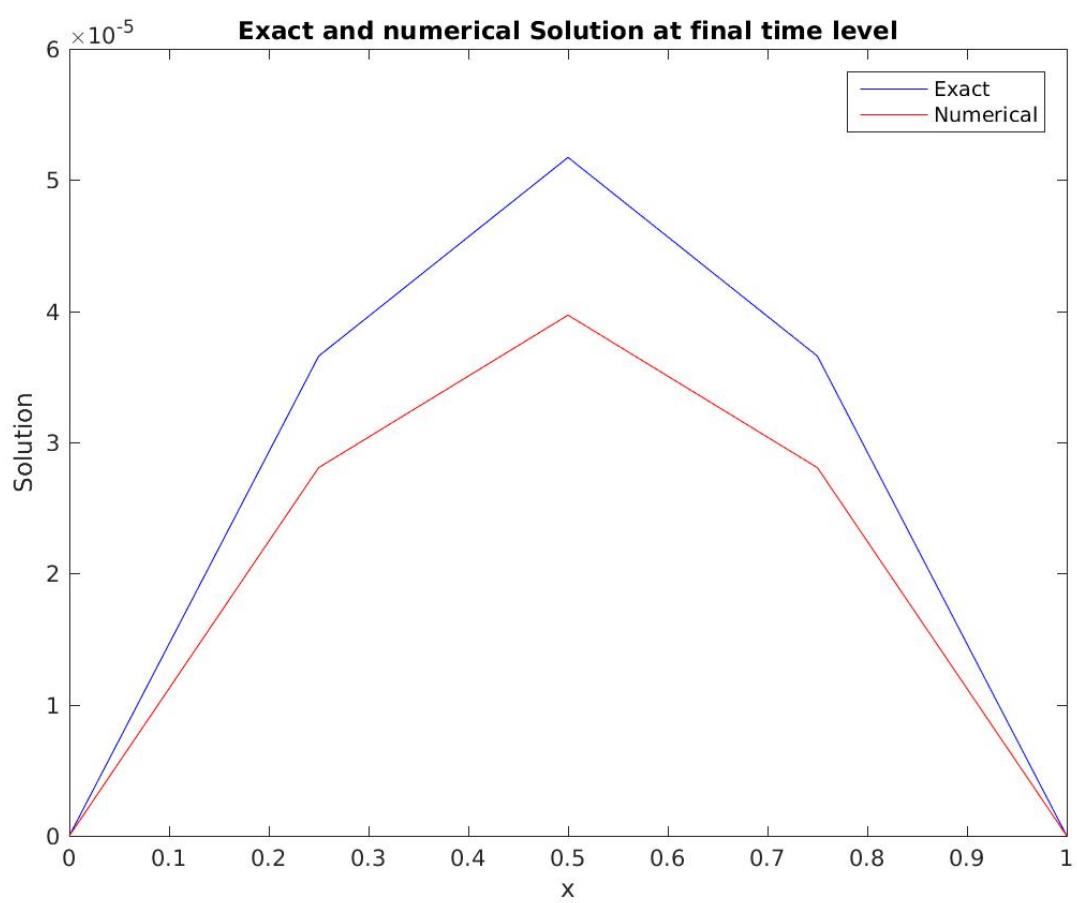
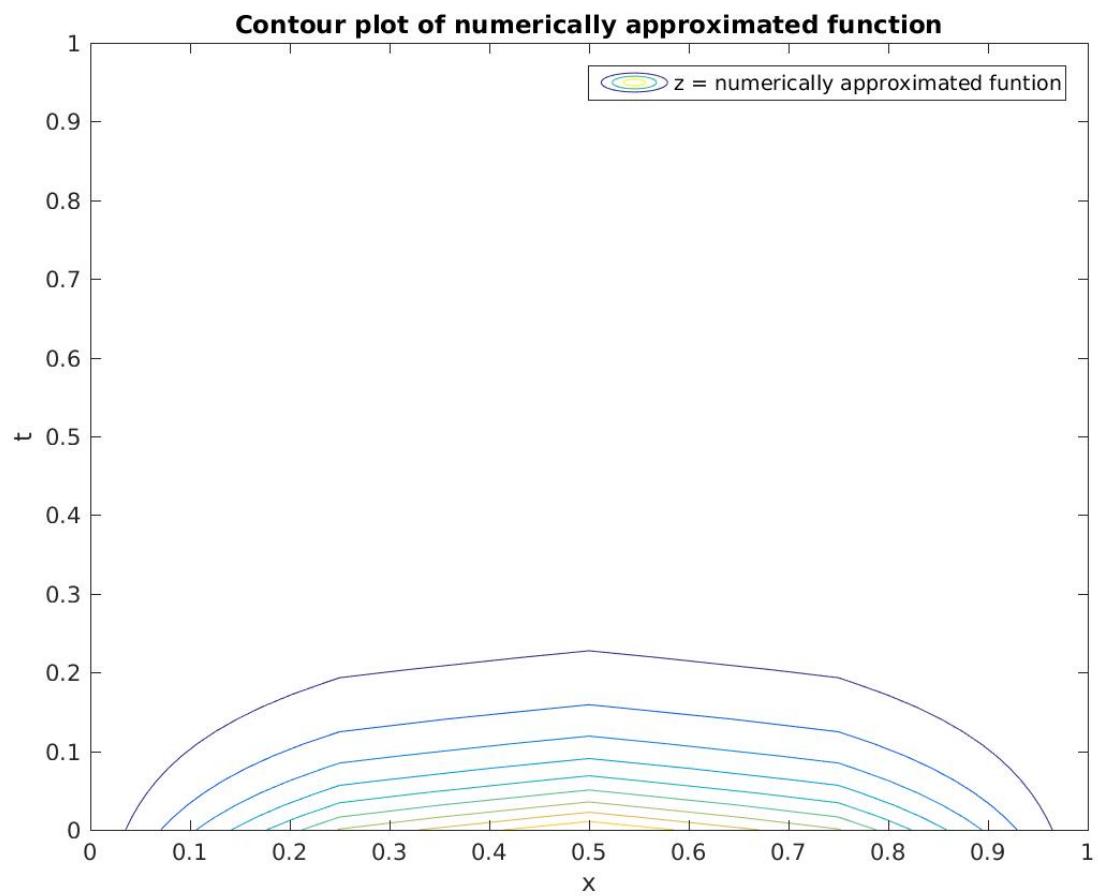


Surface plot of numerically approximated function



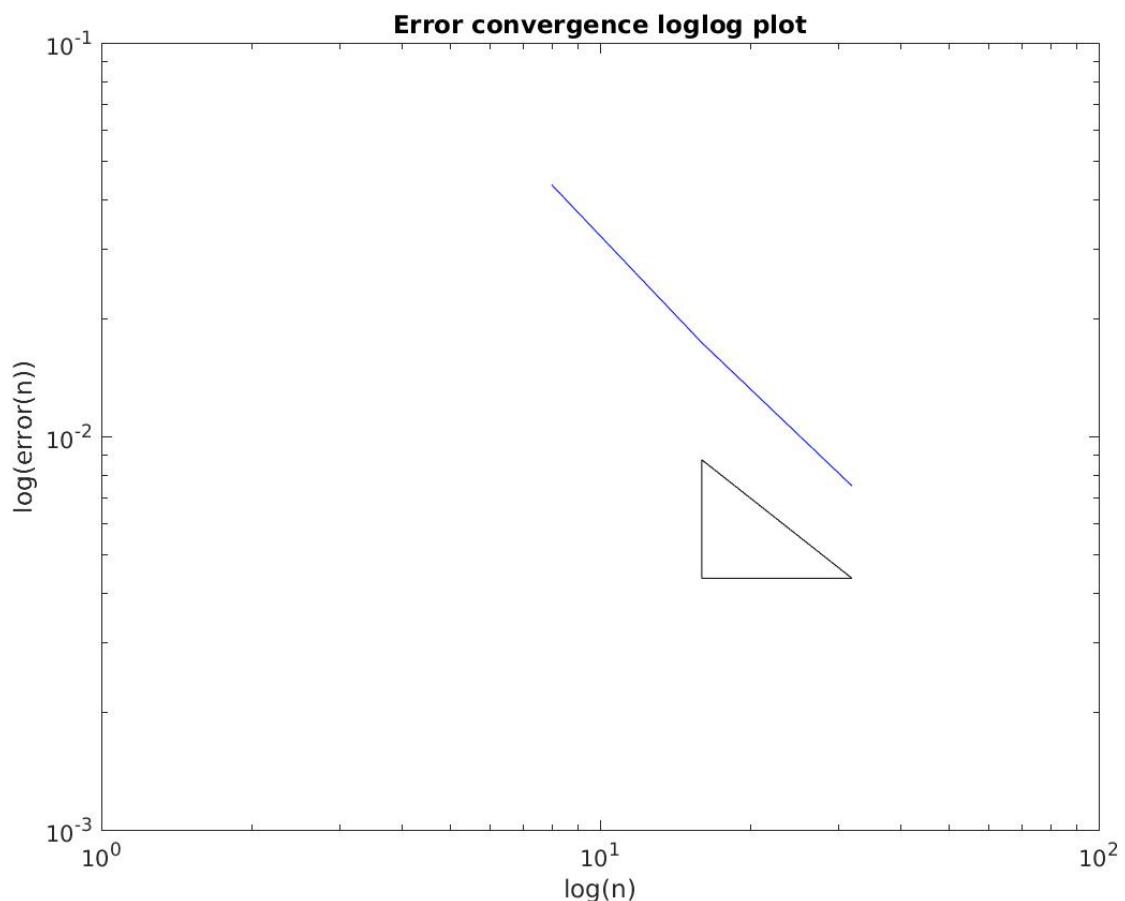
Contour plot of original function





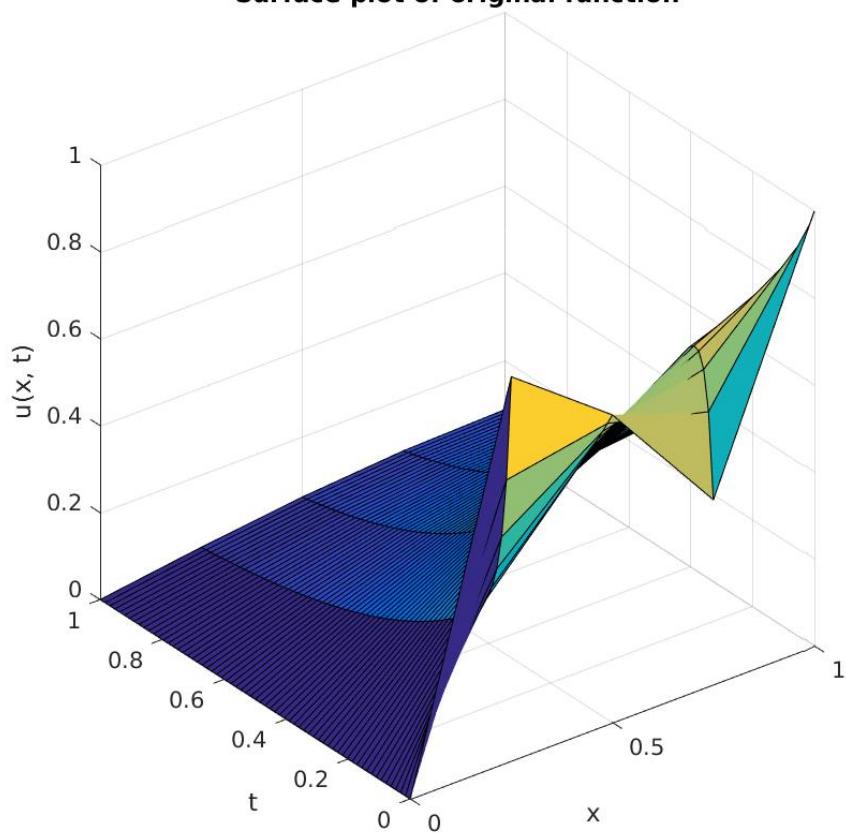
(C)

N	Error	Order
8	4.358656e-02	1.333256
16	1.729826e-02	1.208817
32	7.483632e-03	1.000000



