

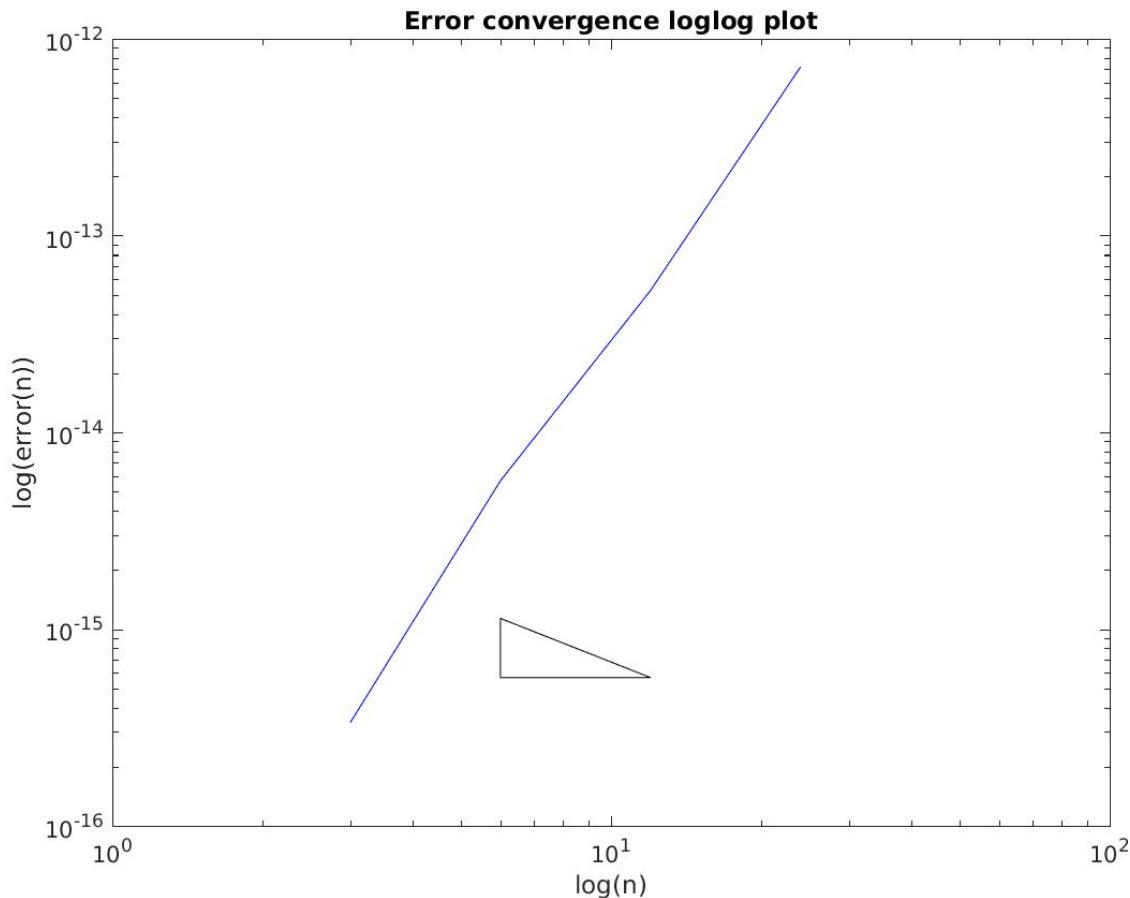
**MA 322: Scientific Computing  
LAB 9 Report  
Abheek Ghosh - 140123047**

**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**

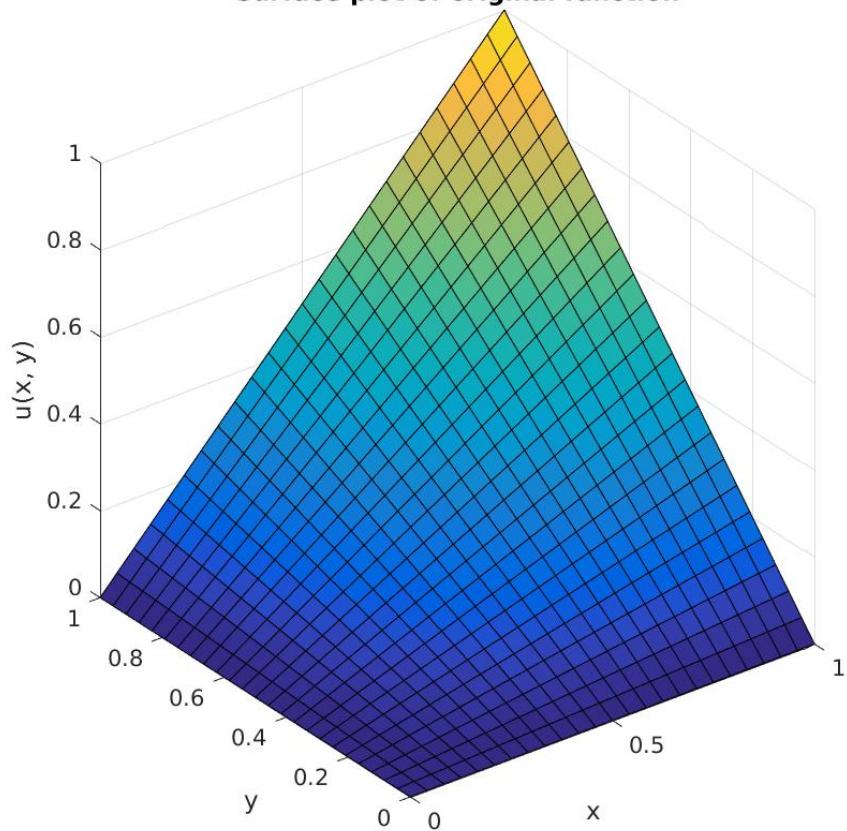
(A) The function is of order 2 so there is no truncation error. The only error is roundoff, and it does not have a order 2 convergence.

N	Error	Order
3	3.346089e-16	-4.082370
6	5.668305e-15	-3.213053
12	5.256281e-14	-3.778065>



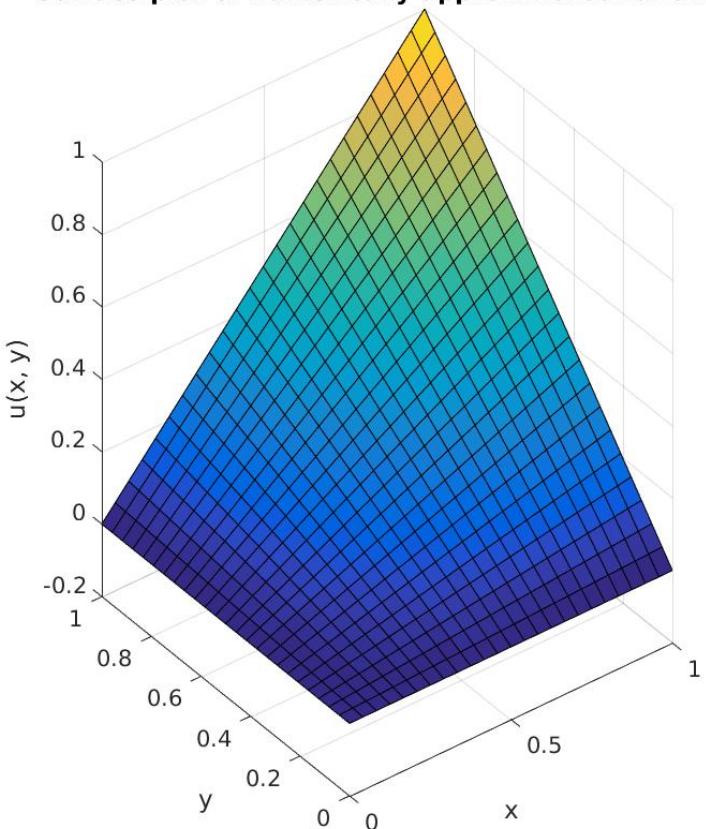
**Surface plot of original function**

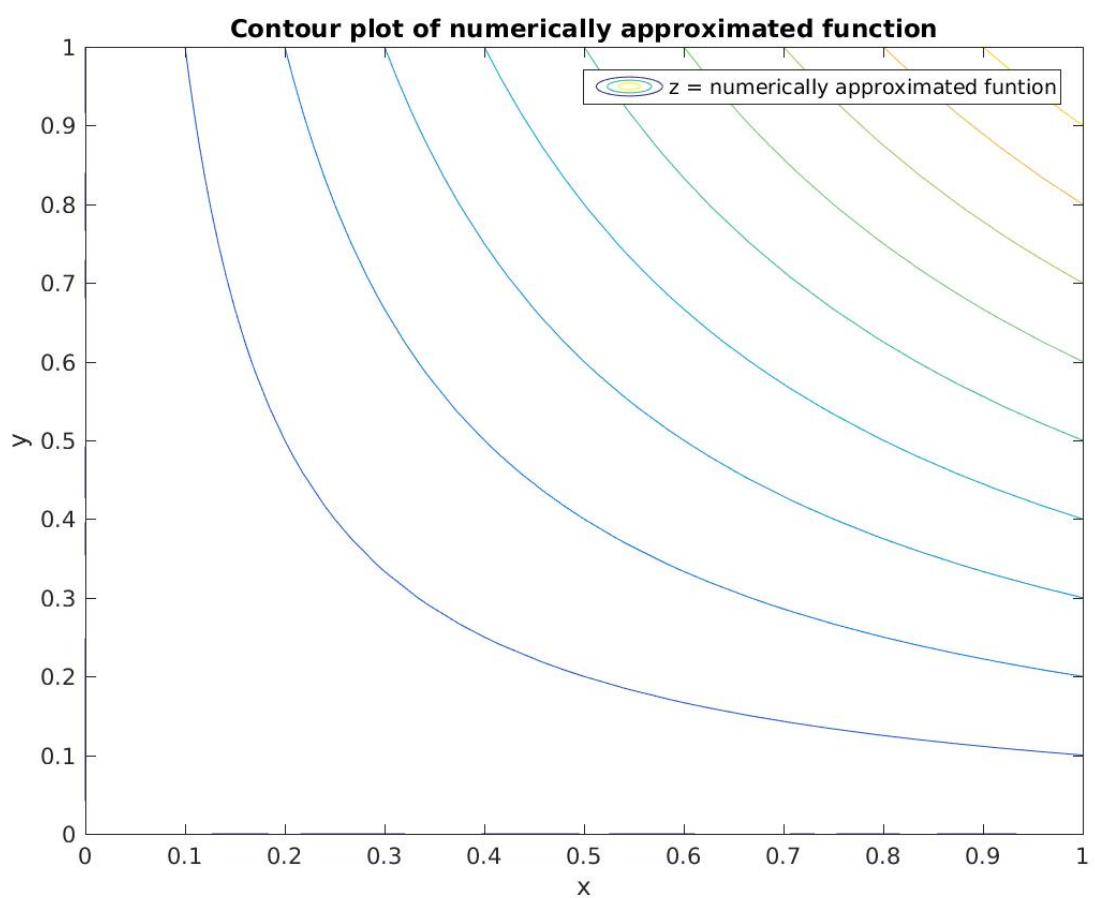
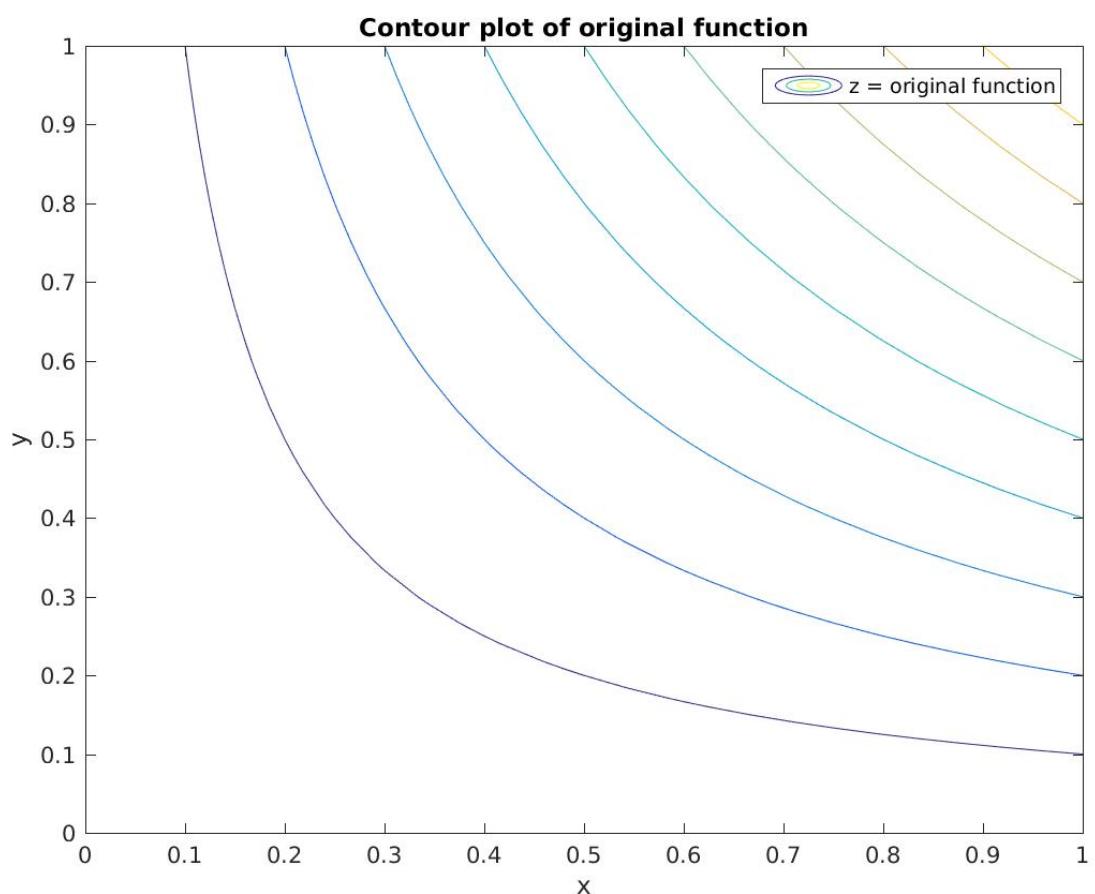
 z = original function