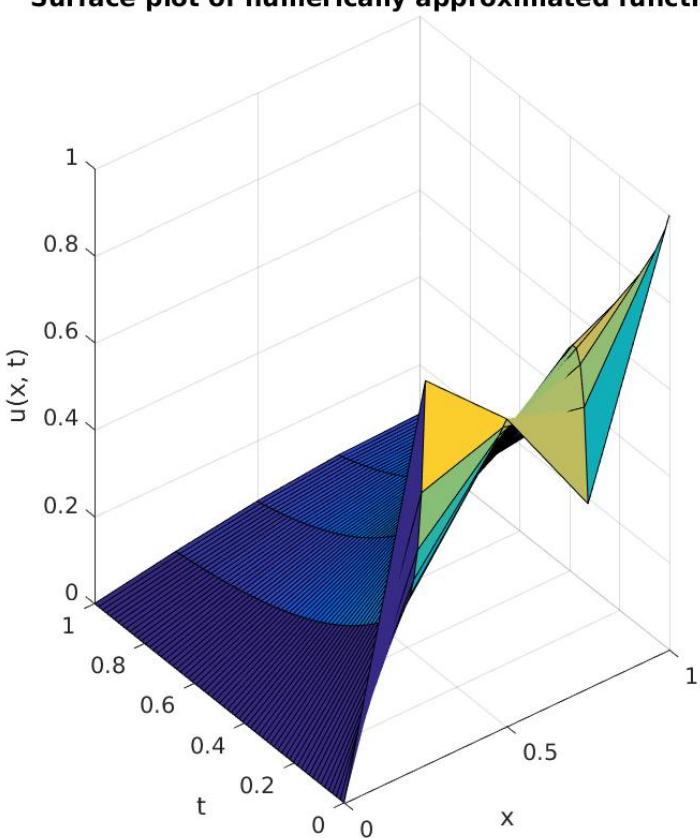
Surface plot of original function

 z = original function

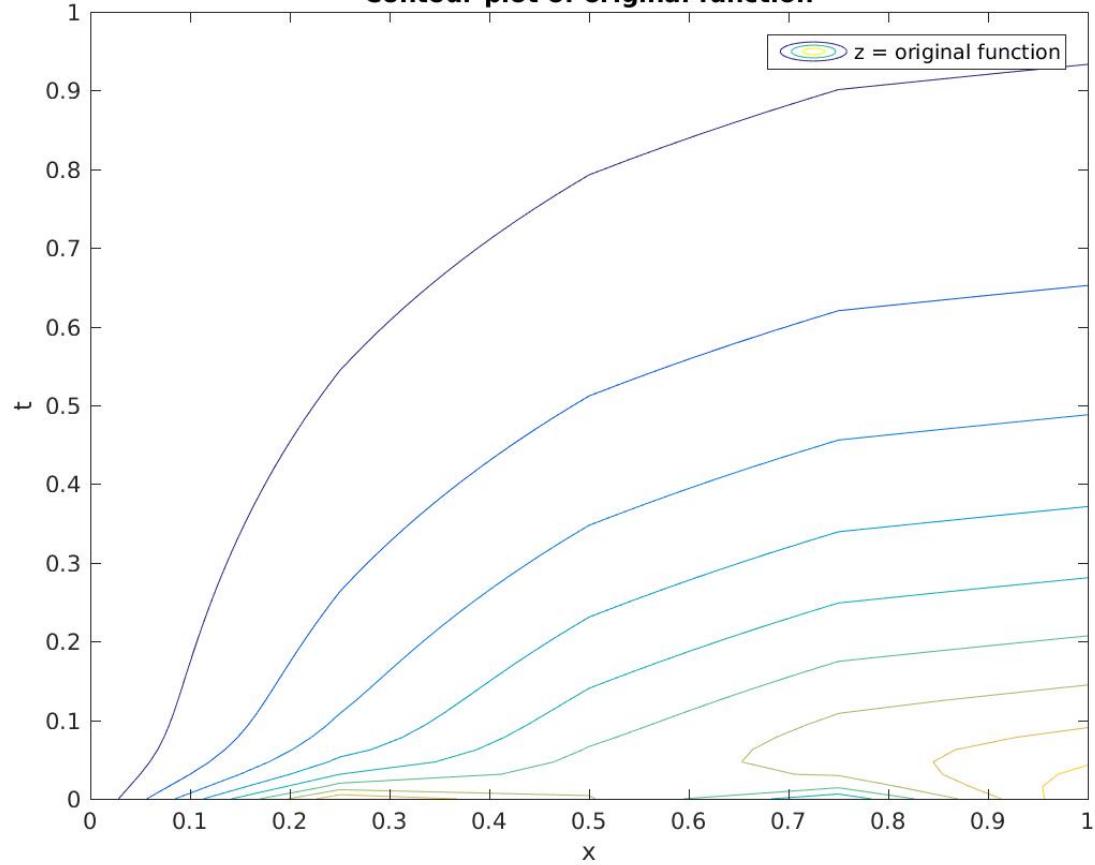


Surface plot of numerically approximated function

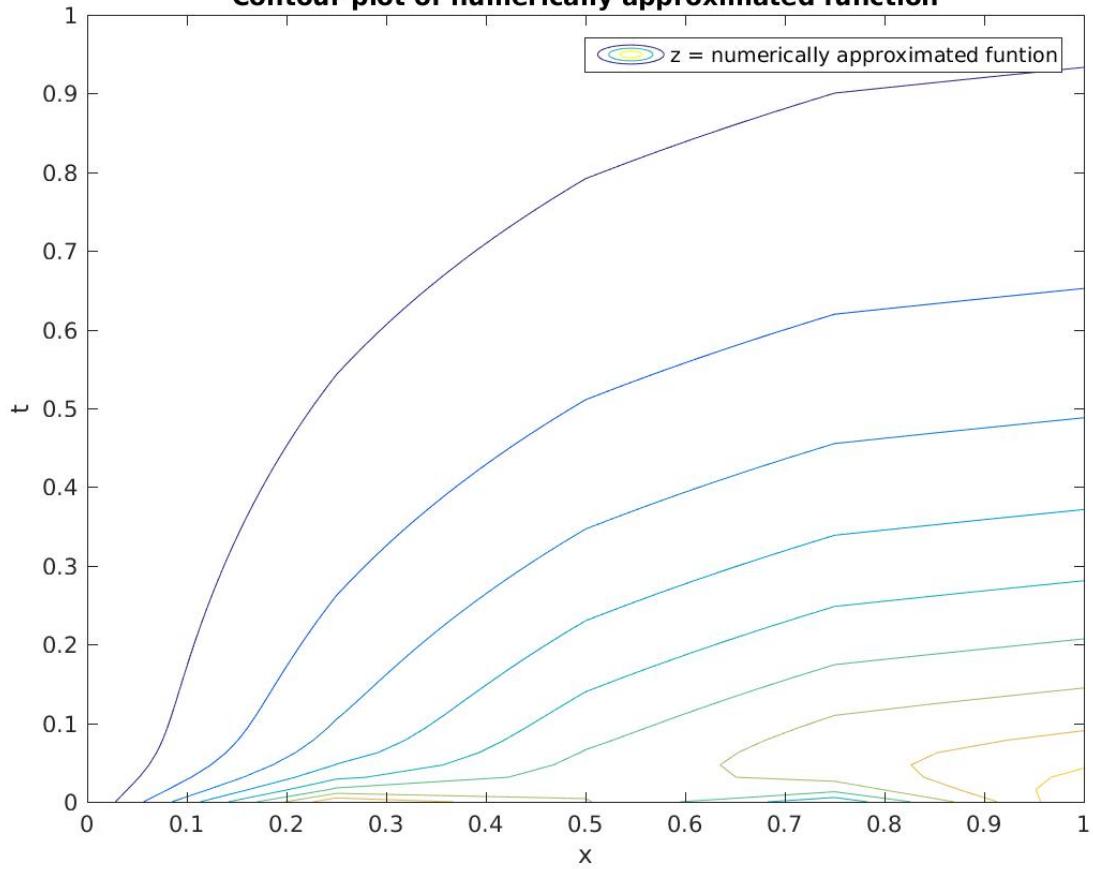
 z = numerically approximated funtion

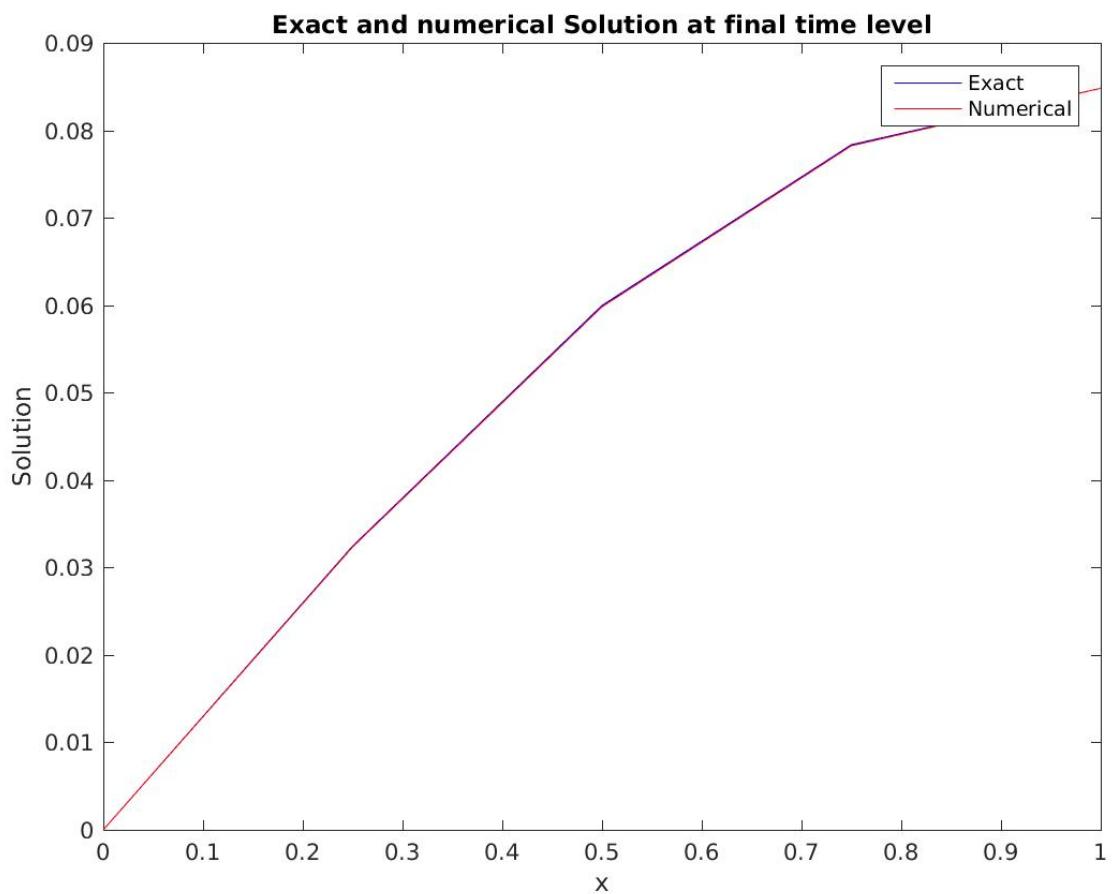


Contour plot of original function



Contour plot of numerically approximated function



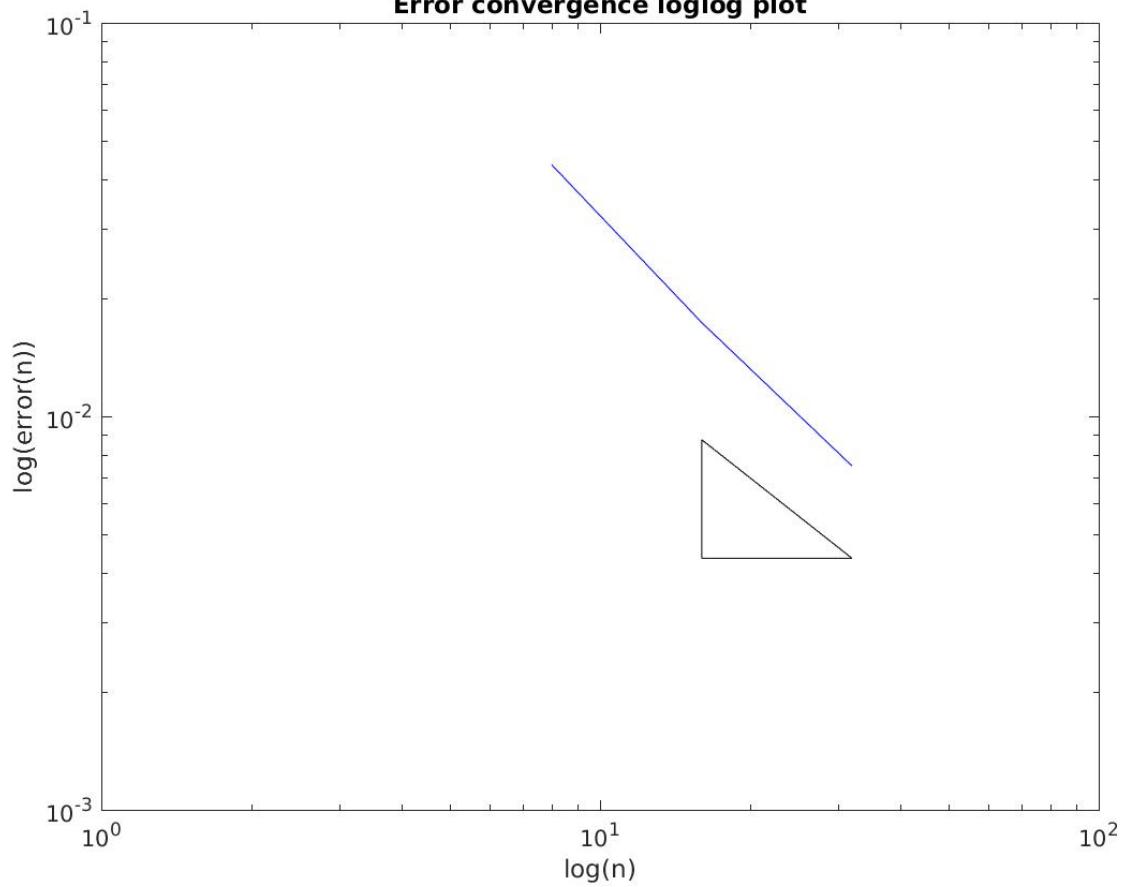


Question 2 (BTCS)

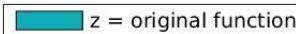
(A)

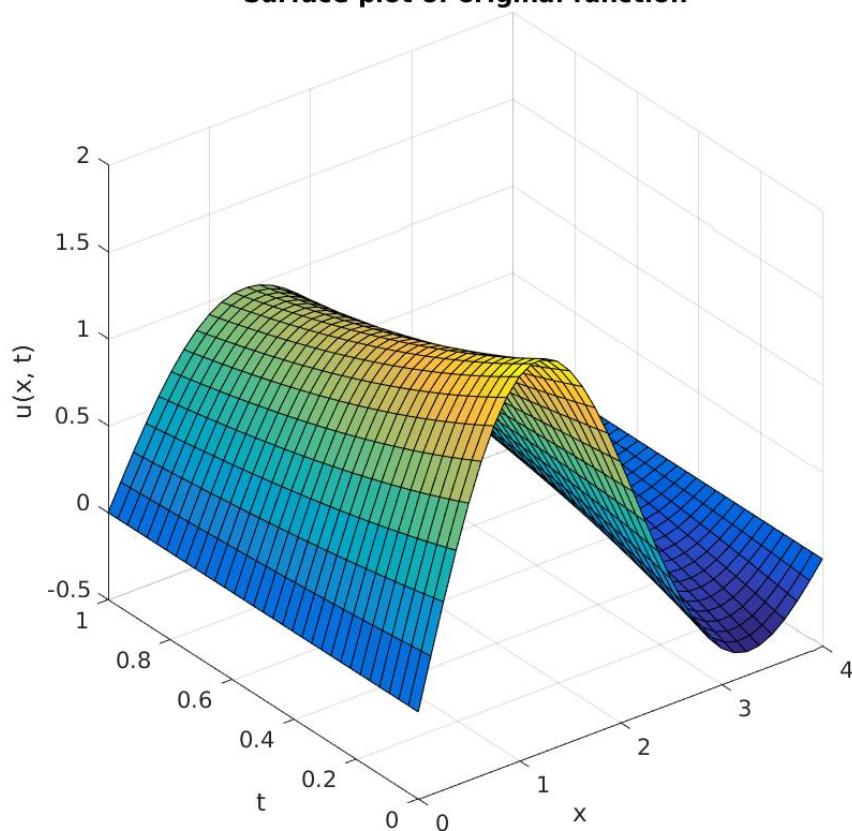
N	Error	Order
8	4.358656e-02	1.333256
16	1.729826e-02	1.208817
32	7.483632e-03	1.000000

Error convergence loglog plot

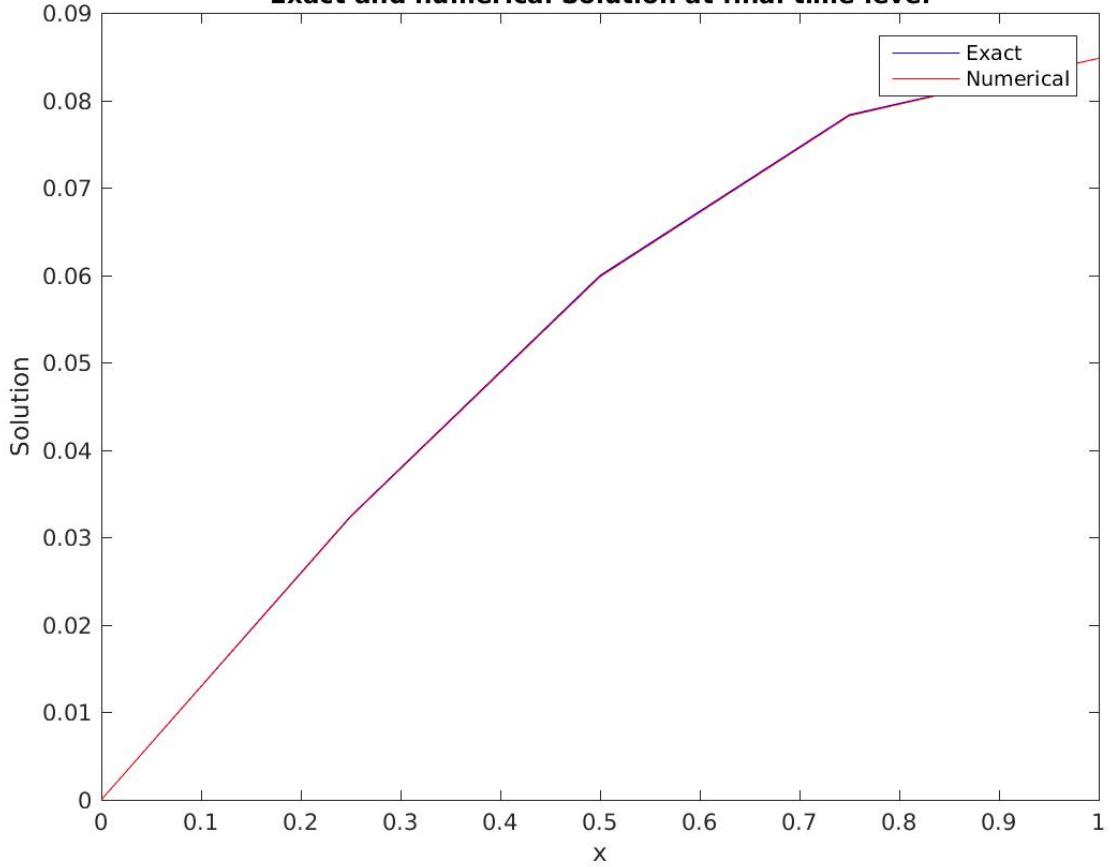


Surface plot of original function

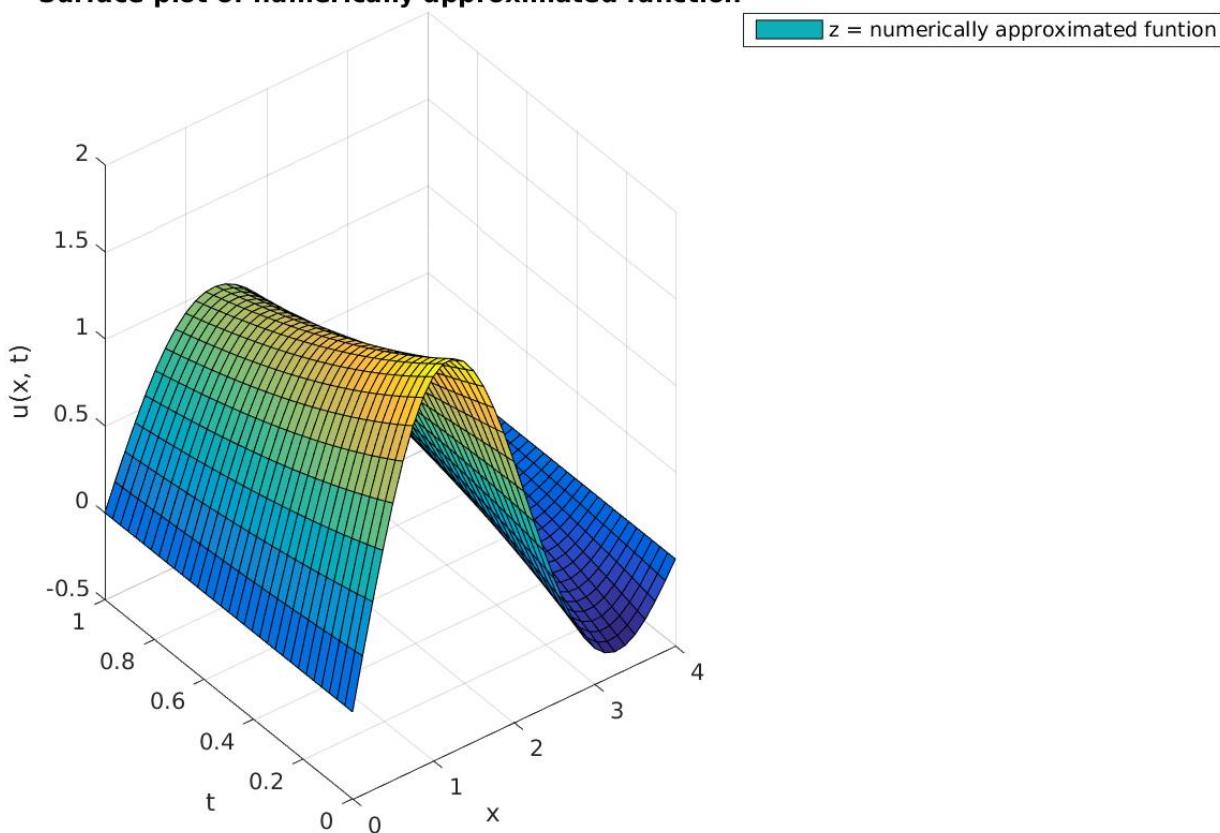
 z = original function



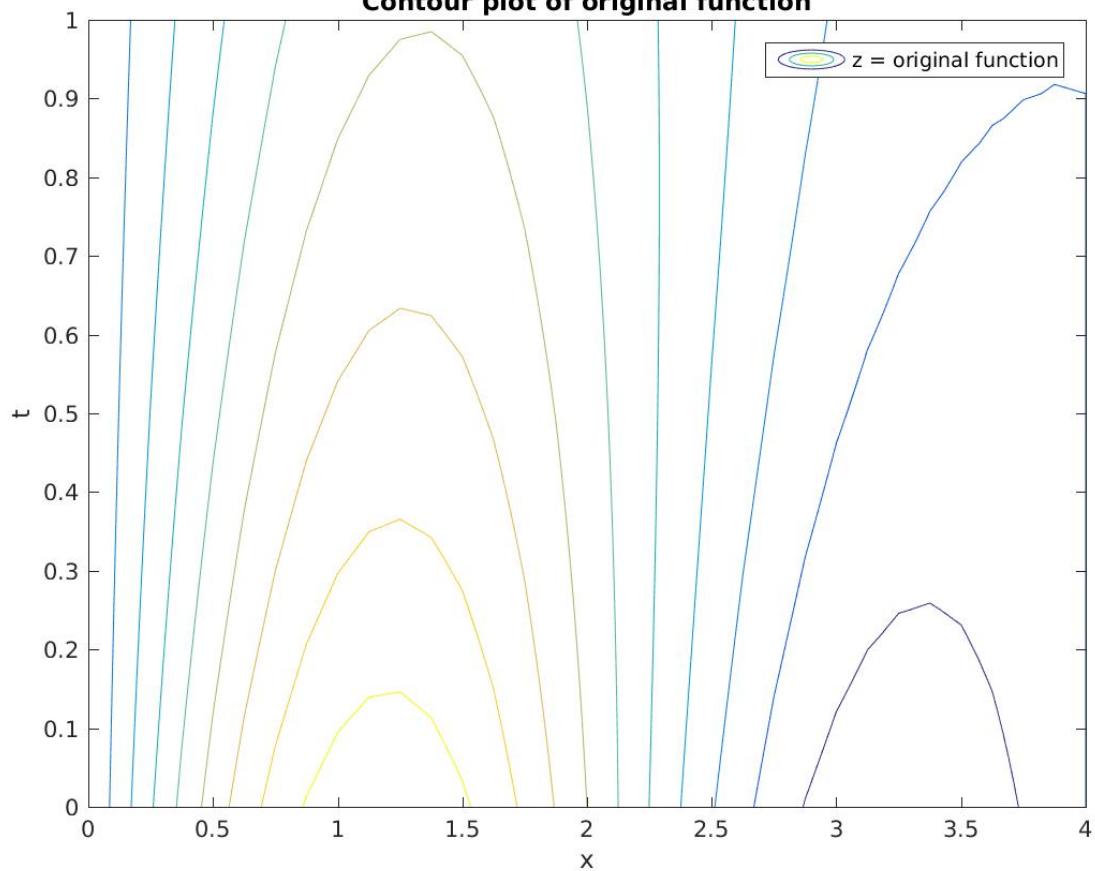
Exact and numerical Solution at final time level

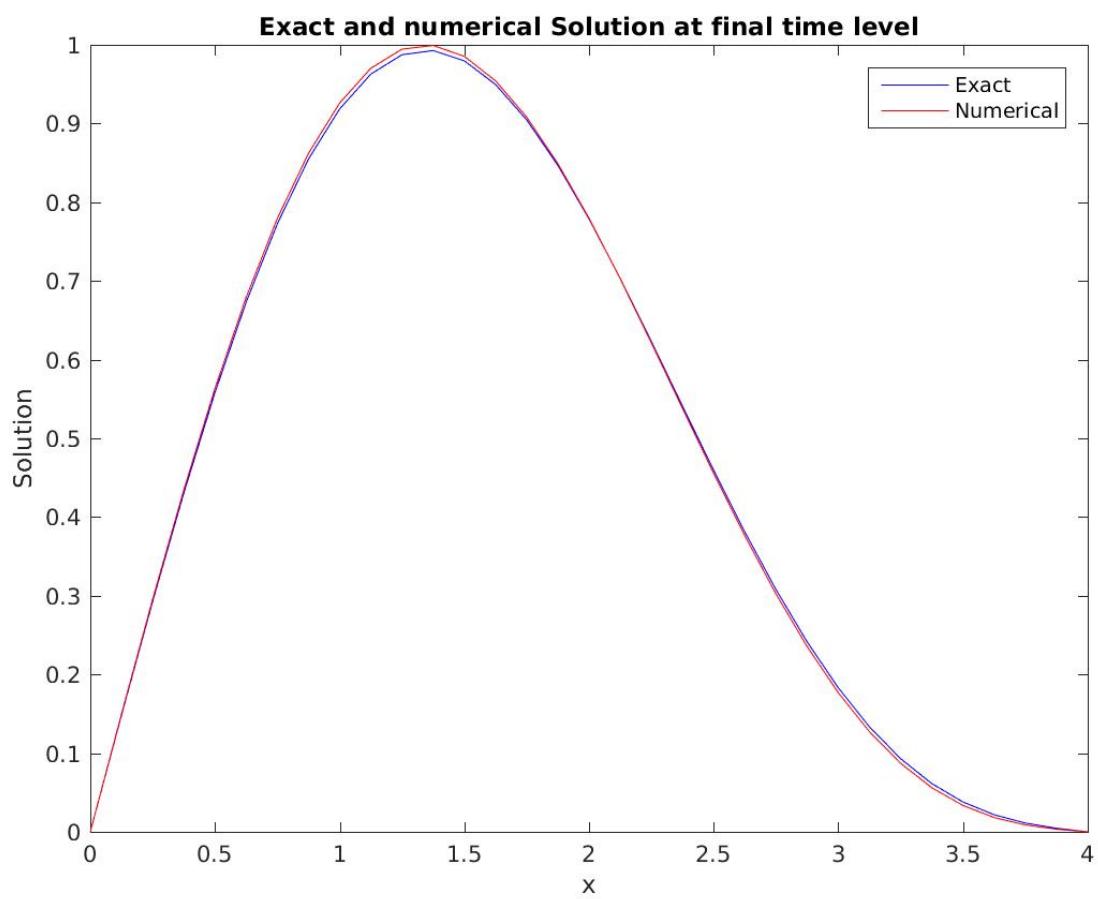
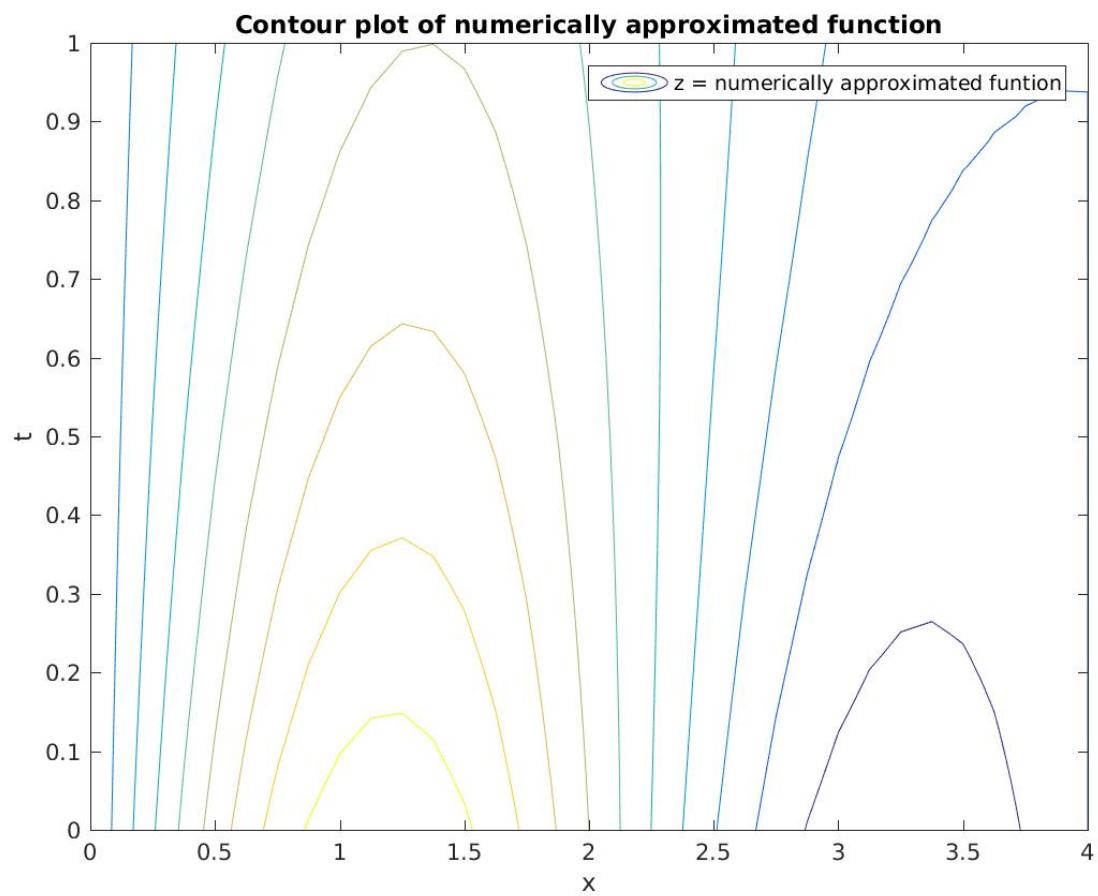