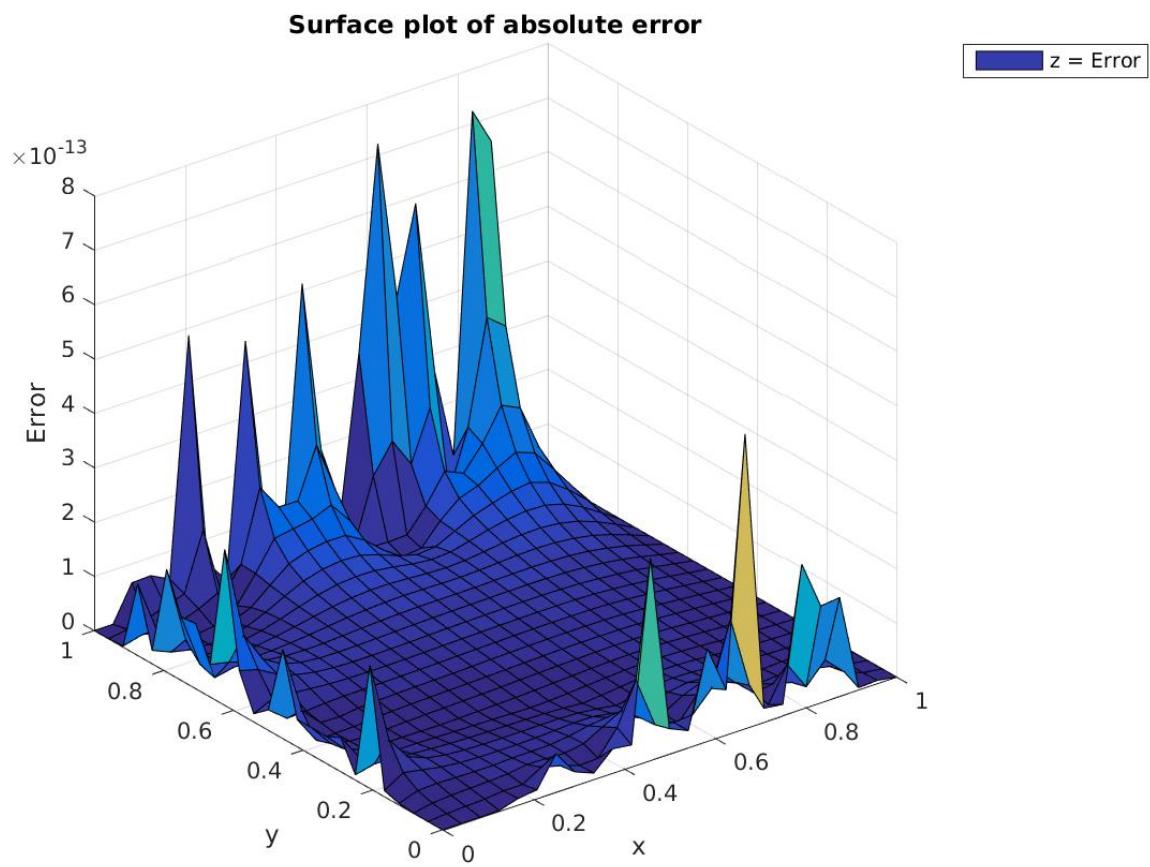


**Surface plot of numerically approximated function**

 z = numerically approximated funtion

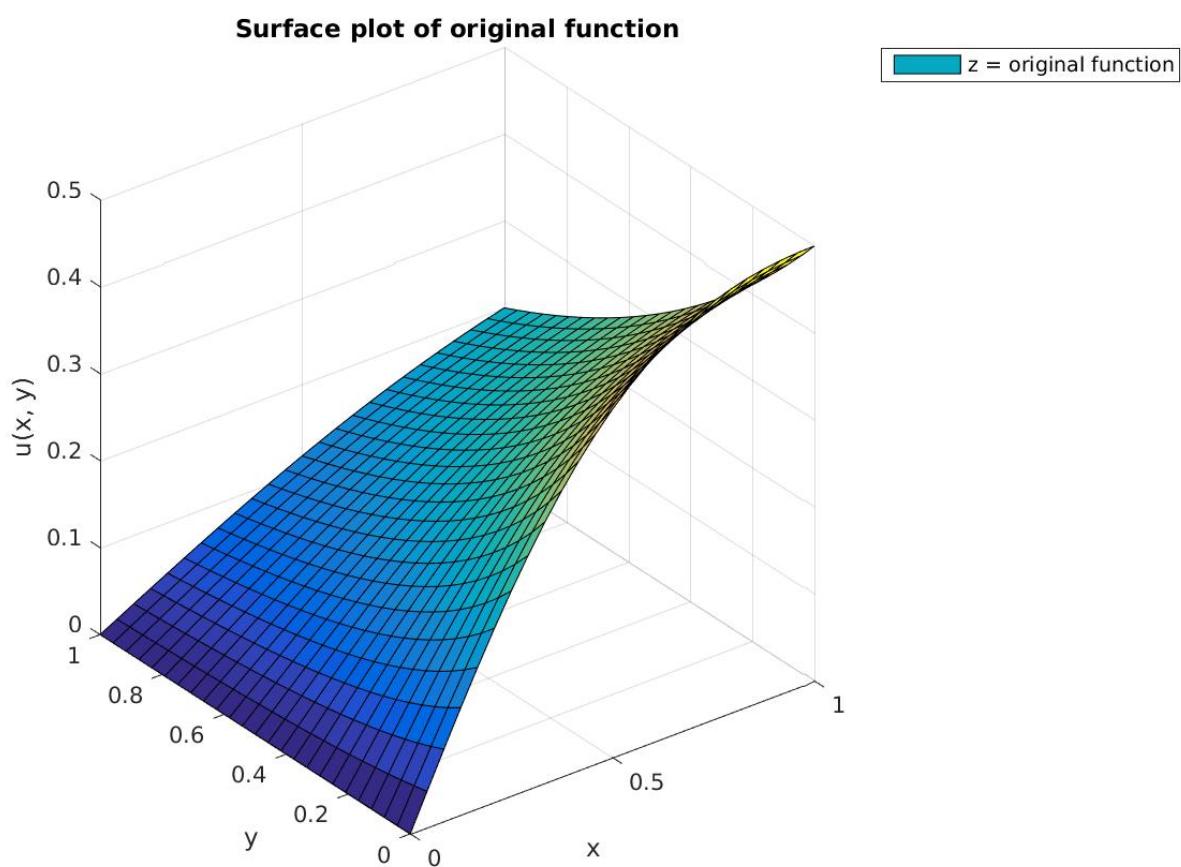
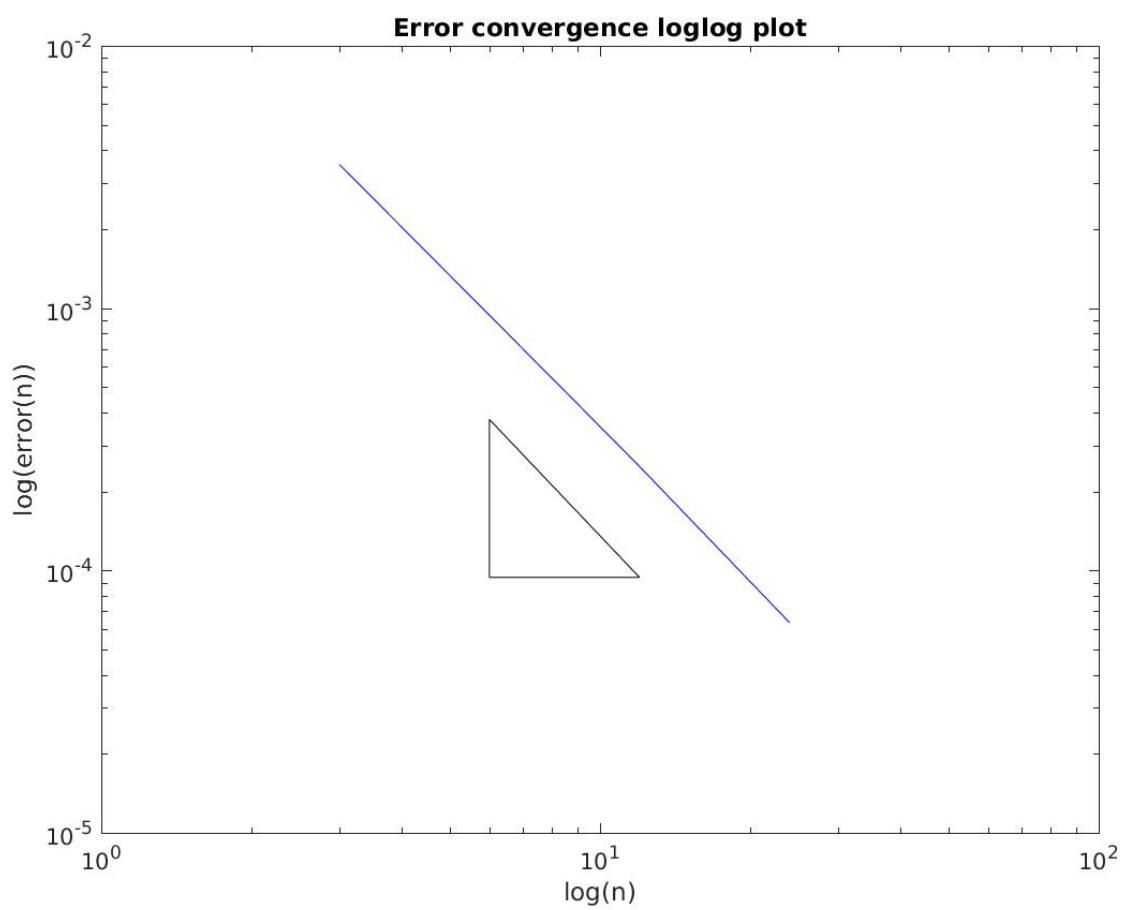




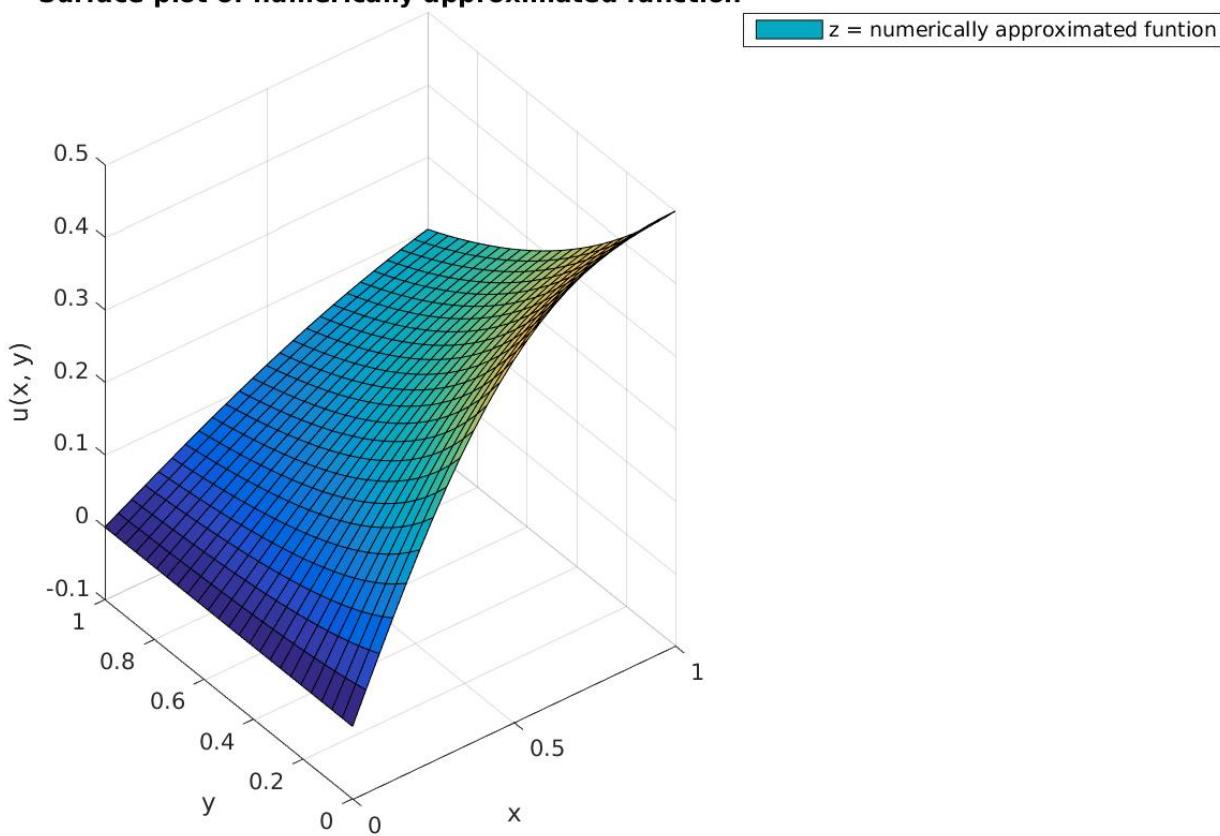


(B)

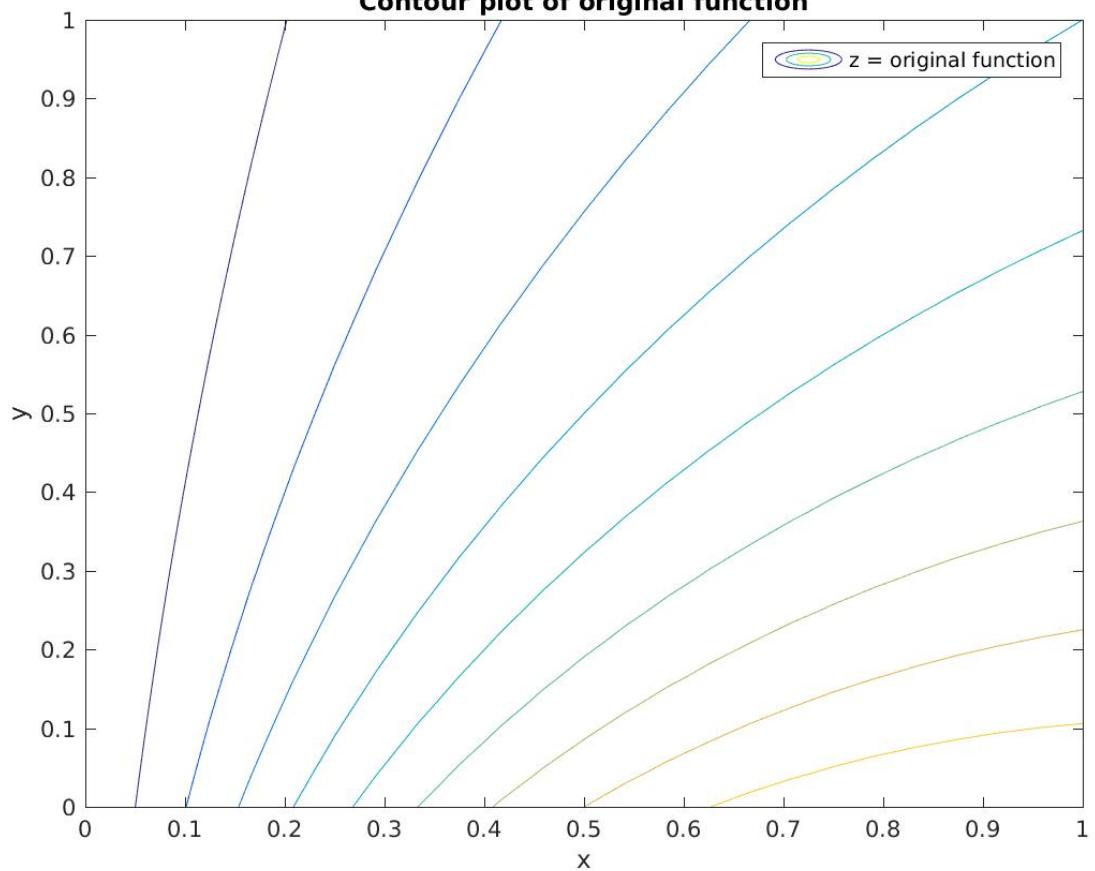
N	Error	Order
3	3.527119e-03	1.905469
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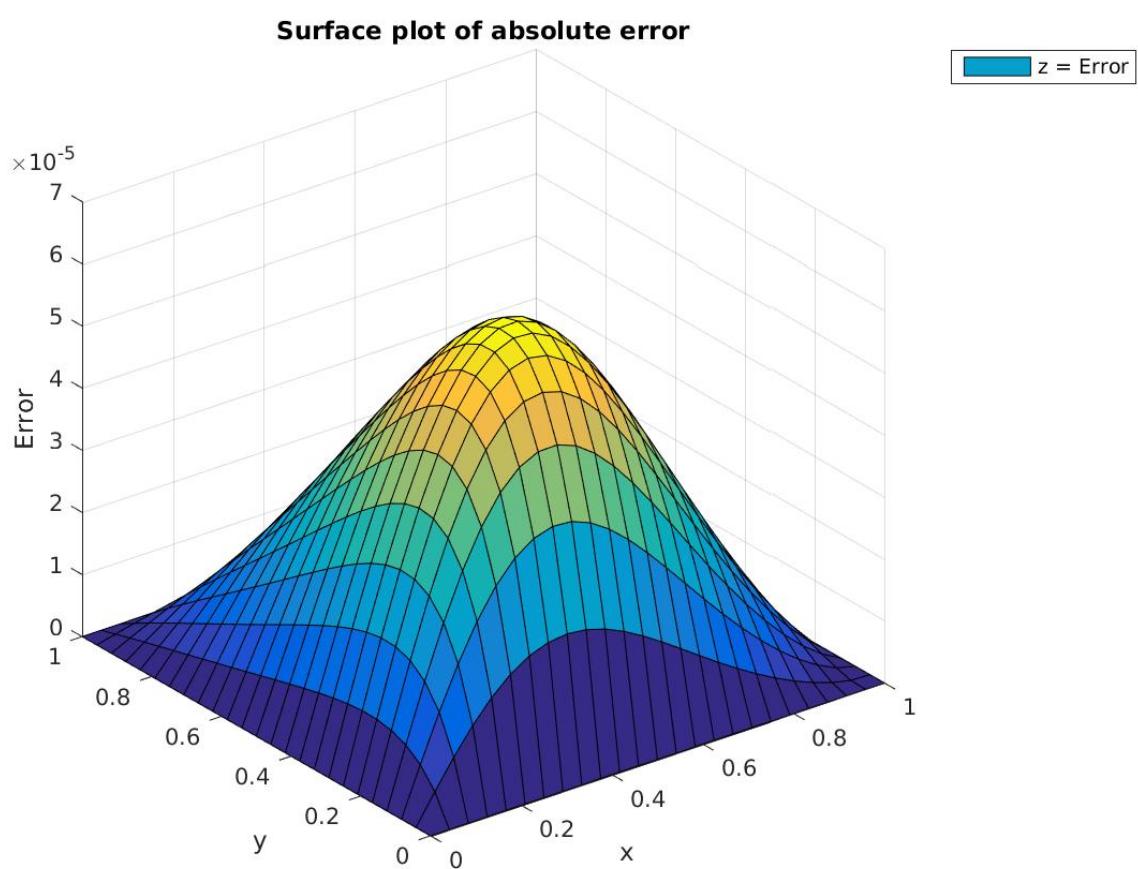
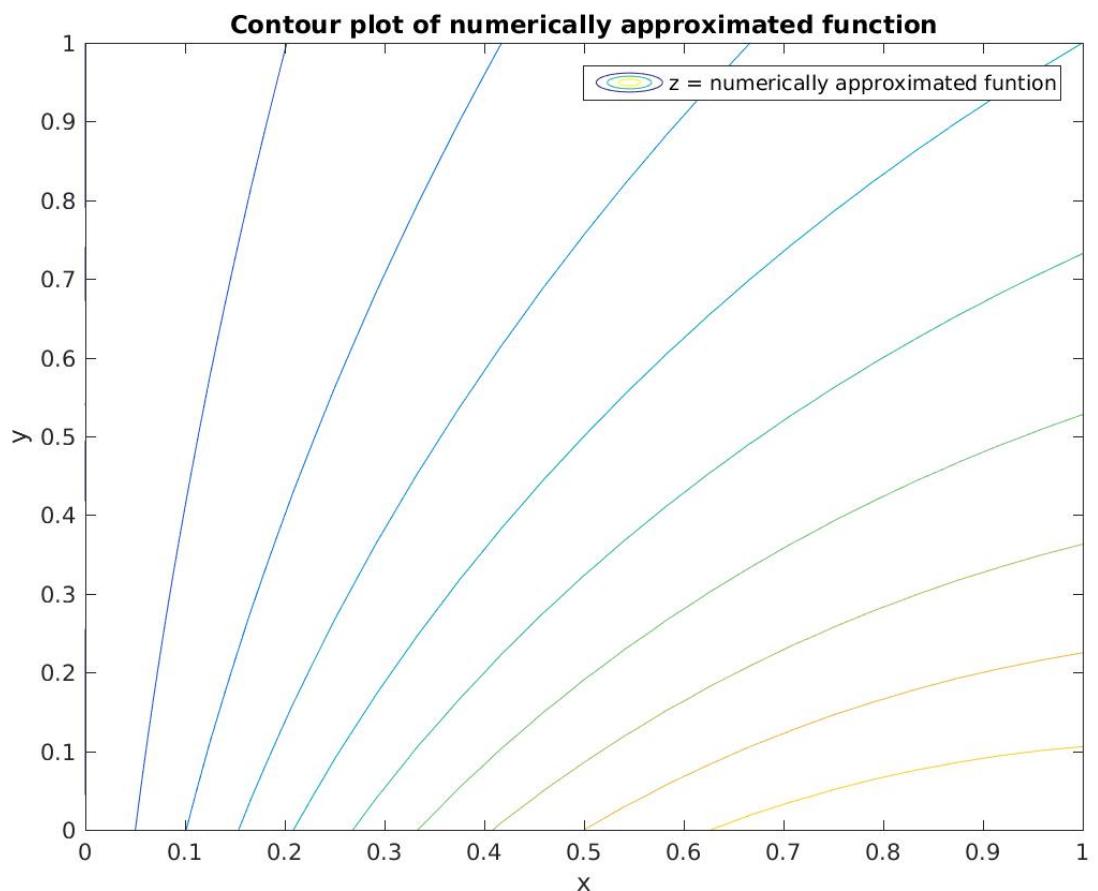