Surface plot of numerically approximated function



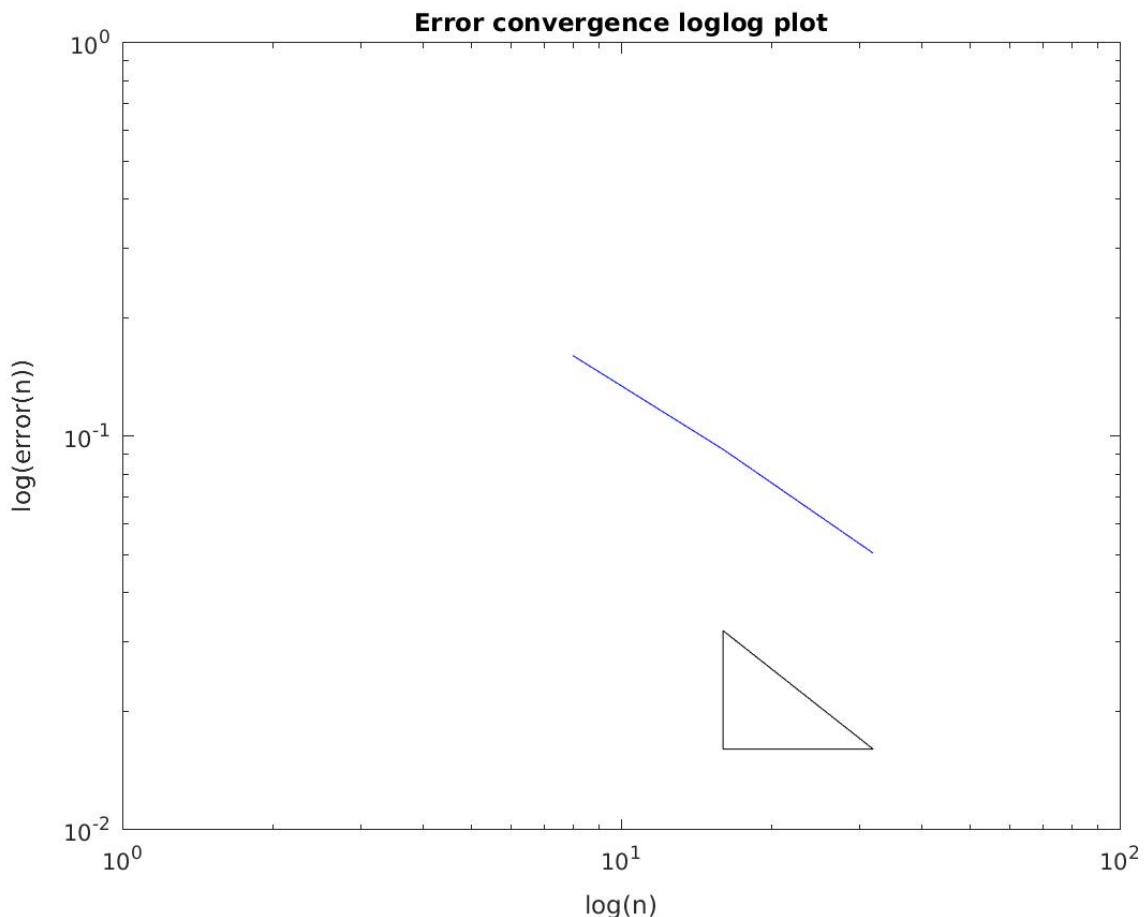
Contour plot of original function





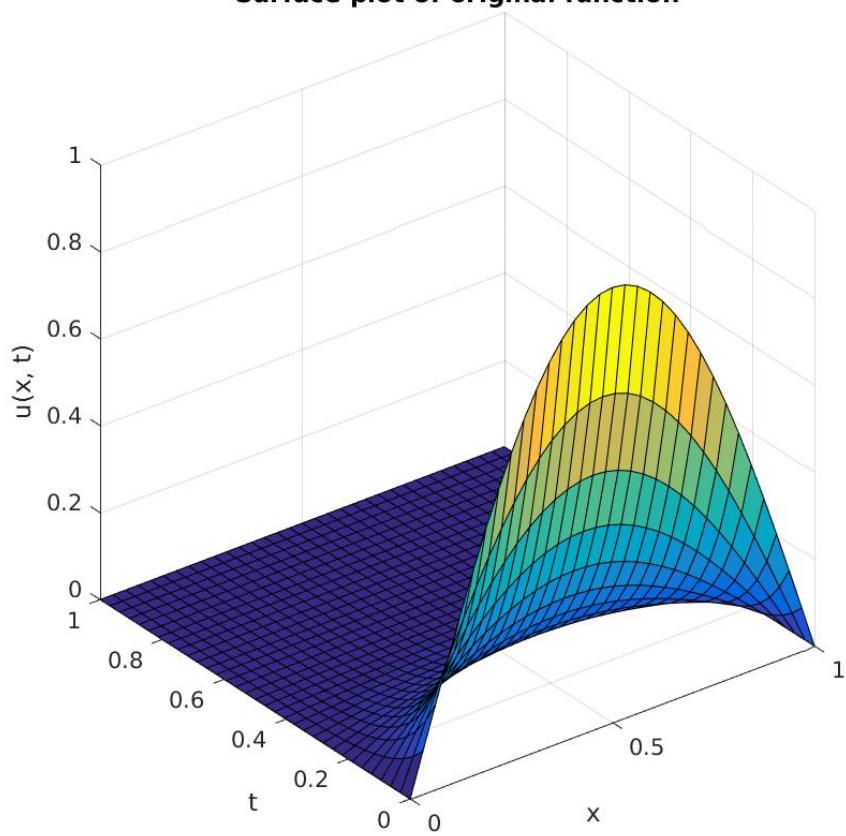
(B)

N	Error	Order
8	1.596584e-01	0.791355
16	9.225082e-02	0.876112
32	5.026135e-02	1.000000

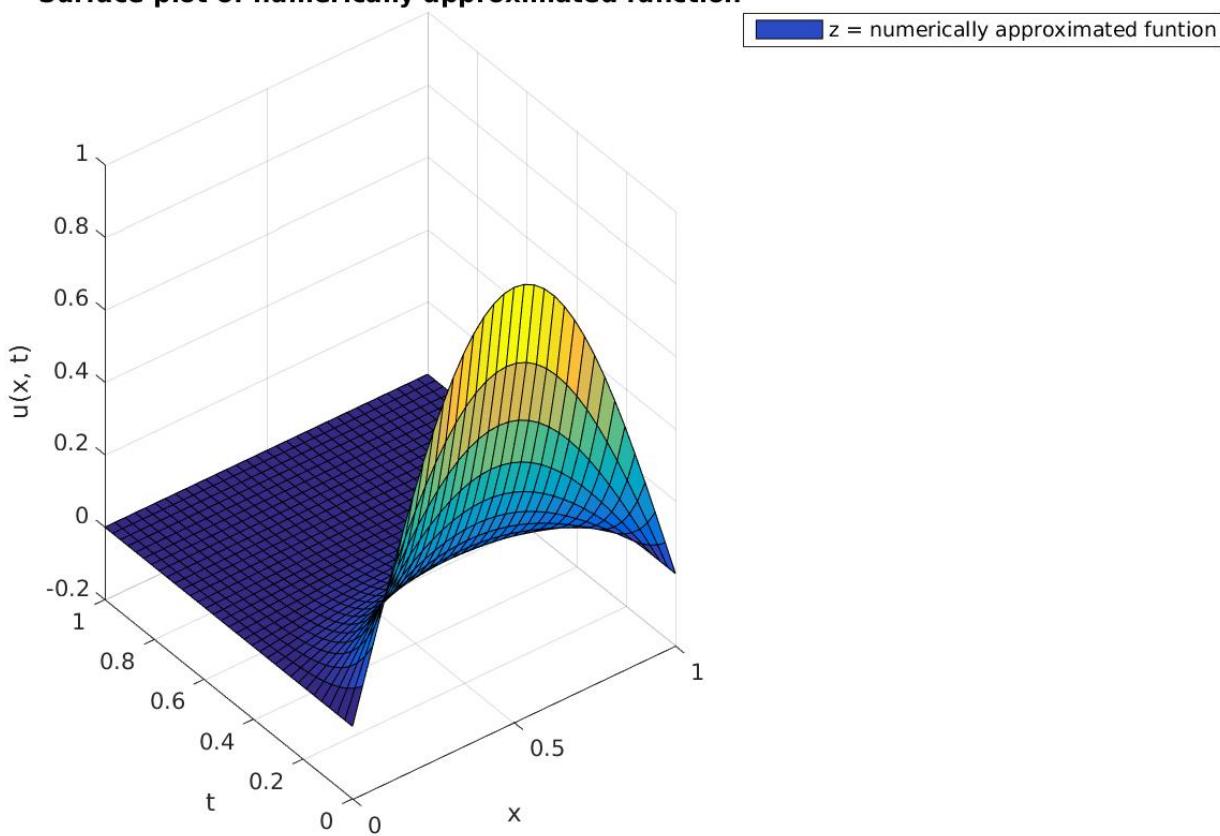


Surface plot of original function

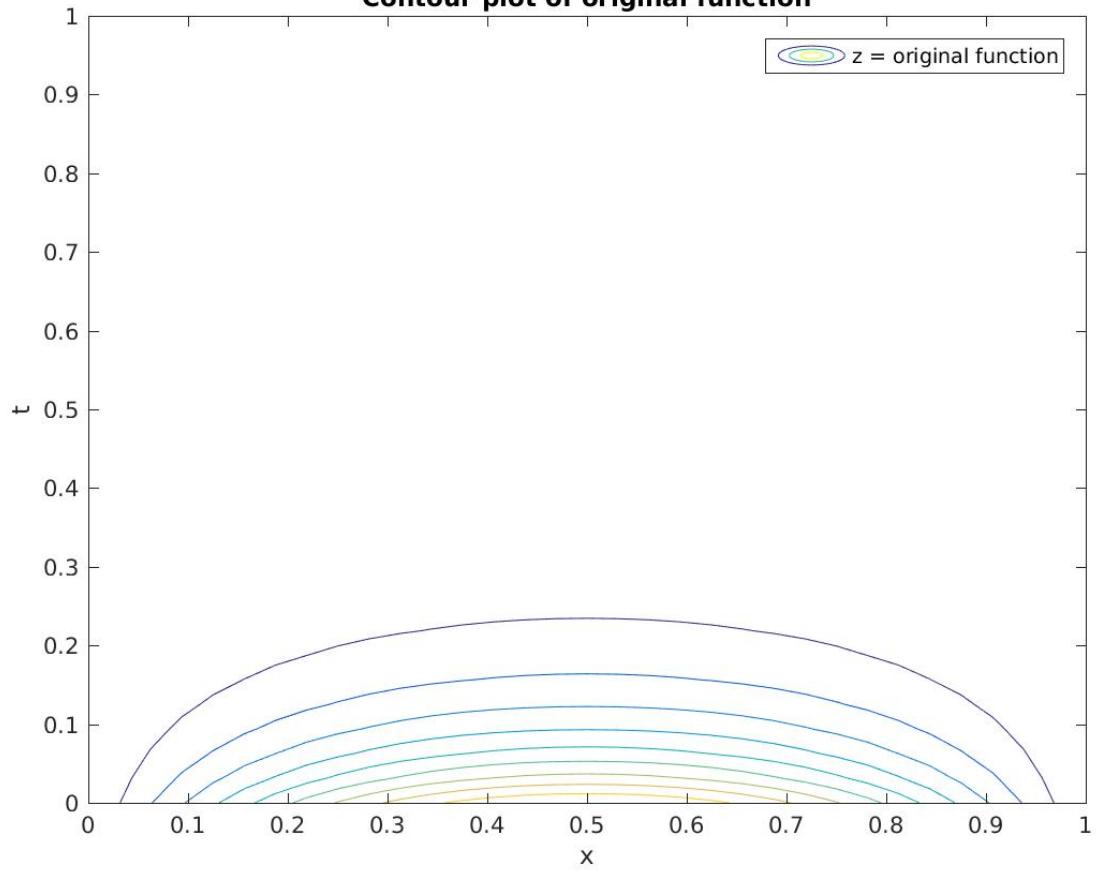
 z = original function

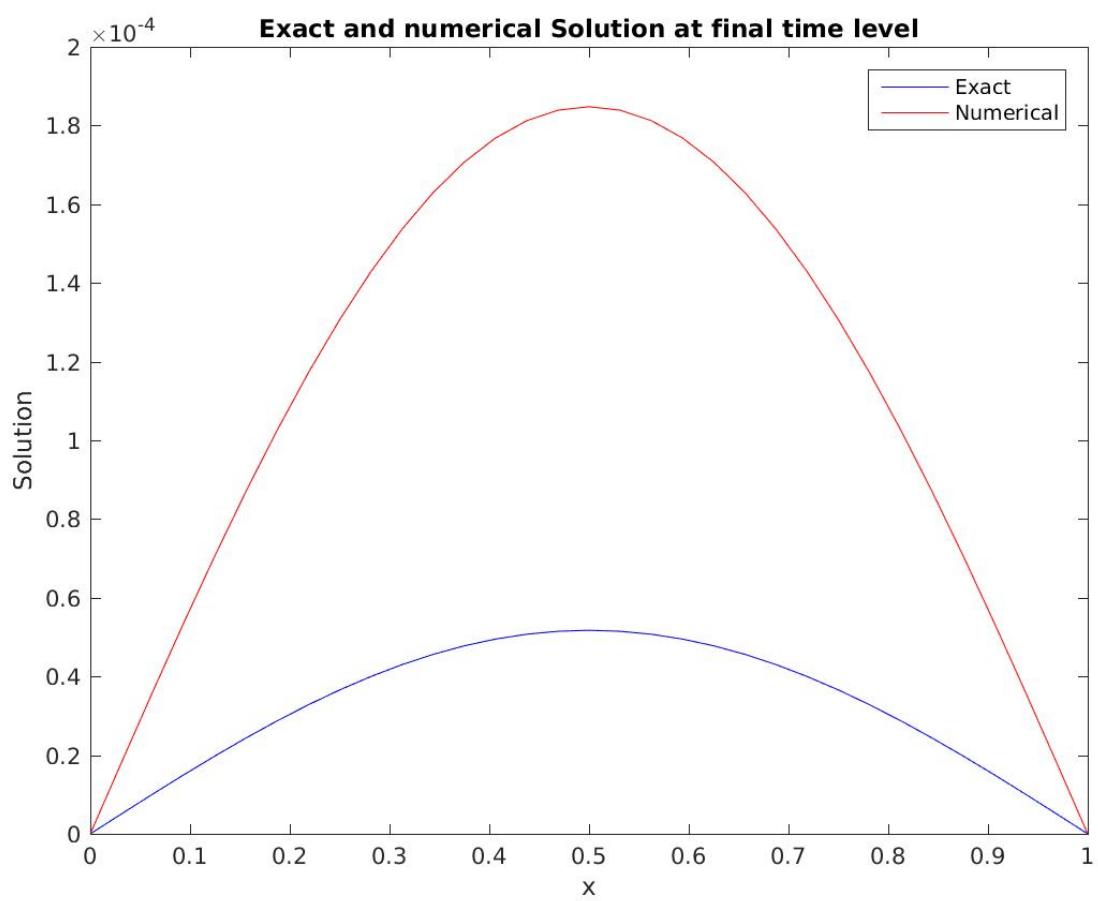
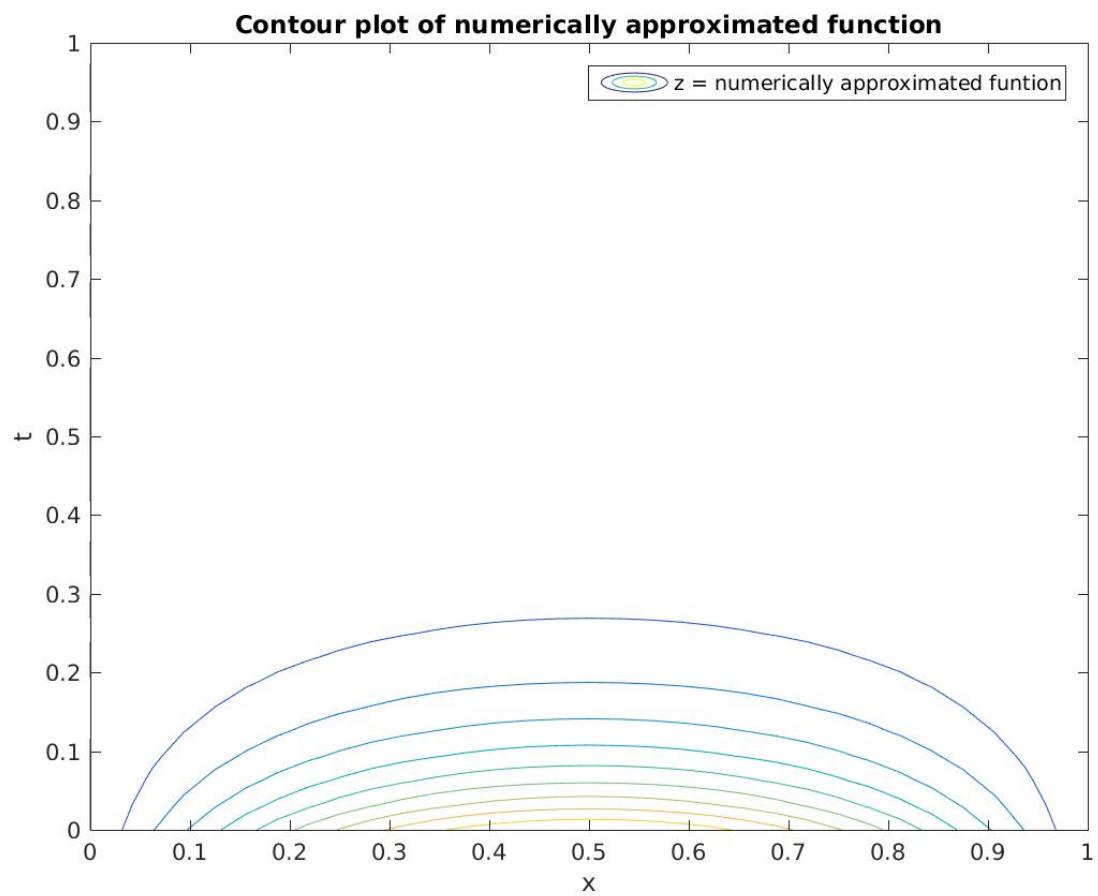


Surface plot of numerically approximated function



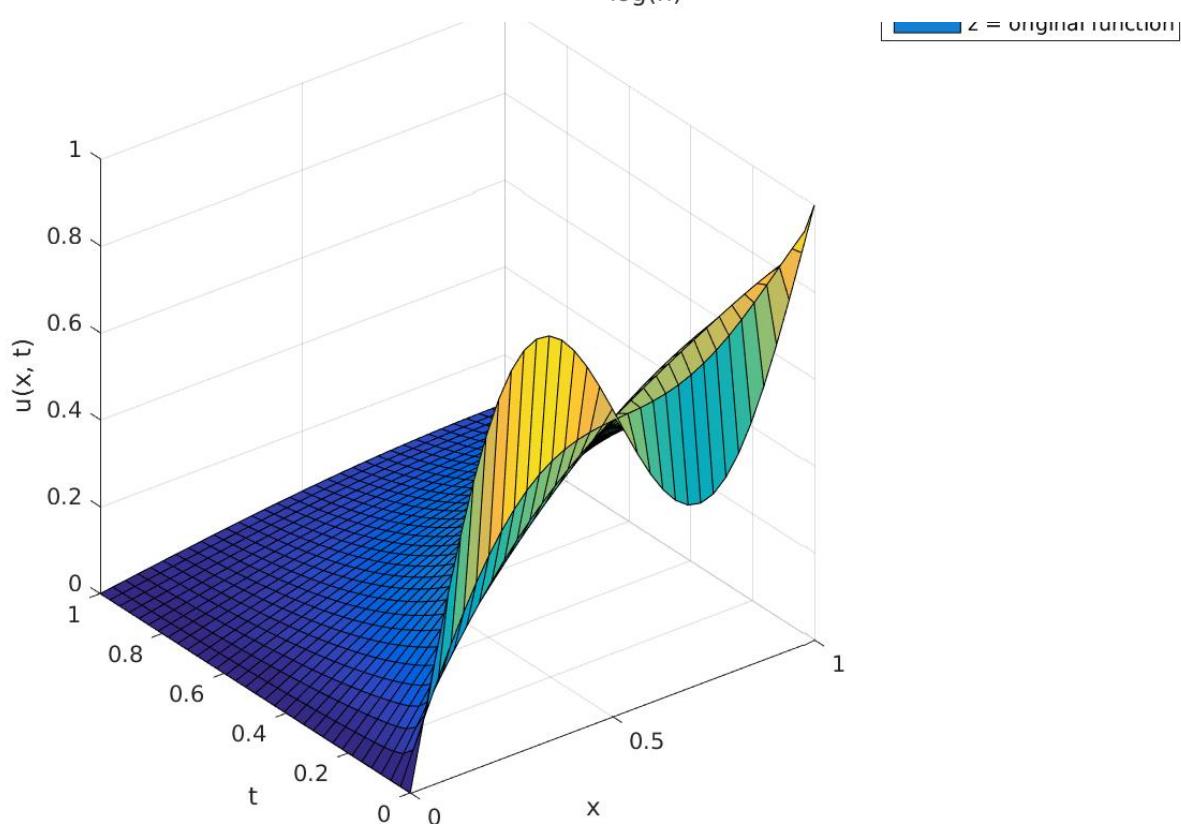
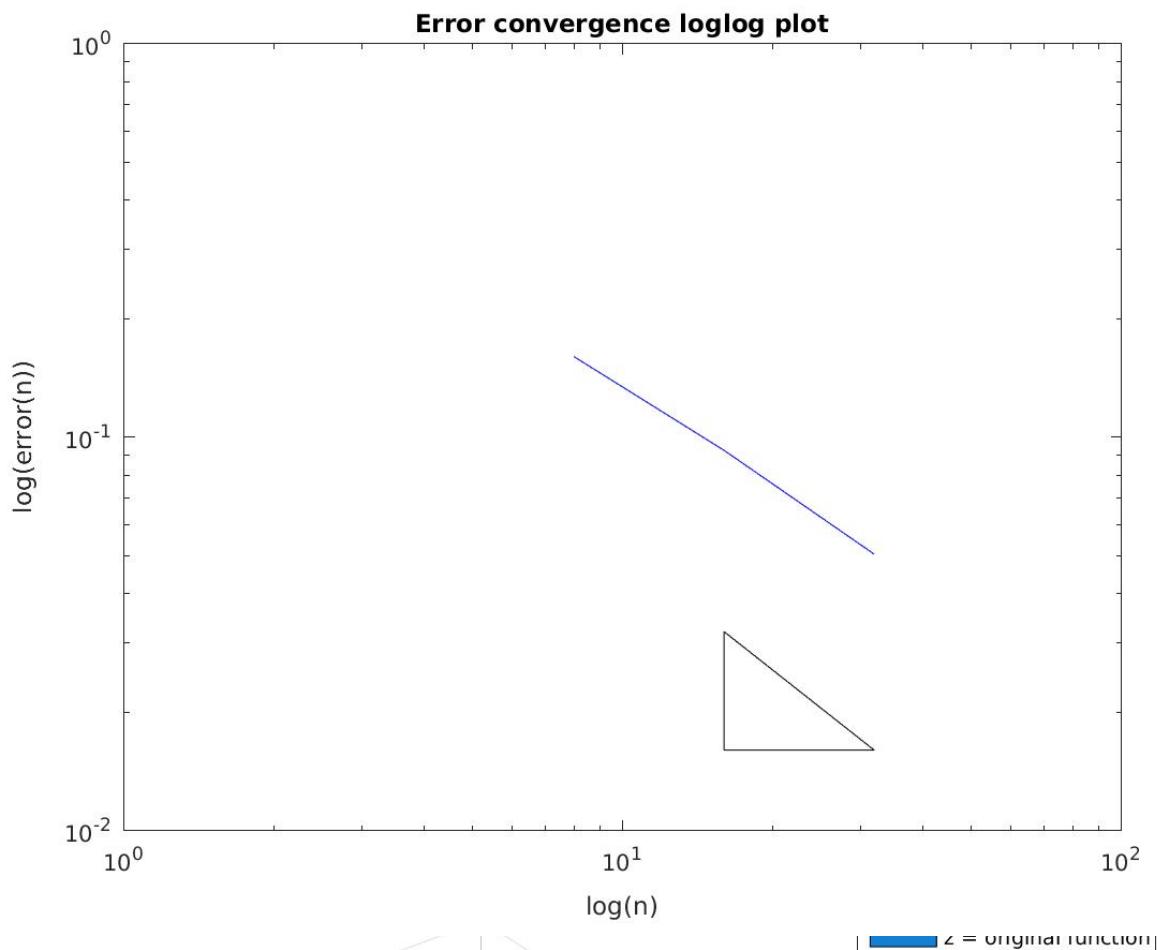
Contour plot of original function



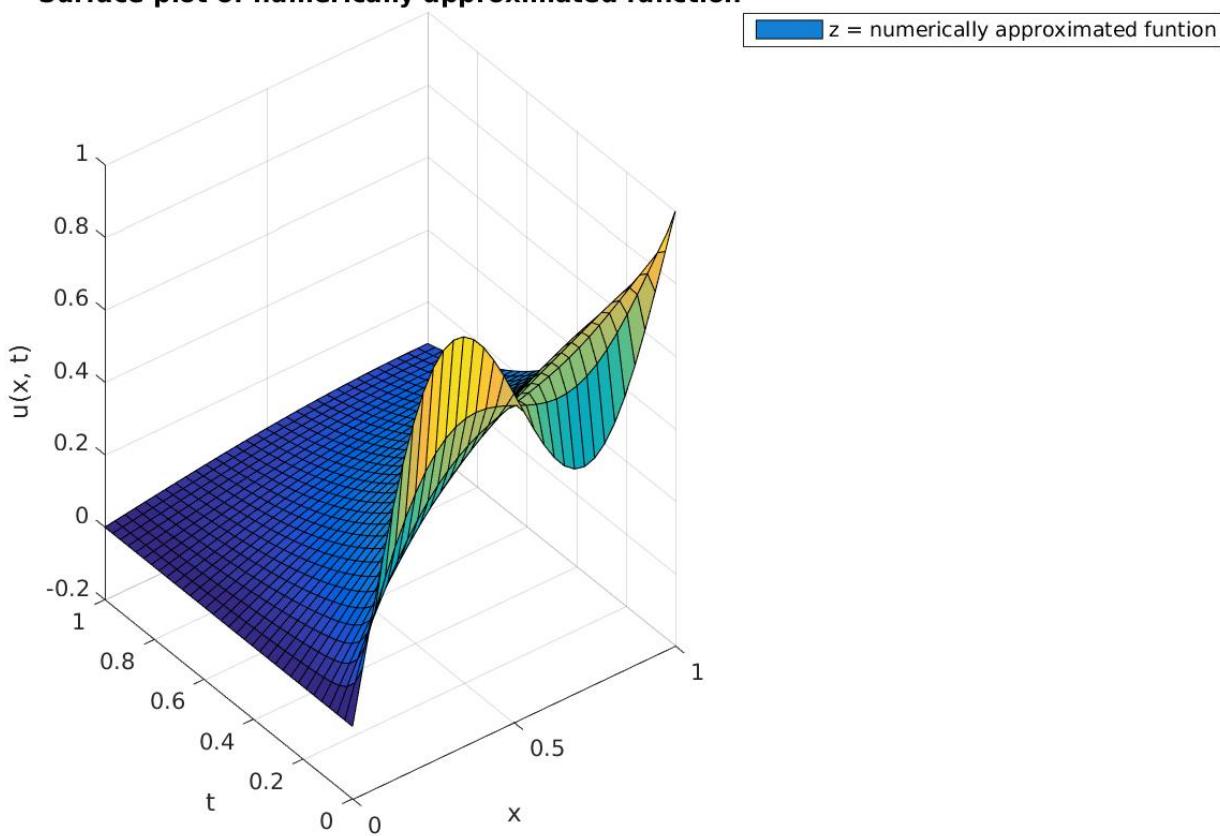


(C)

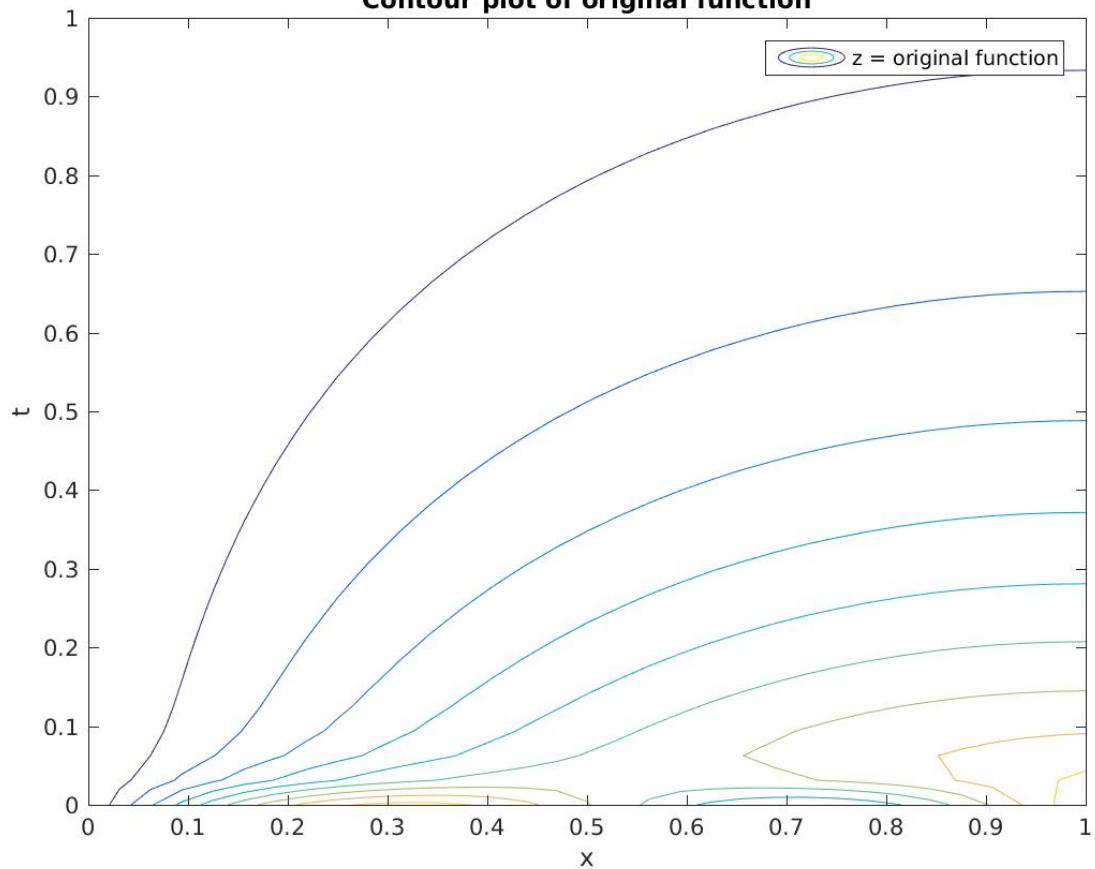
N	Error	Order
8	9.313377e-02	0.890894
16	1.063095e-01	0.97296
32	7.960741e-02	1.000000

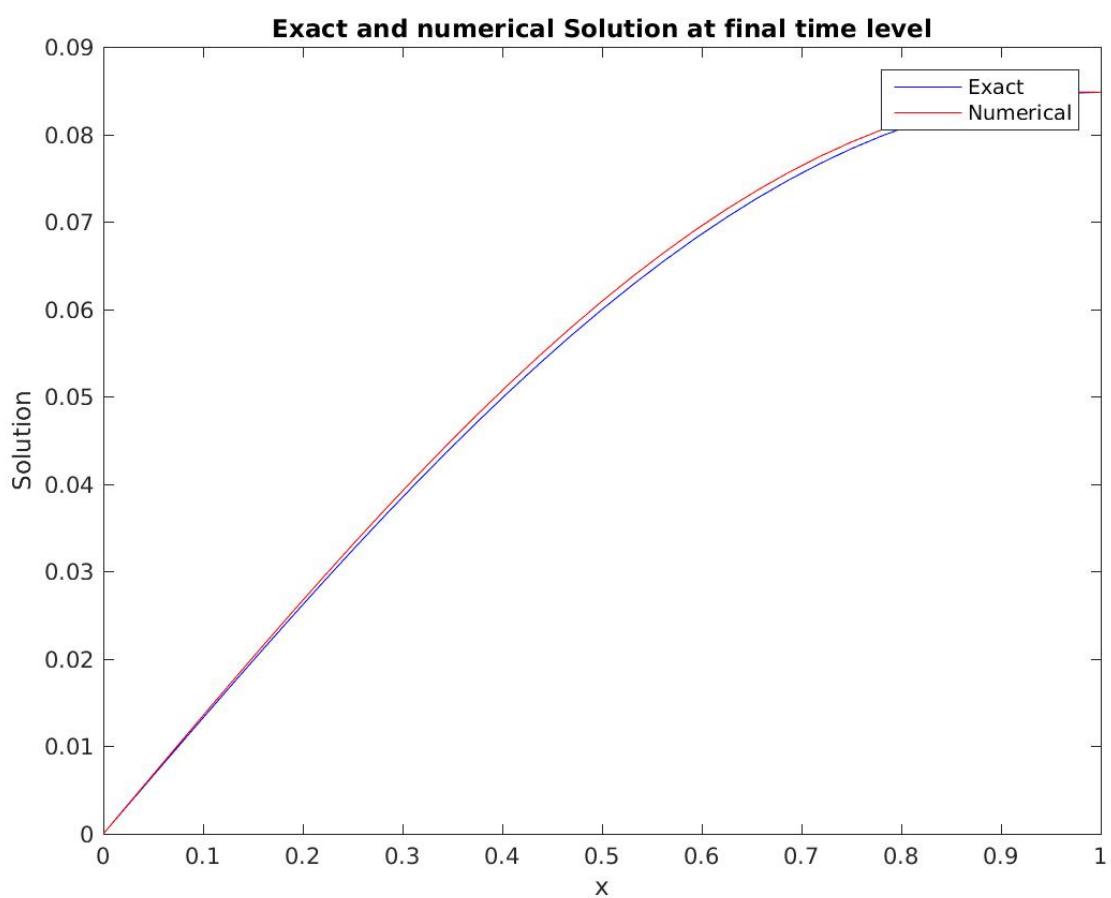
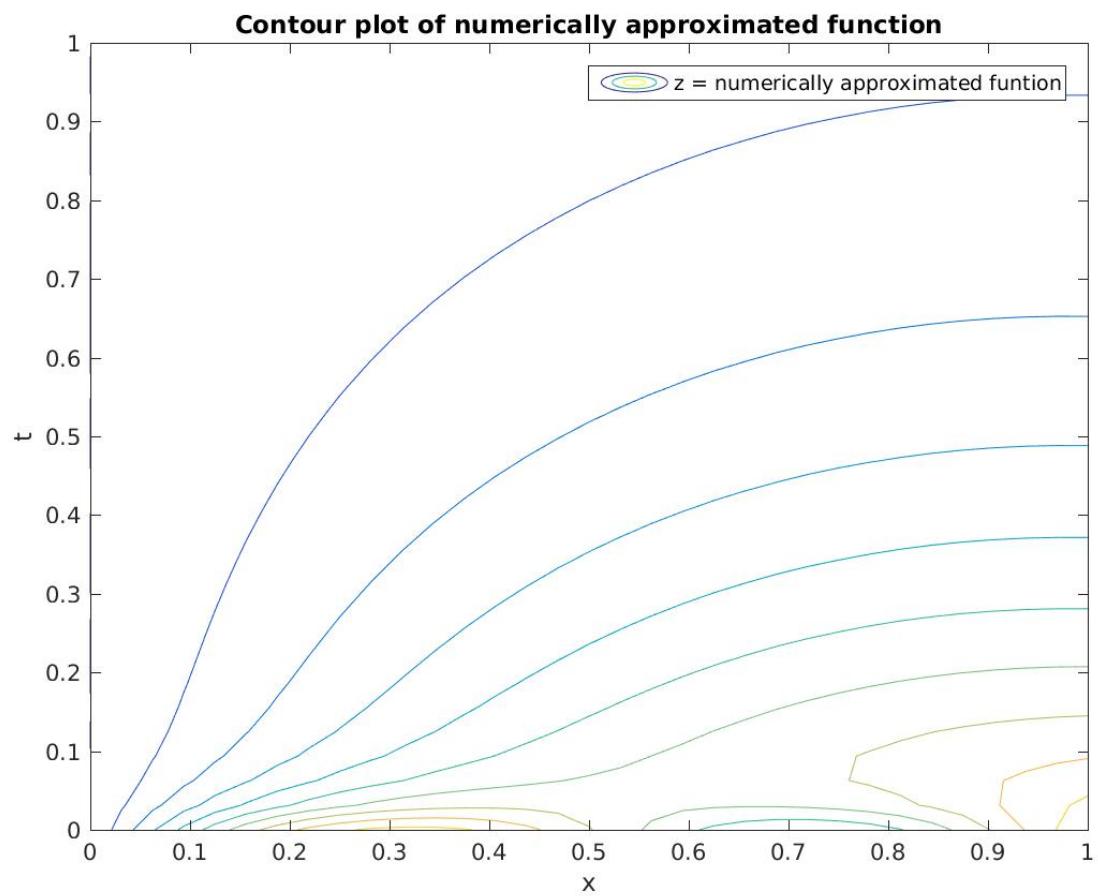