**Surface plot of numerically approximated function**



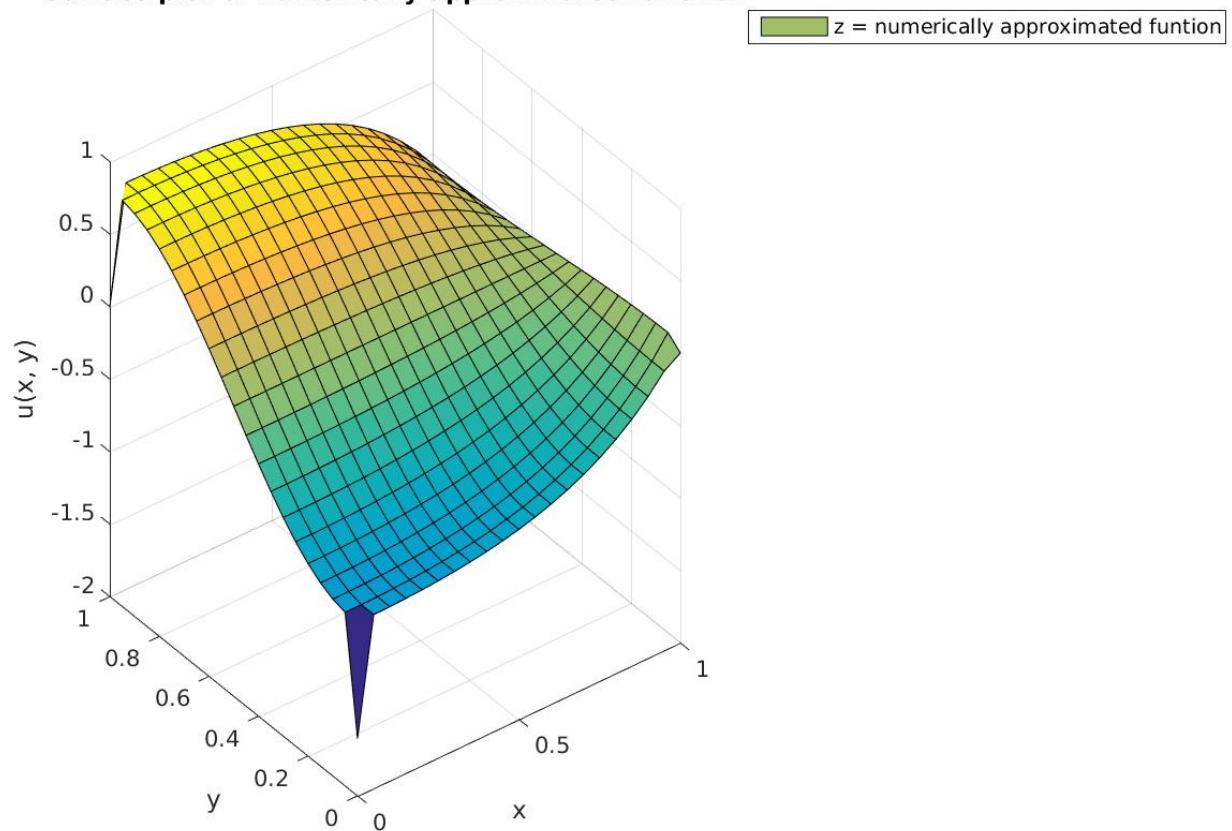
**Contour plot of original function**



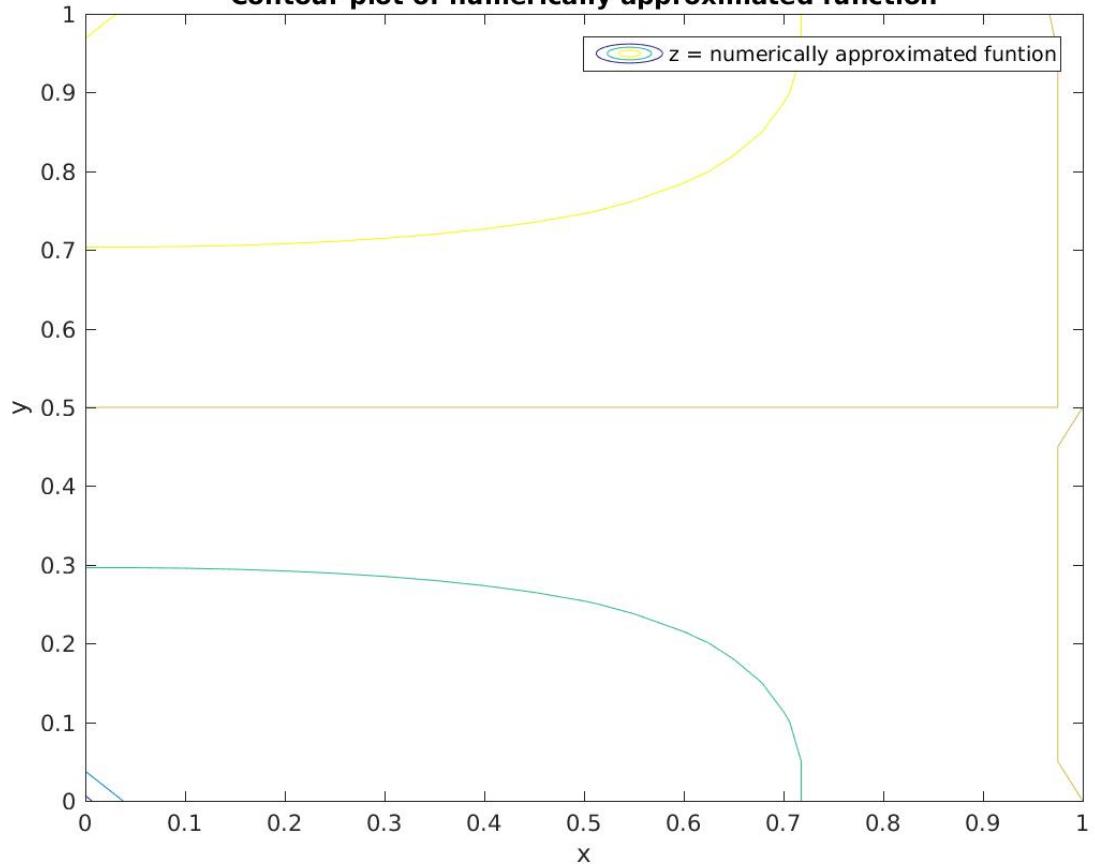


(C) (Original function not available)

**Surface plot of numerically approximated function**

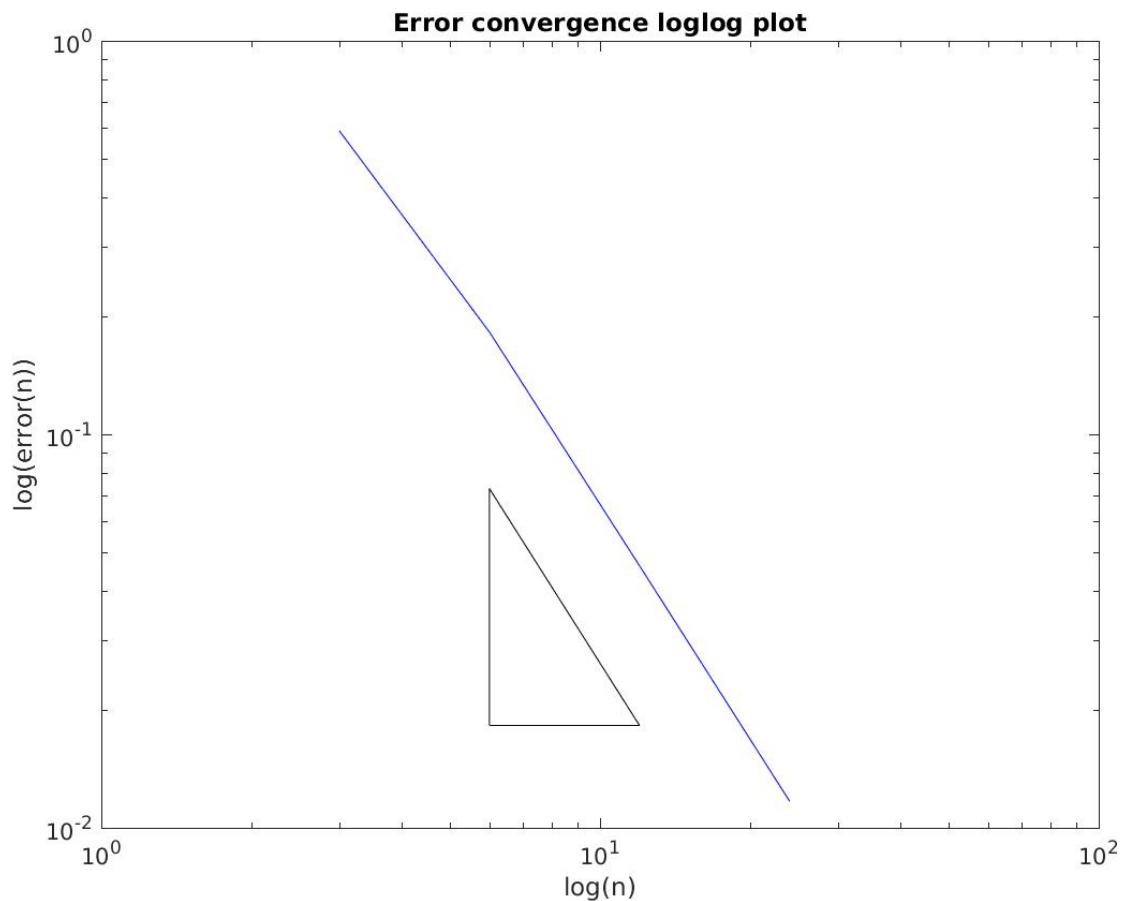


**Contour plot of numerically approximated function**



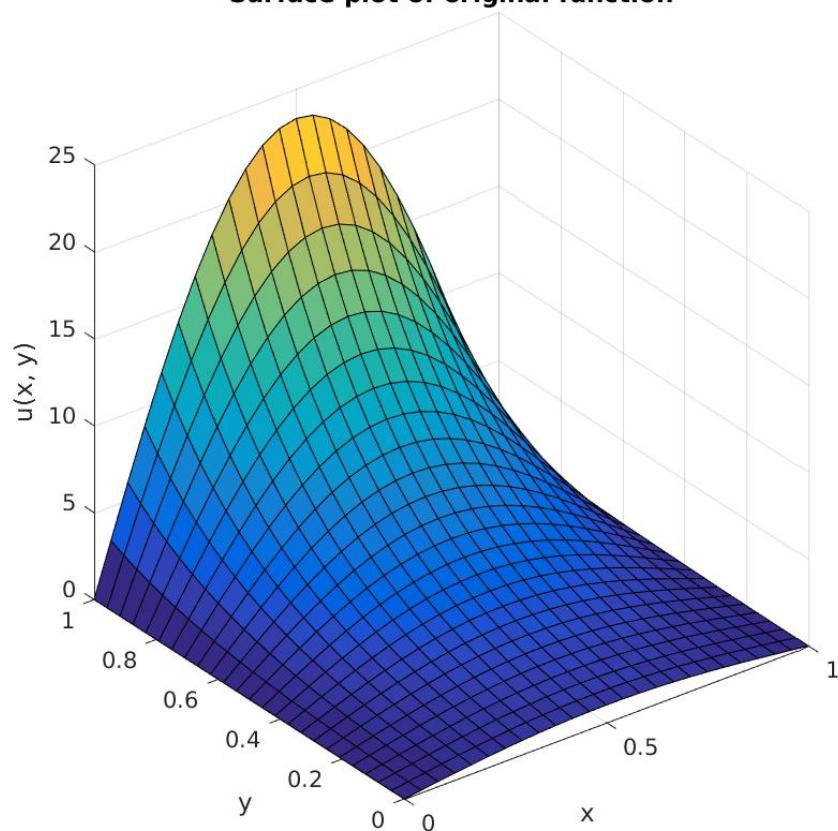
(D)