Surface plot of numerically approximated function



Contour plot of original function

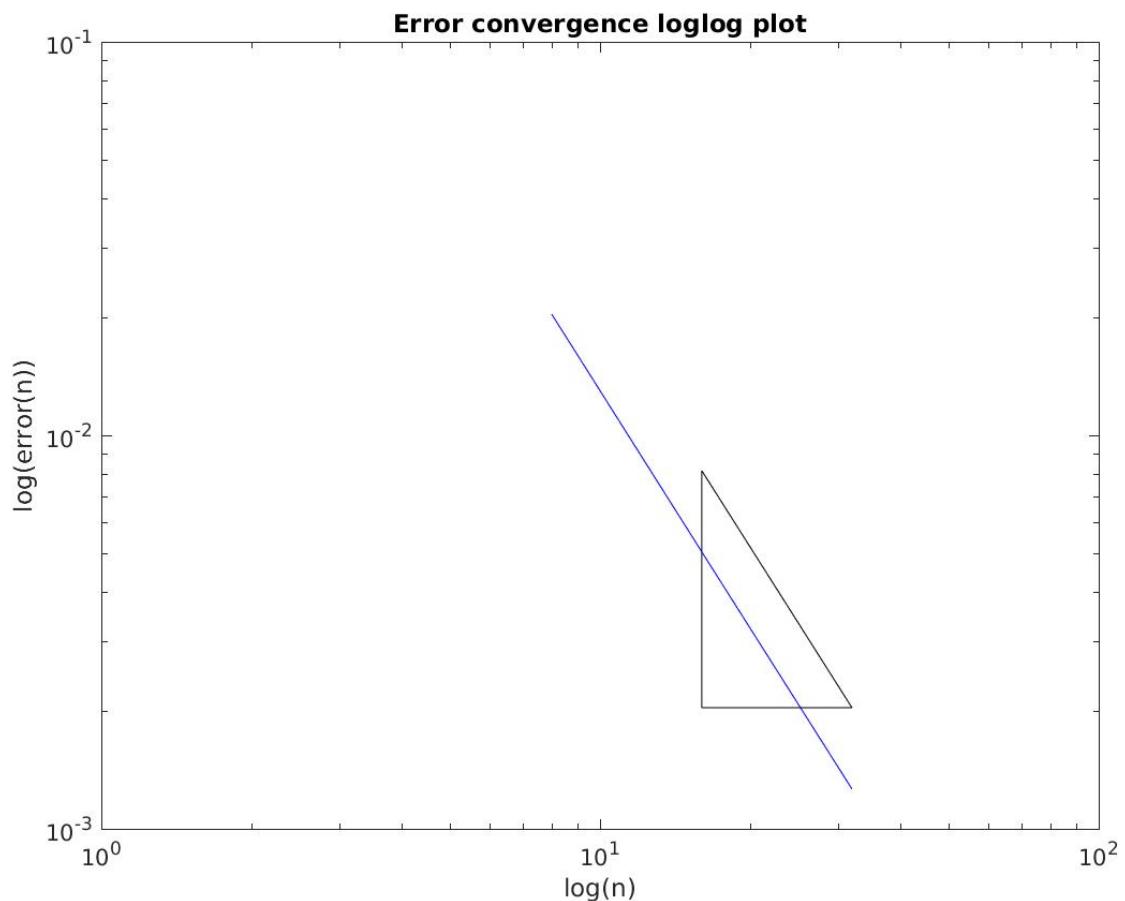




Question 3 (Crank-Nicolson)

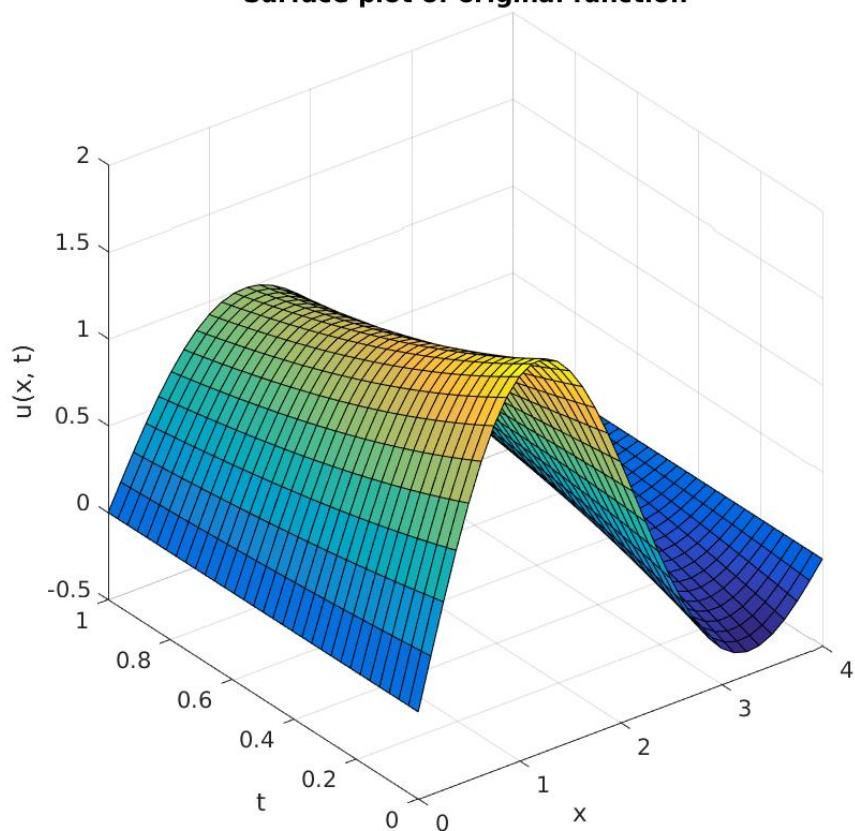
(A)

8	2.032047e-02	2.006867
16	5.055994e-03	2.001834
32	1.262393e-03	2.000000



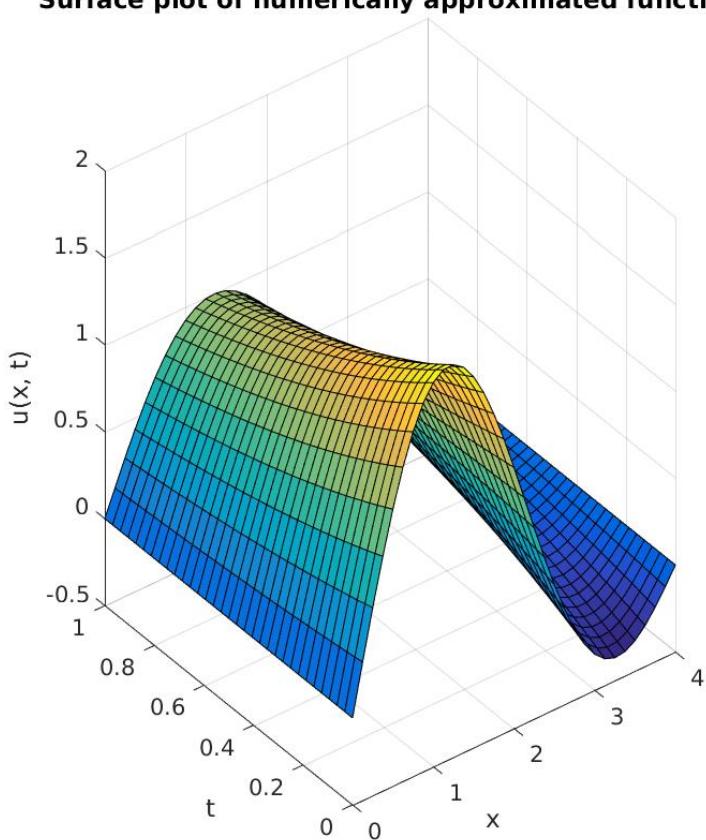
Surface plot of original function

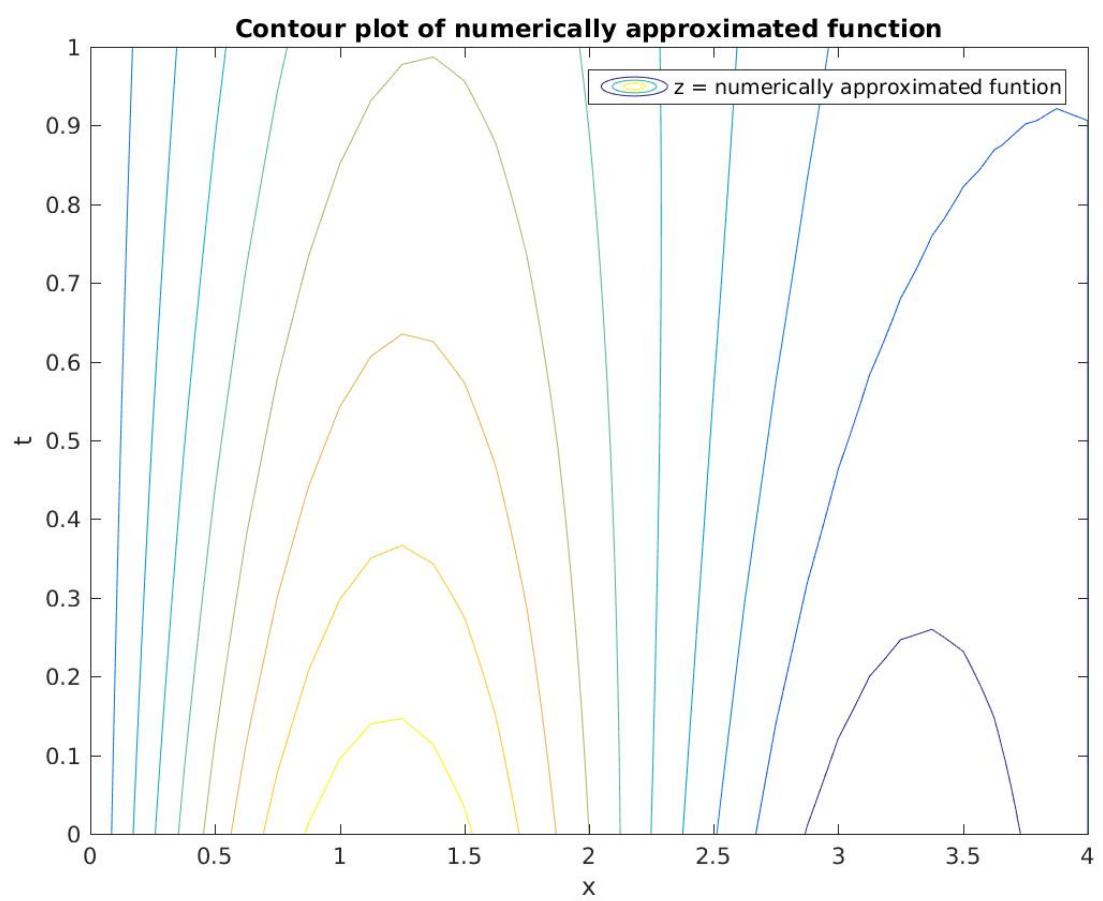
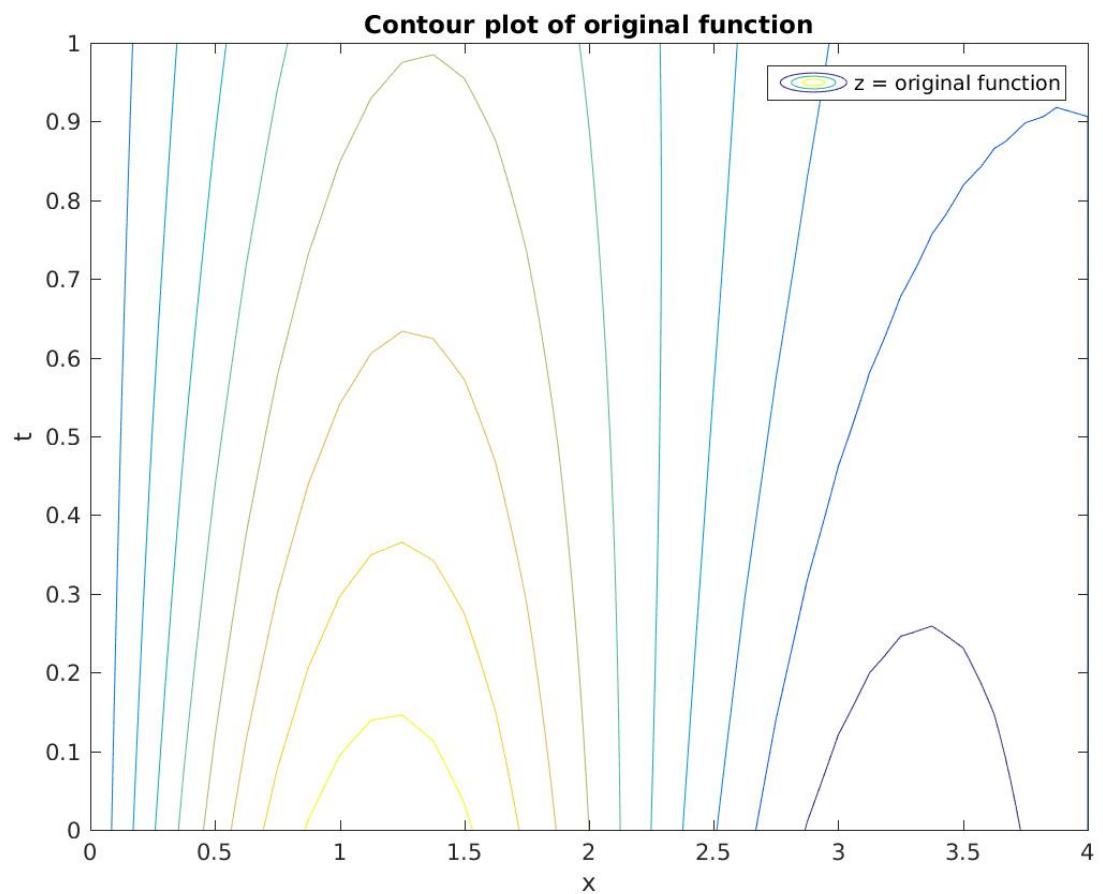
 z = original function