N	Error	Order
3	5.908305e-01	1.698461
6	1.820435e-01	1.973942
12	4.634037e-02	1.987778



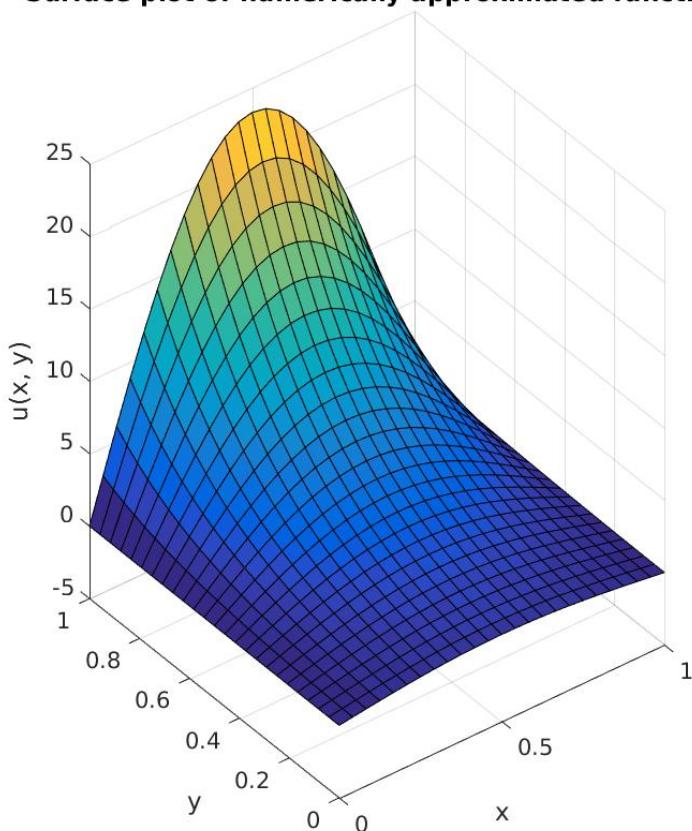
**Surface plot of original function**

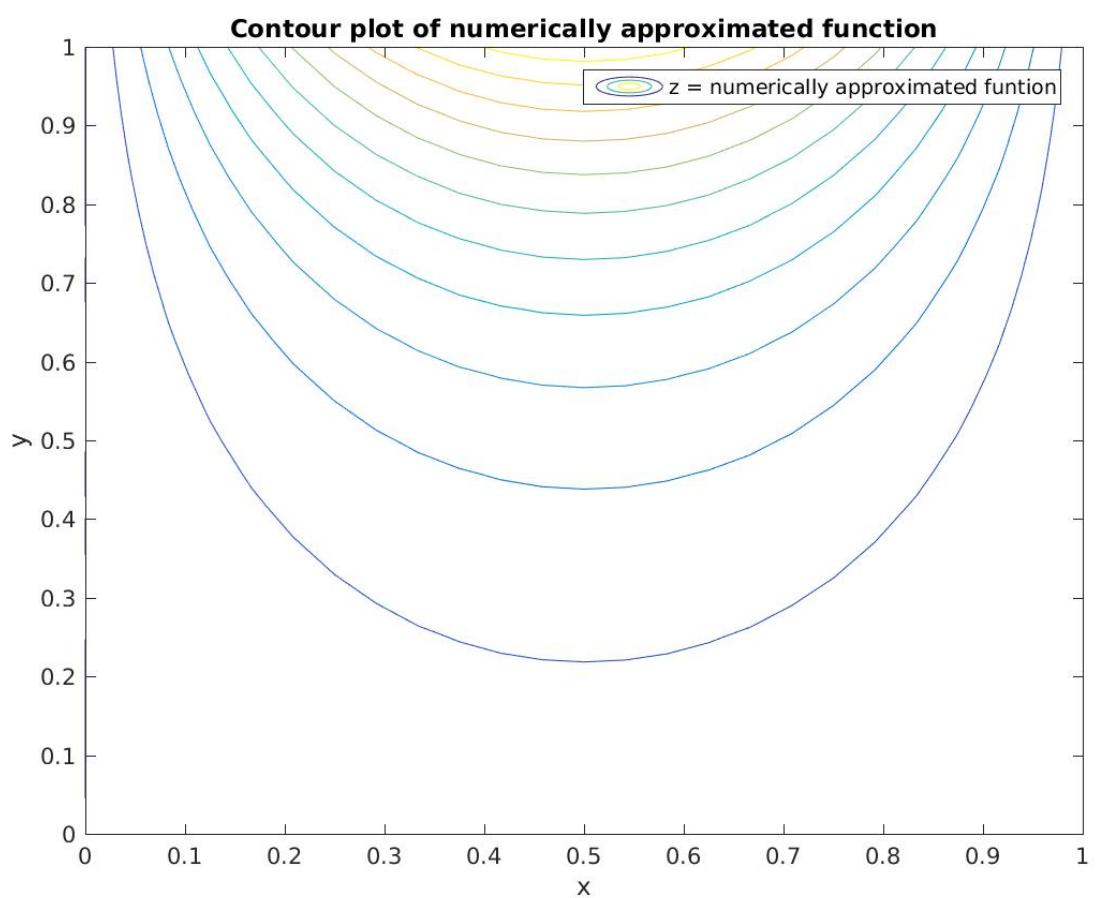
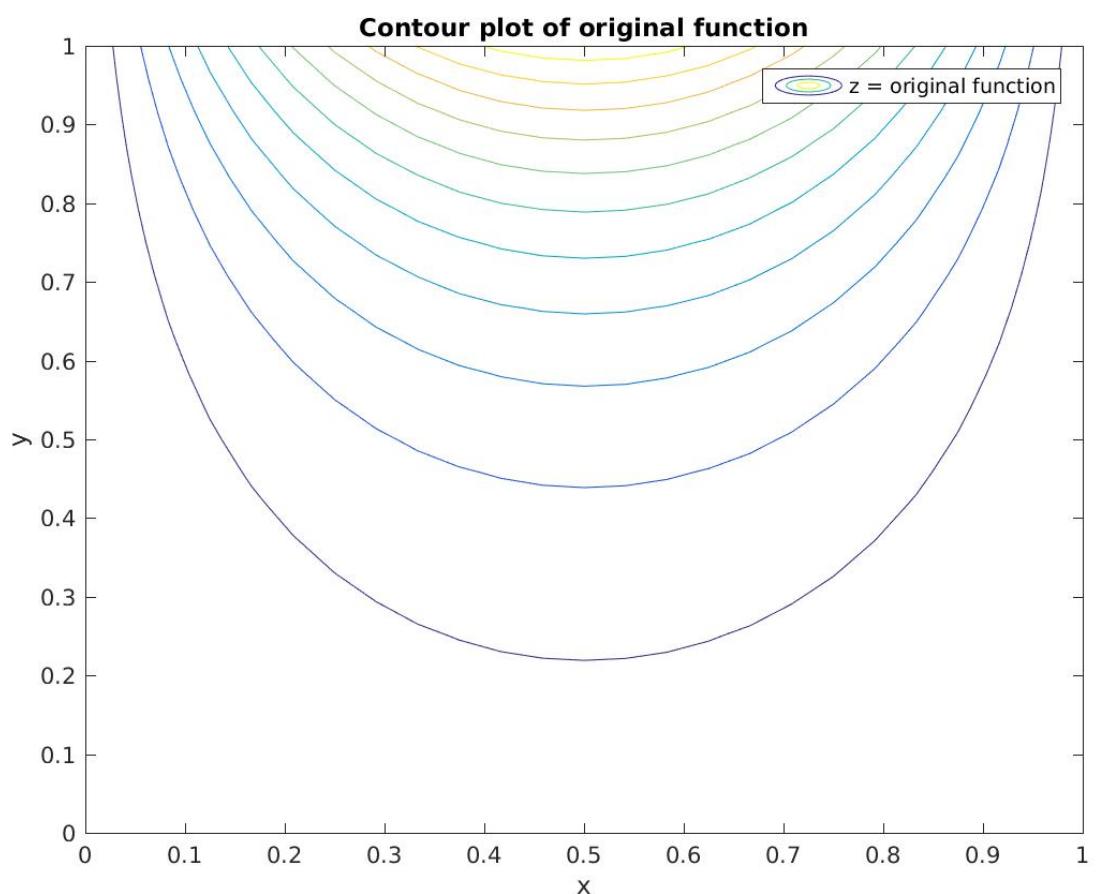
 z = original function

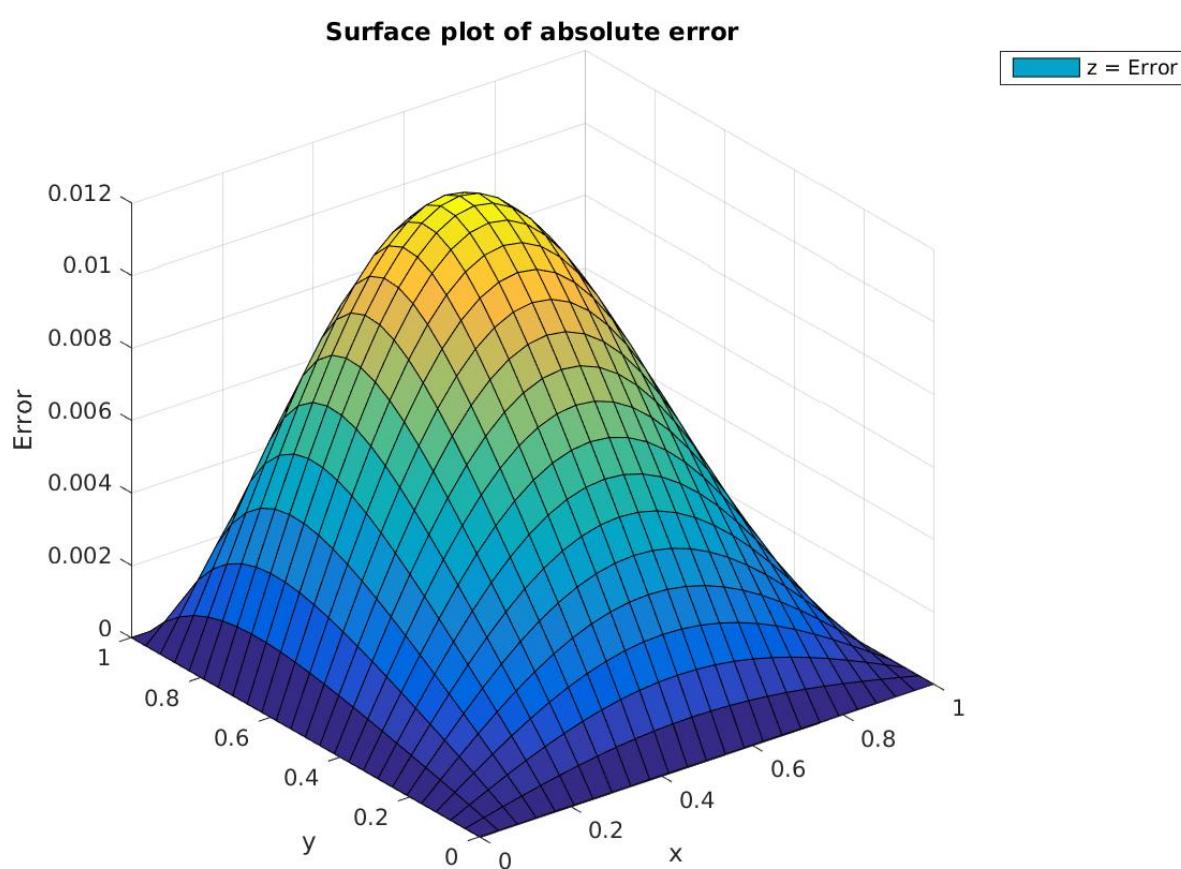


**Surface plot of numerically approximated function**

 z = numerically approximated funtion

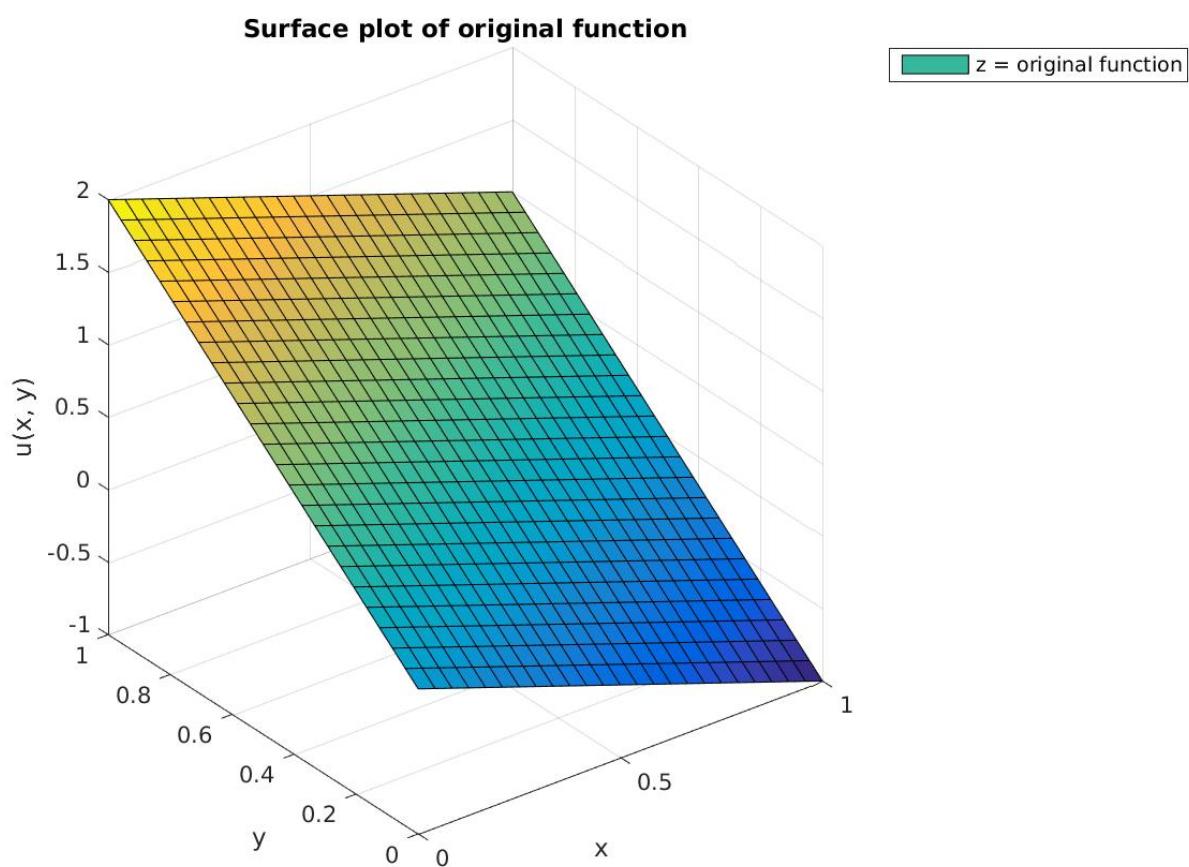
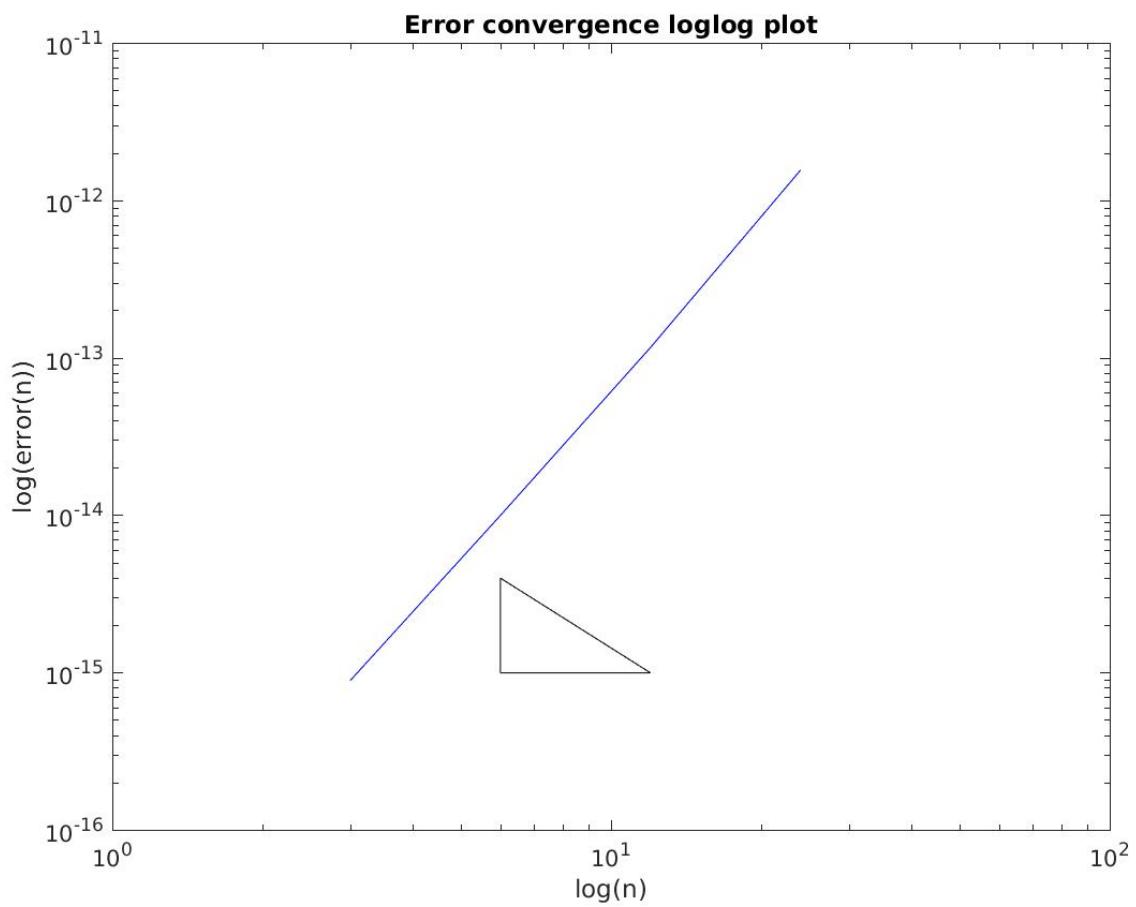




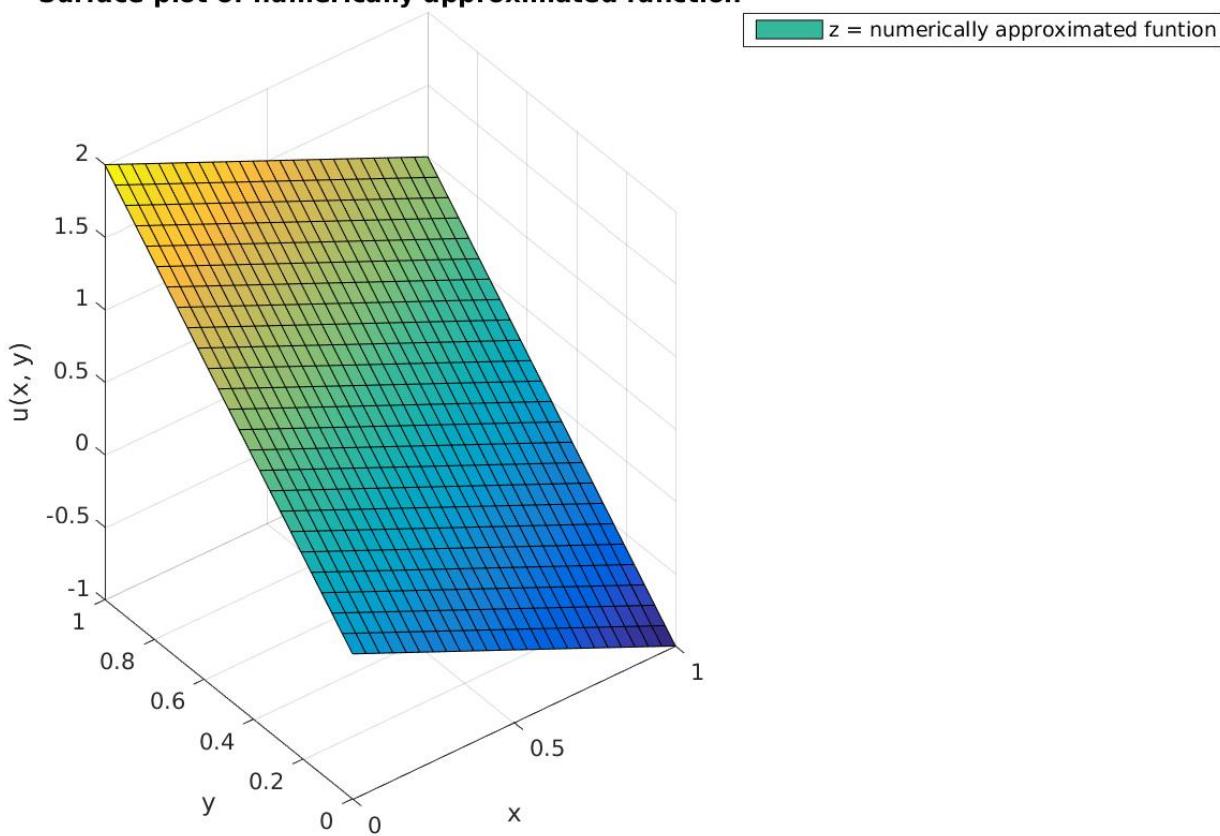


(E) The function is of order 1 so there is no truncation error. The only error is roundoff, and it does not have a order 2 convergence.