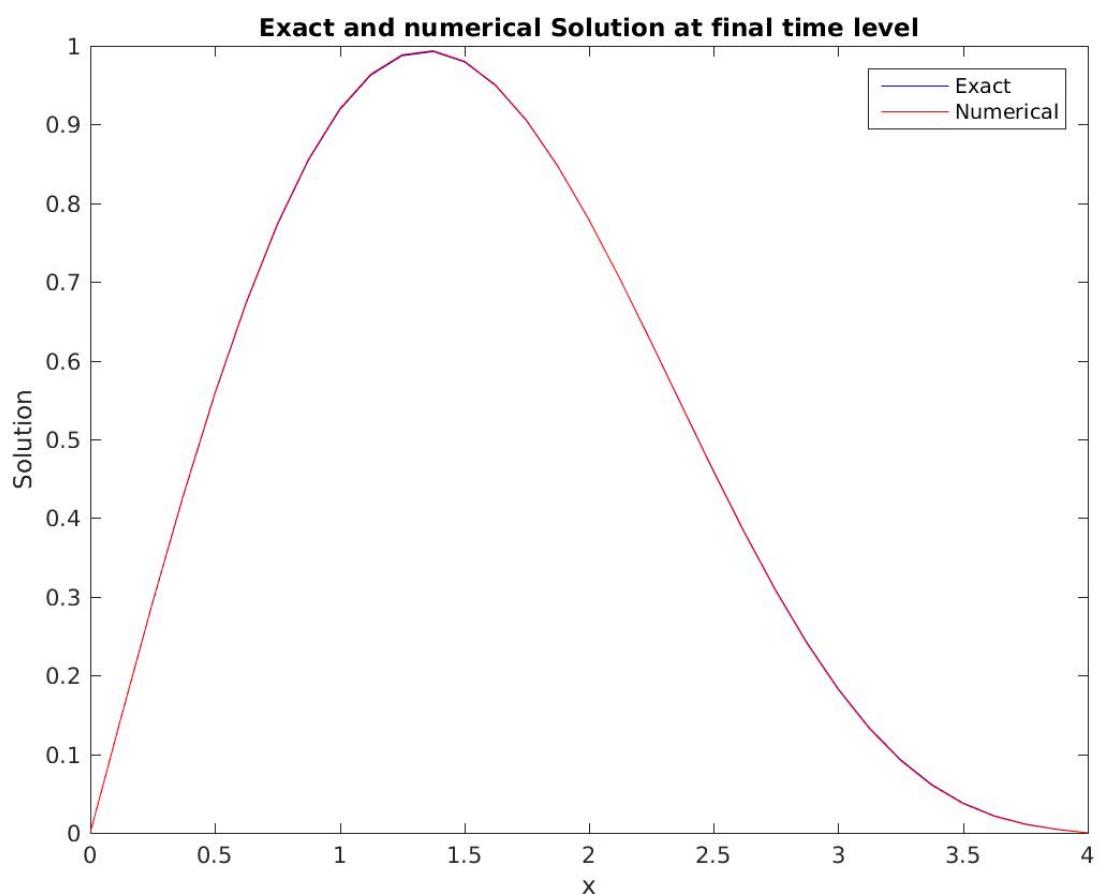


Surface plot of numerically approximated function

 z = numerically approximated funtion



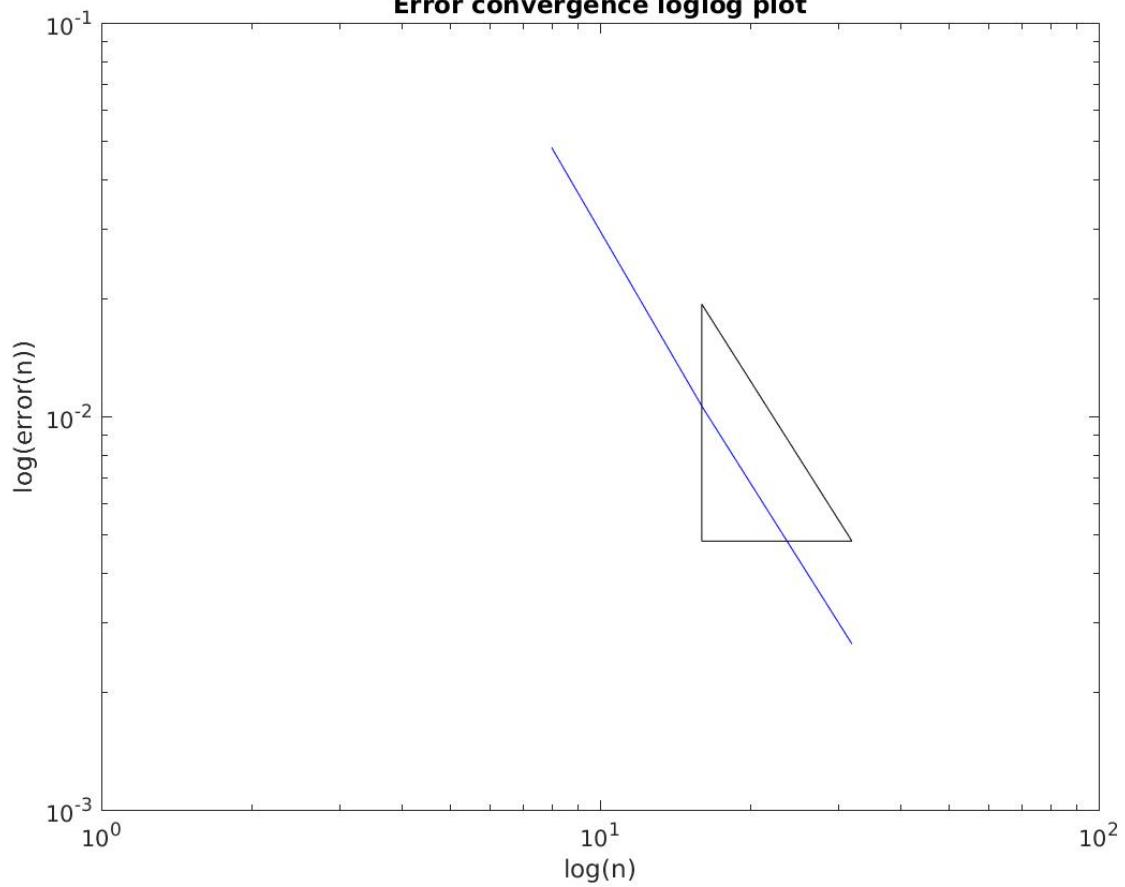




(B)

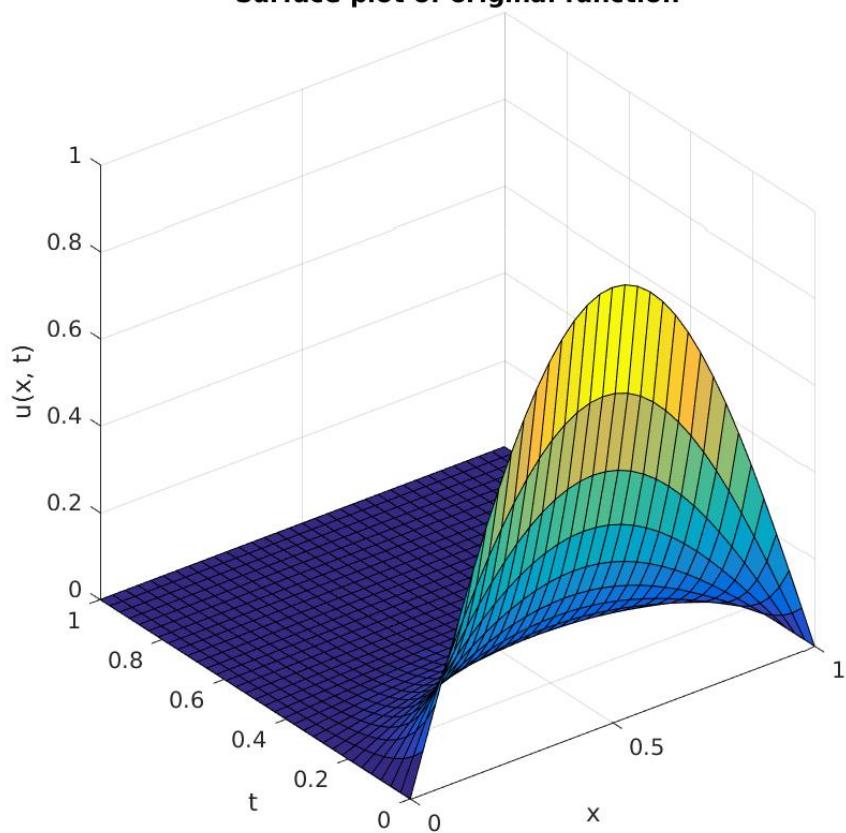
N	Error	Order
8	4.817684e-02	2.181833
16	1.061796e-02	2.008235
32	2.639382e-03	2.000000