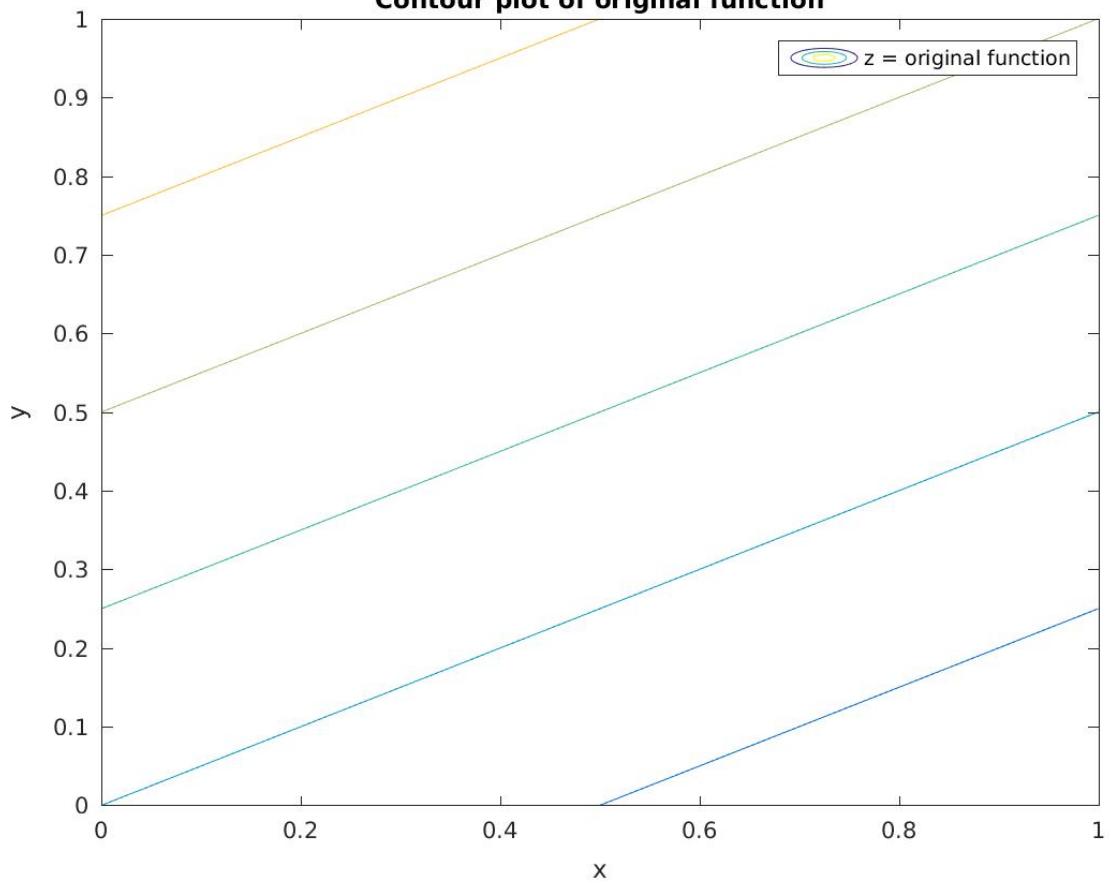
N	Error	Order
3	8.881784e-16	-3.483816
6	9.936496e-15	-3.545471
12	1.160183e-13	-3.745294

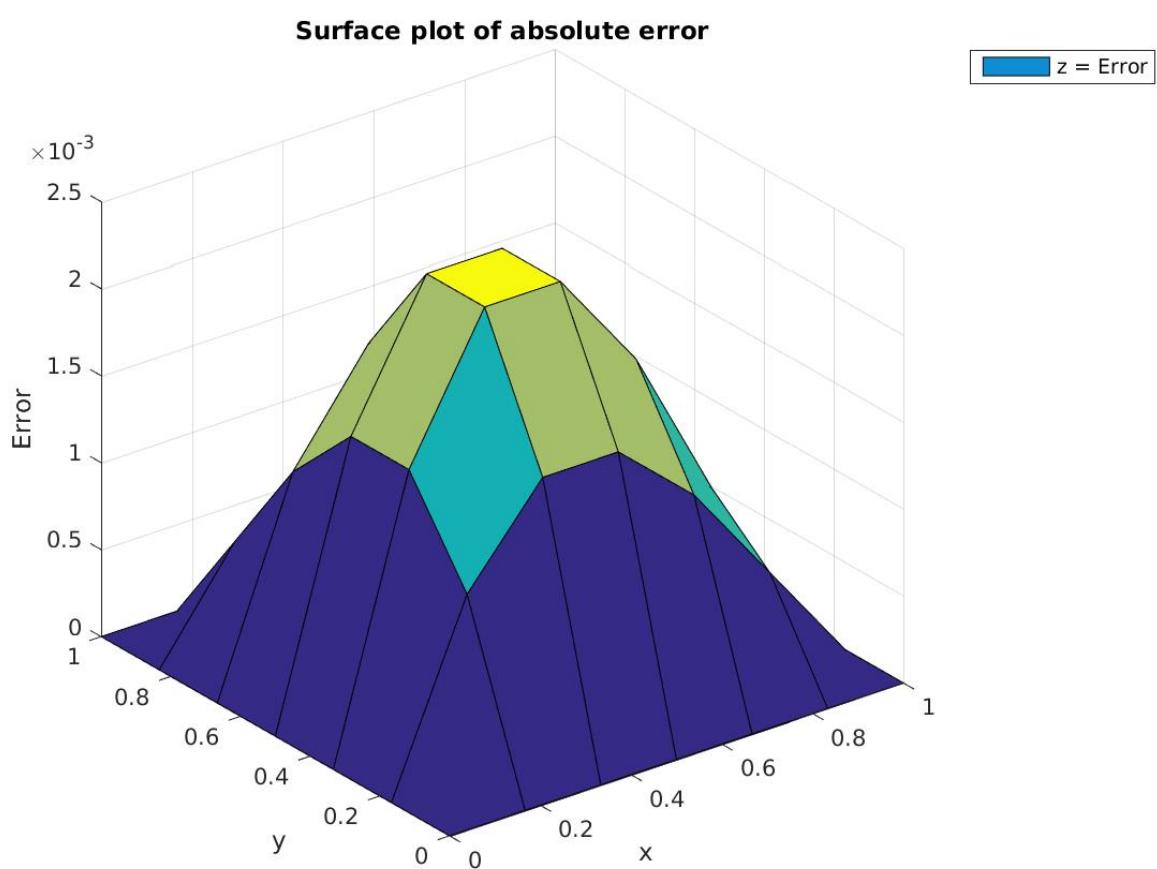
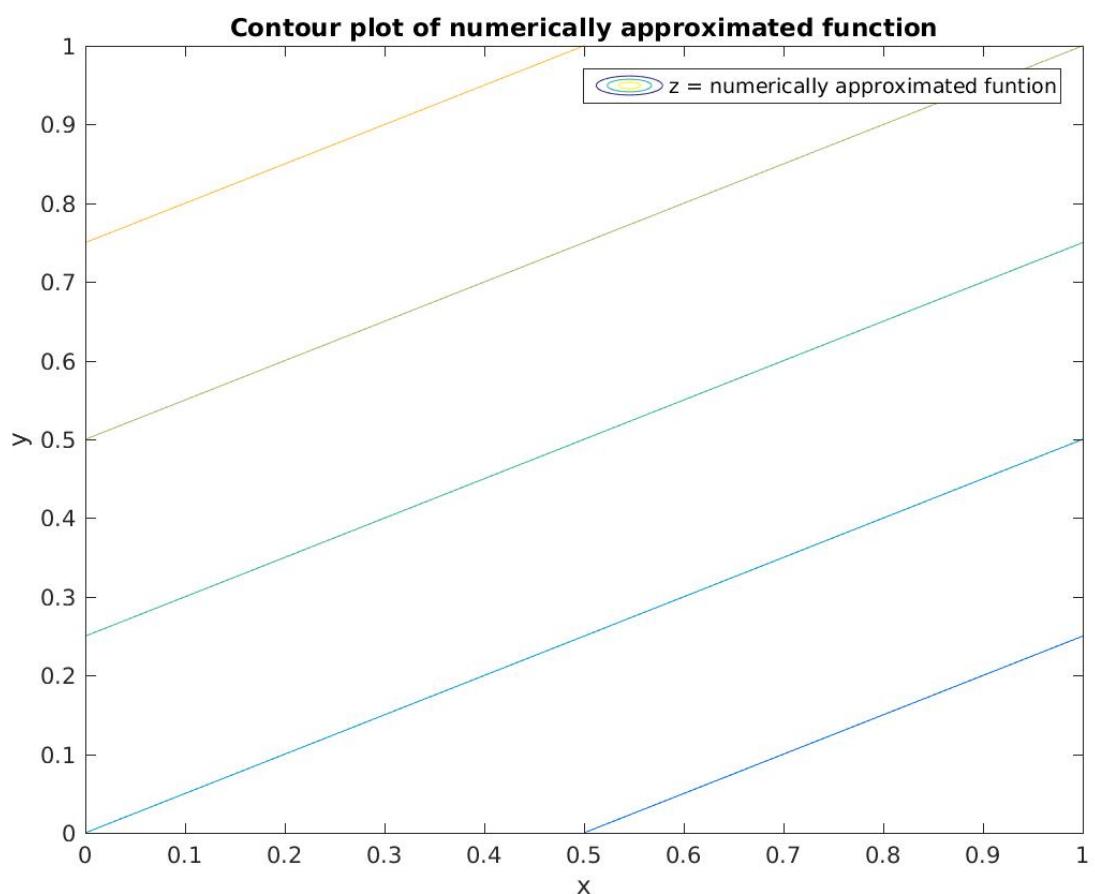


**Surface plot of numerically approximated function**



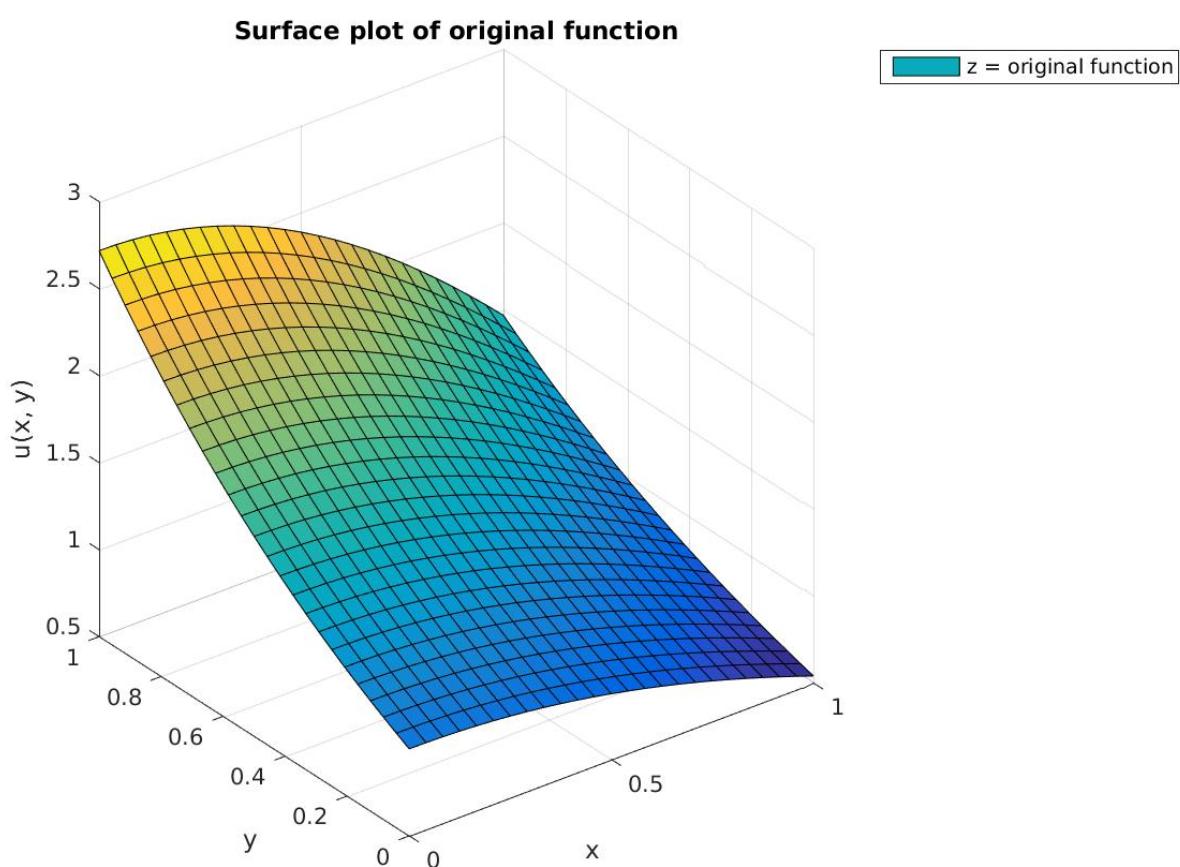
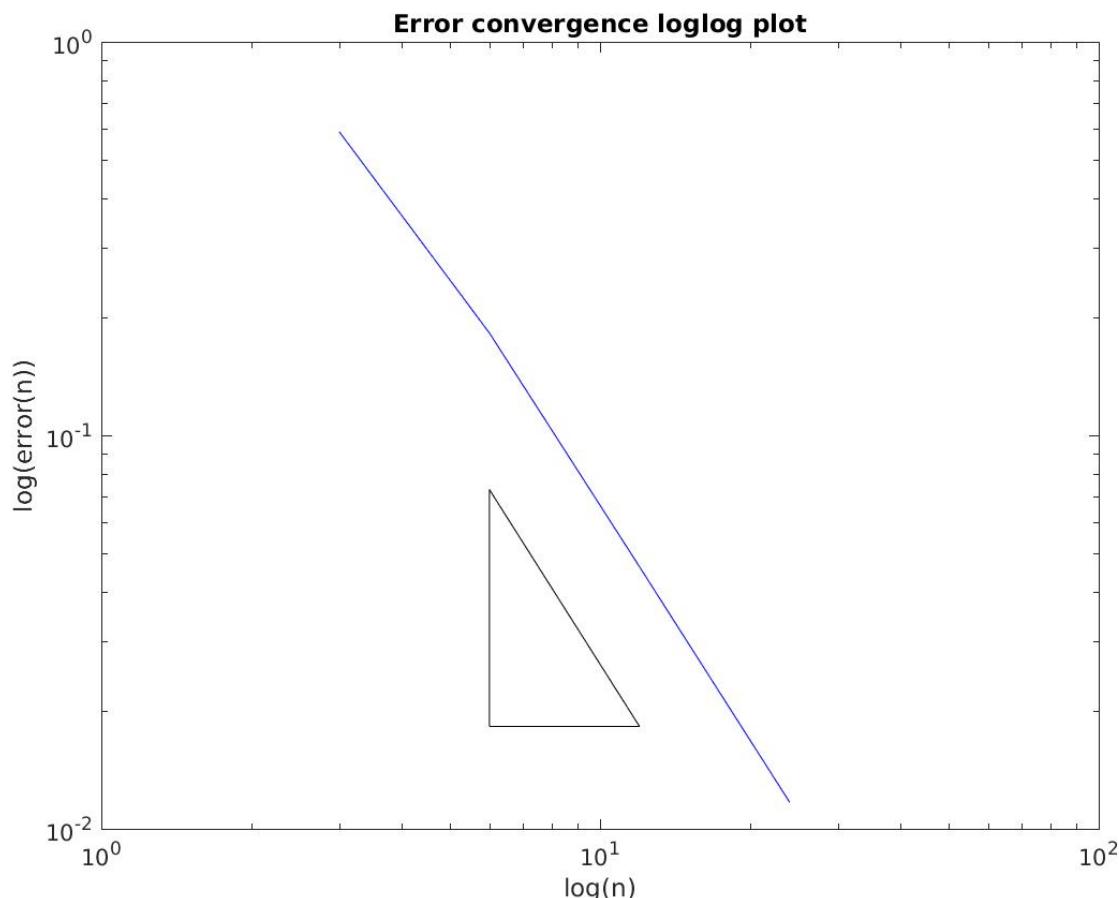
**Contour plot of original function**