Error convergence loglog plot



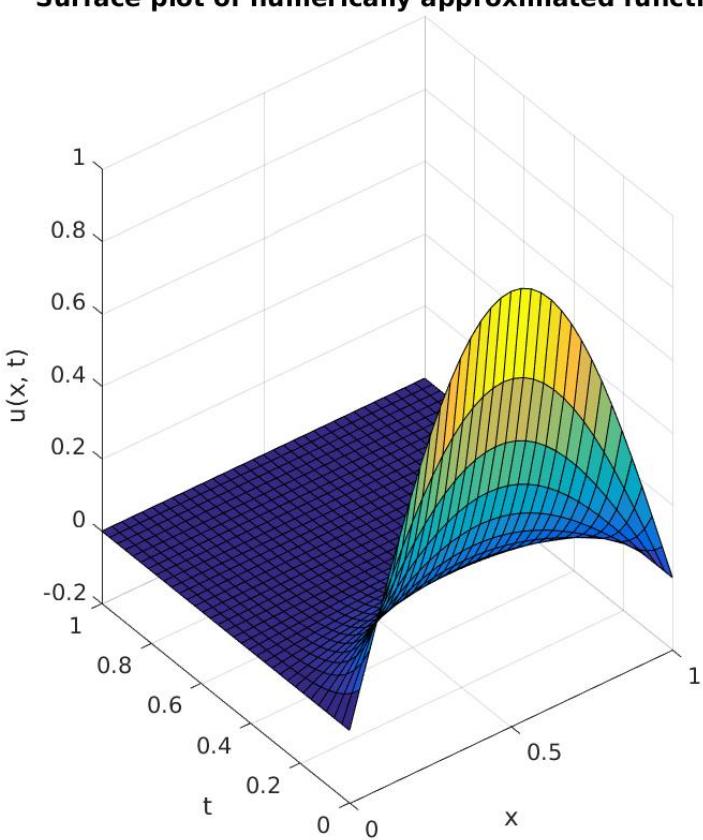
Surface plot of original function

 z = original function

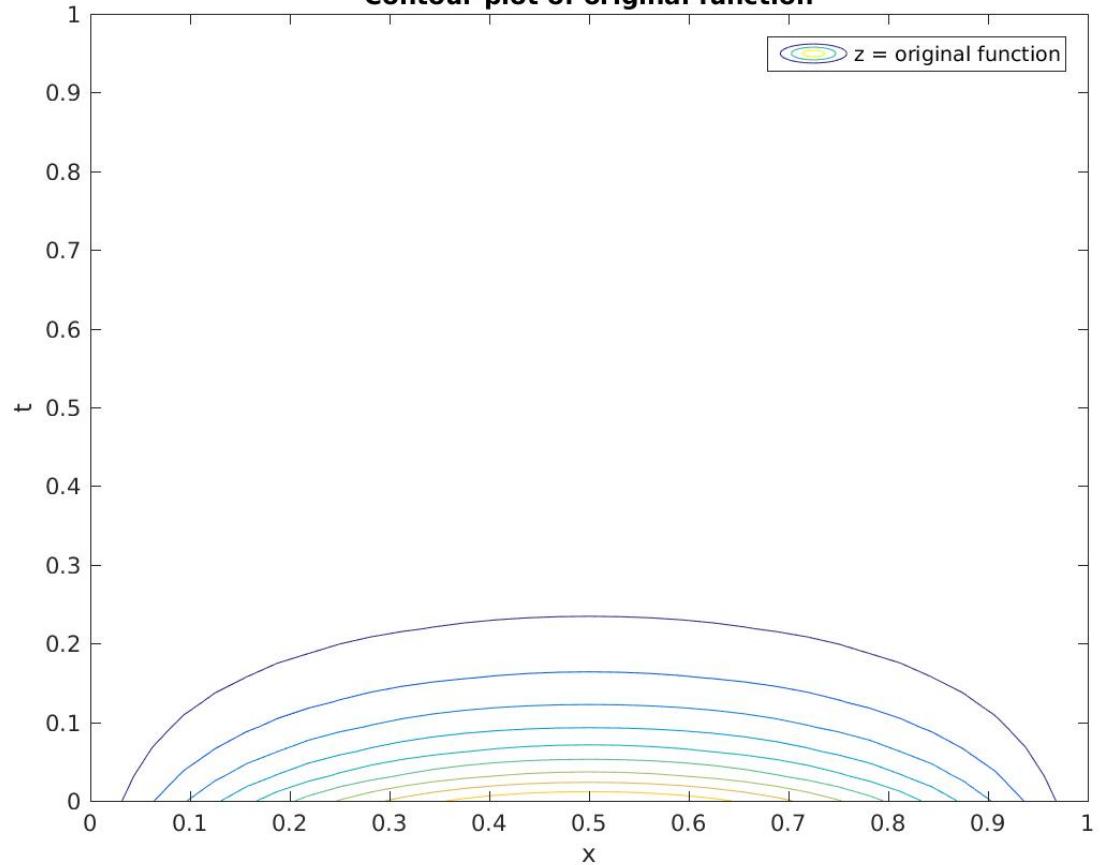


Surface plot of numerically approximated function

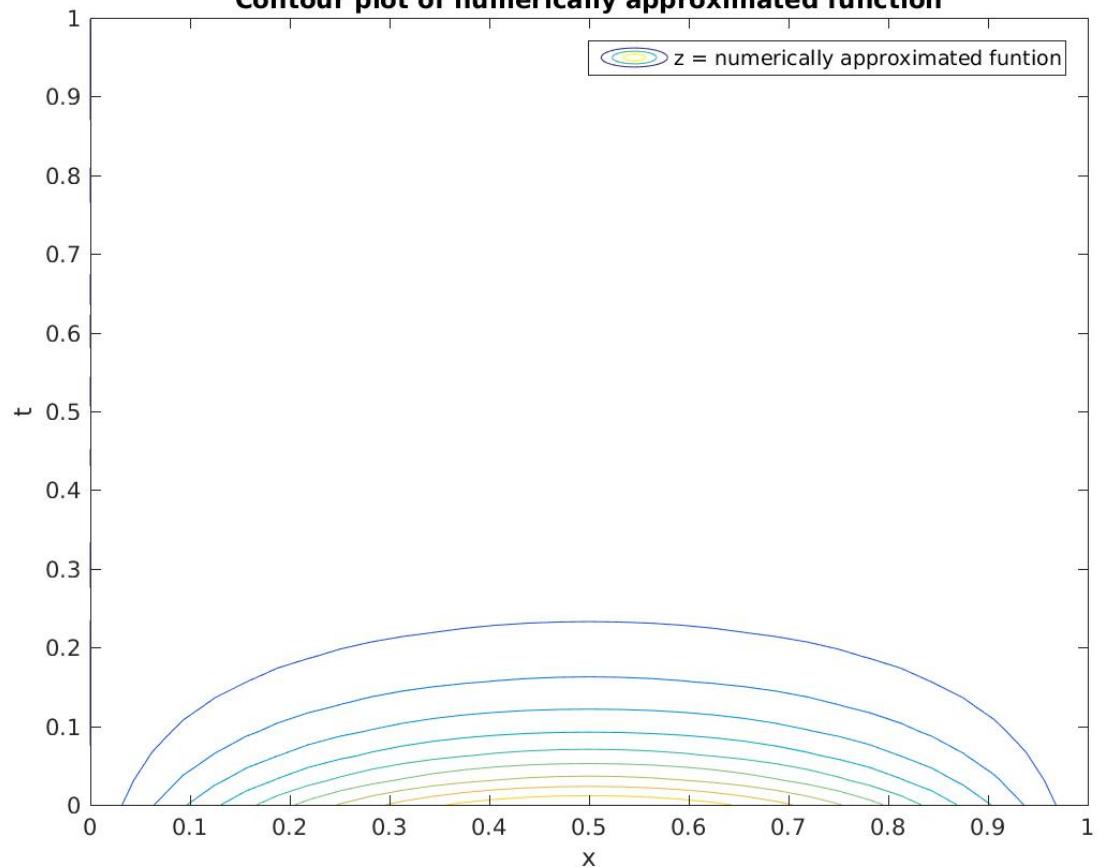
 z = numerically approximated funtion

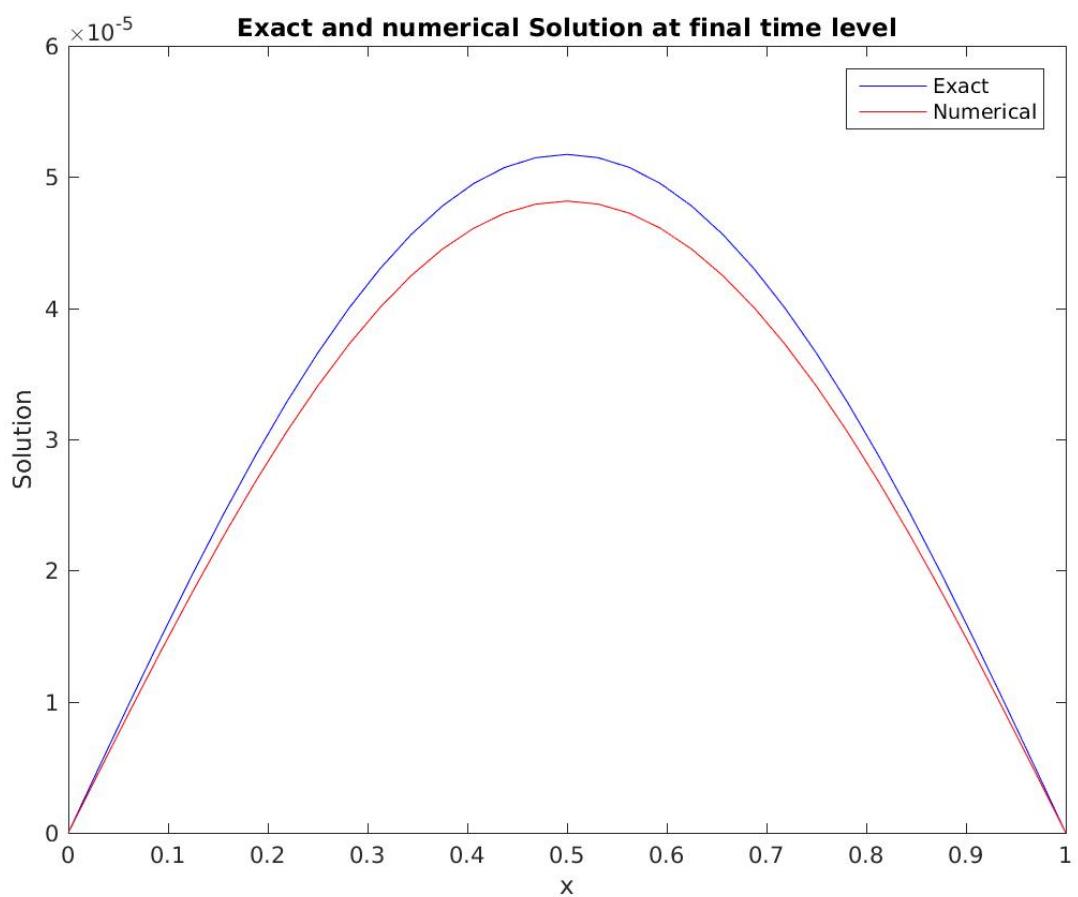


Contour plot of original function



Contour plot of numerically approximated function

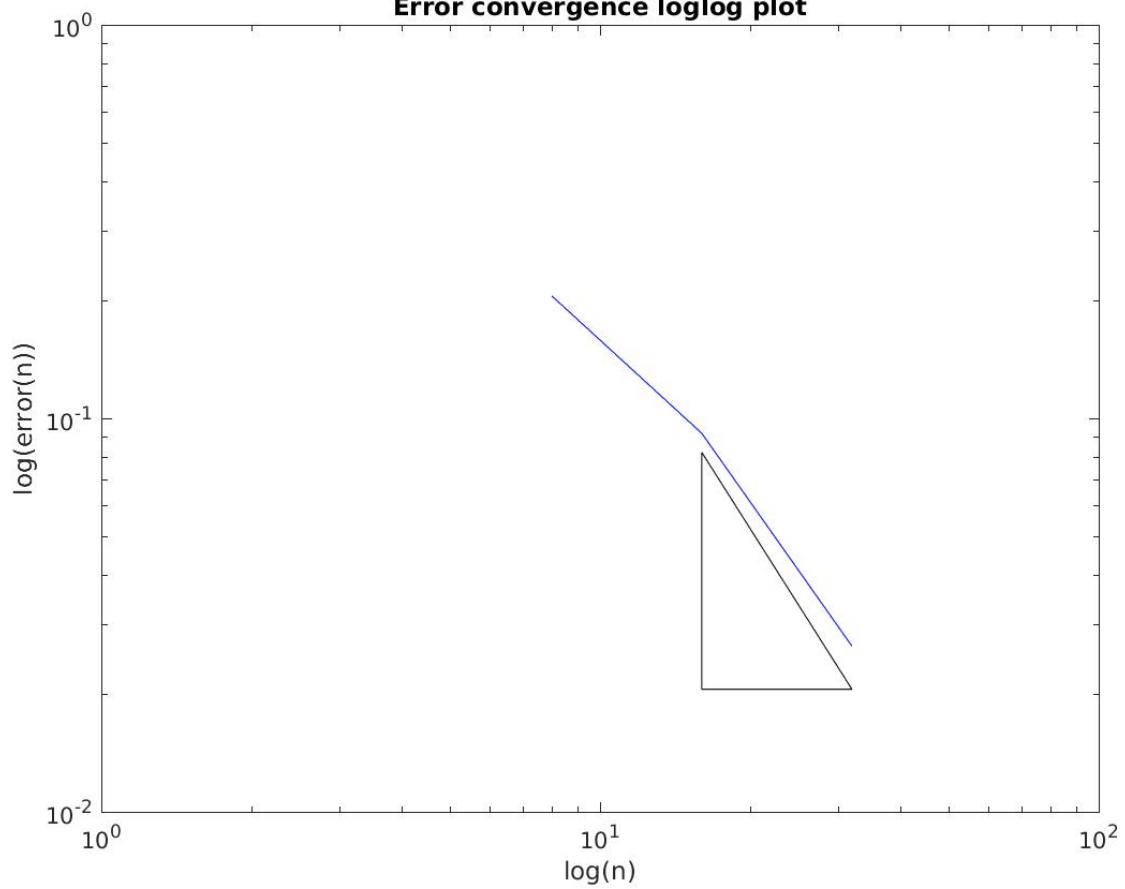




(C)

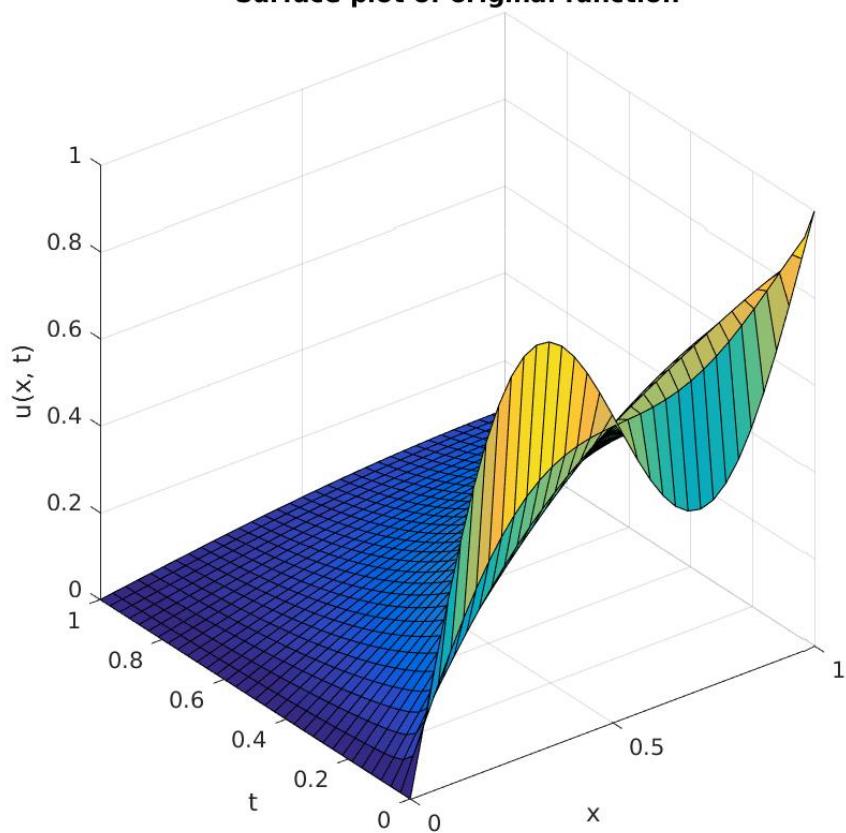
N	Error	Order
8	2.048409e-01	1.161262
16	9.158870e-02	1.796274
32	2.636997e-02	2.000000

Error convergence loglog plot



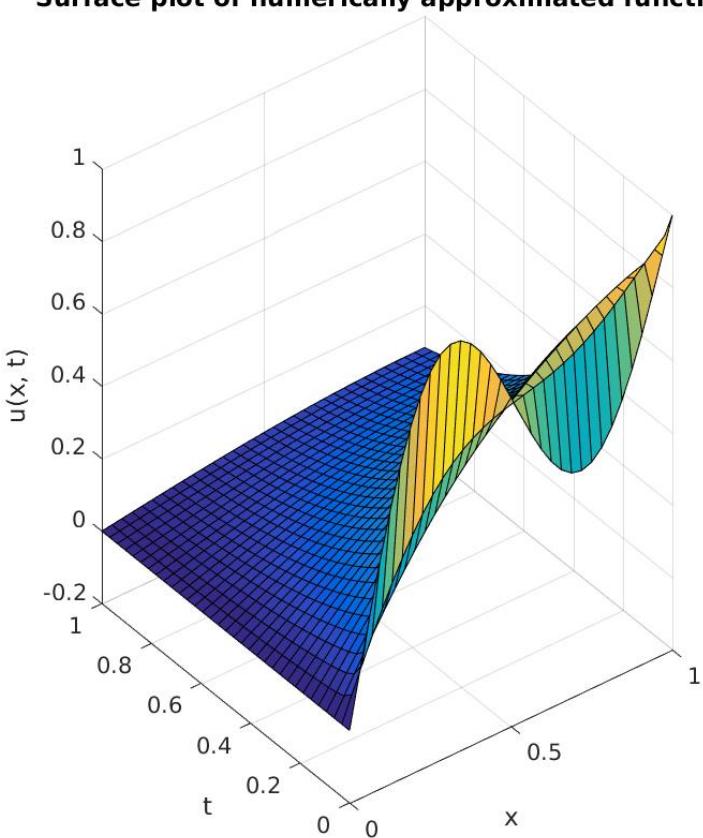
Surface plot of original function

 z = original function

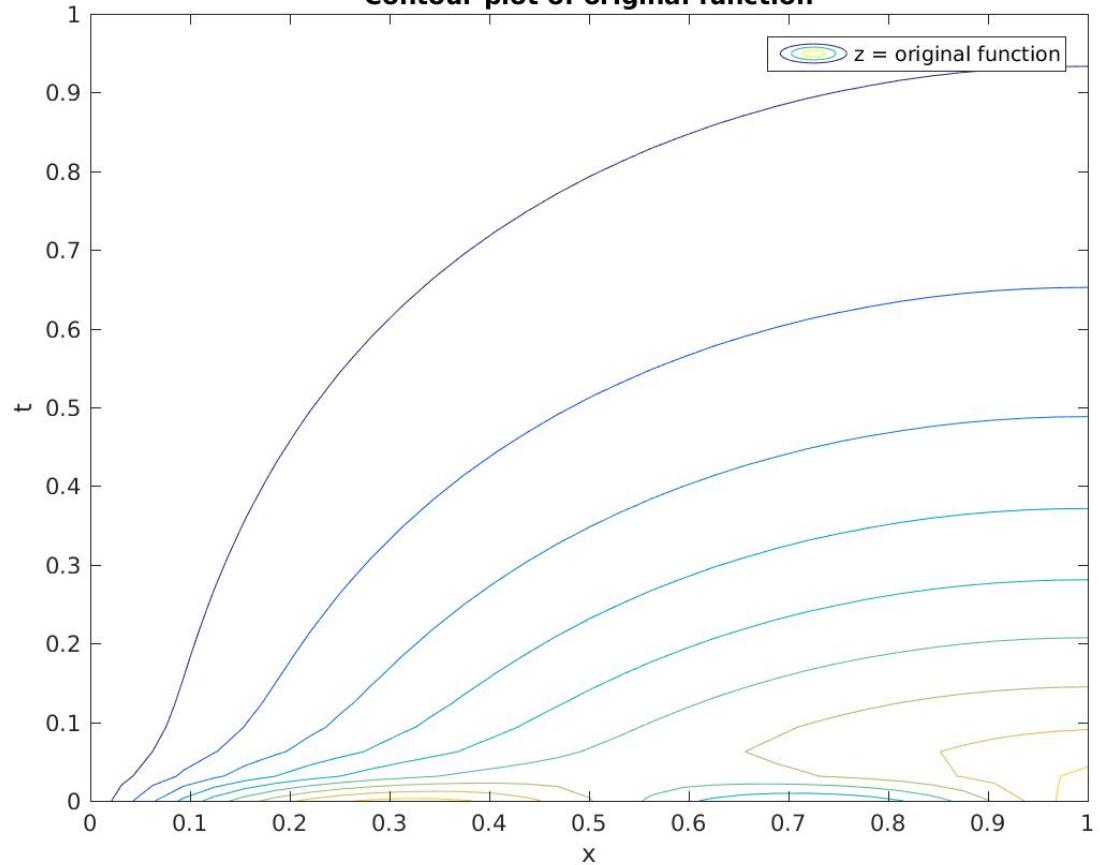


Surface plot of numerically approximated function

 z = numerically approximated funtion



Contour plot of original function



Contour plot of numerically approximated function