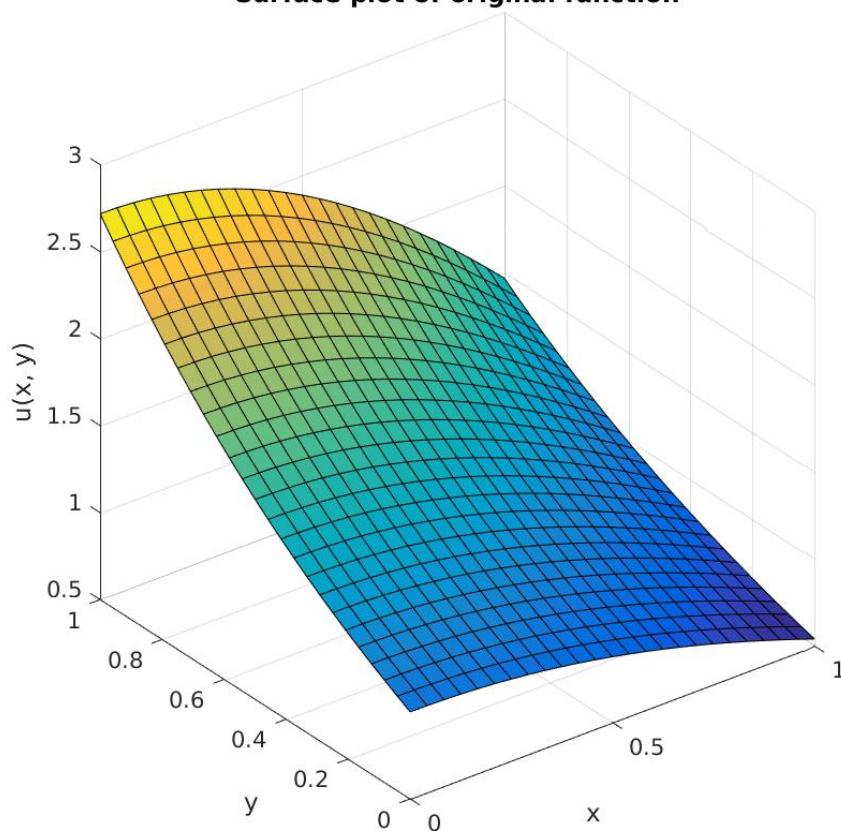
(F)

N	Error	Order
3	5.903116e-01	1.739355
6	1.768005e-01	2.783537



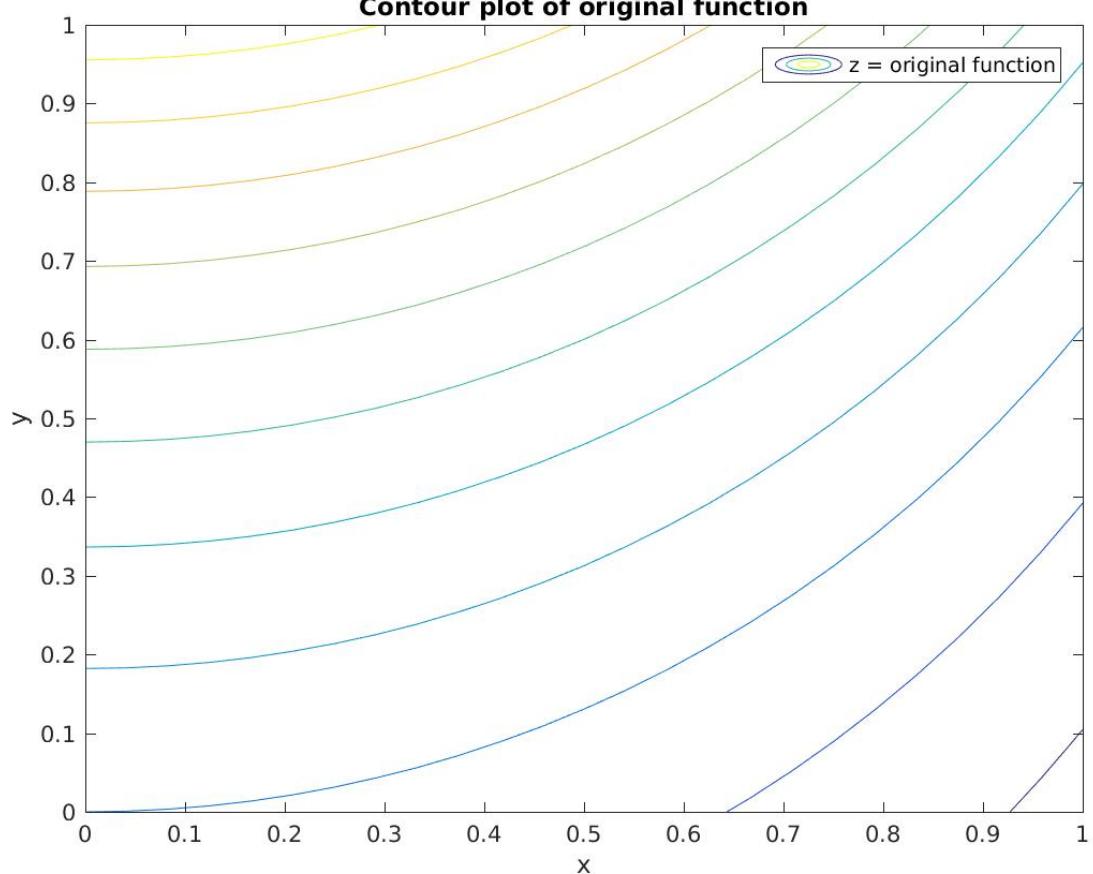
**Surface plot of original function**

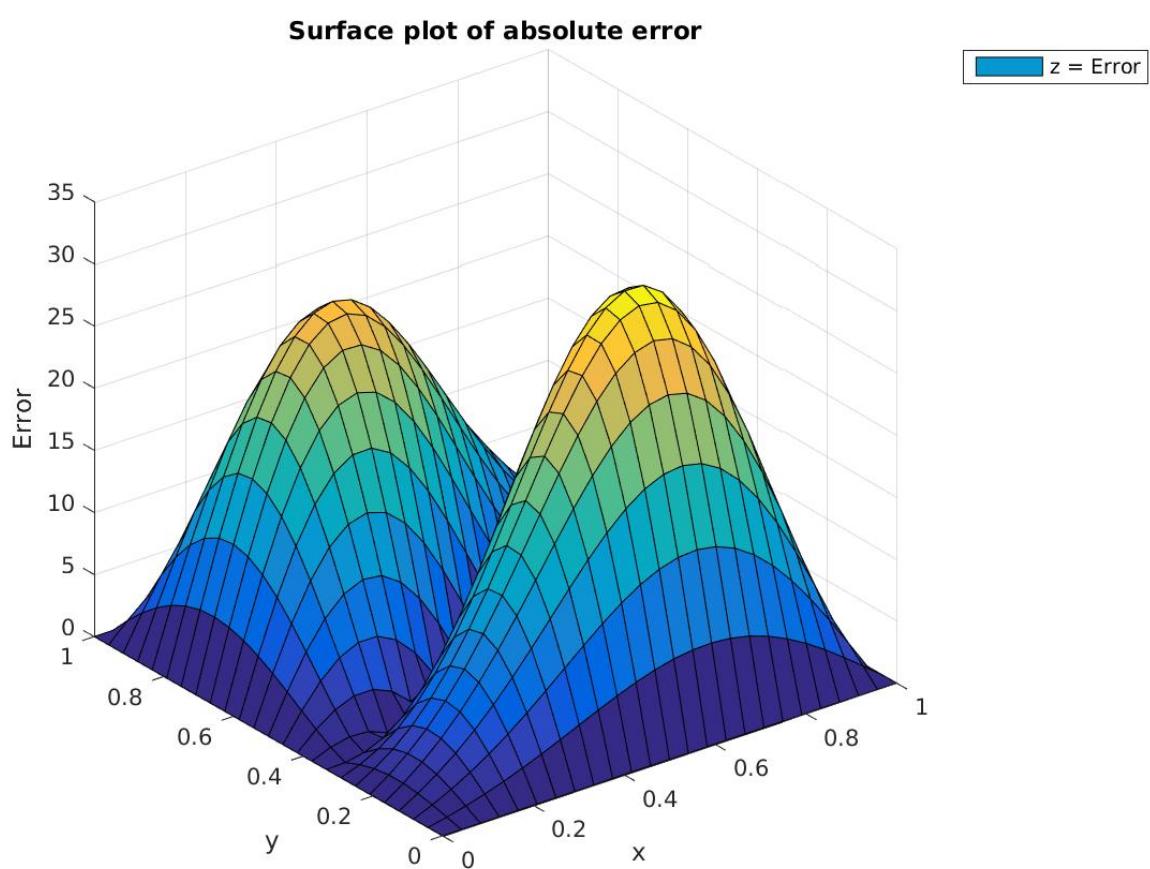
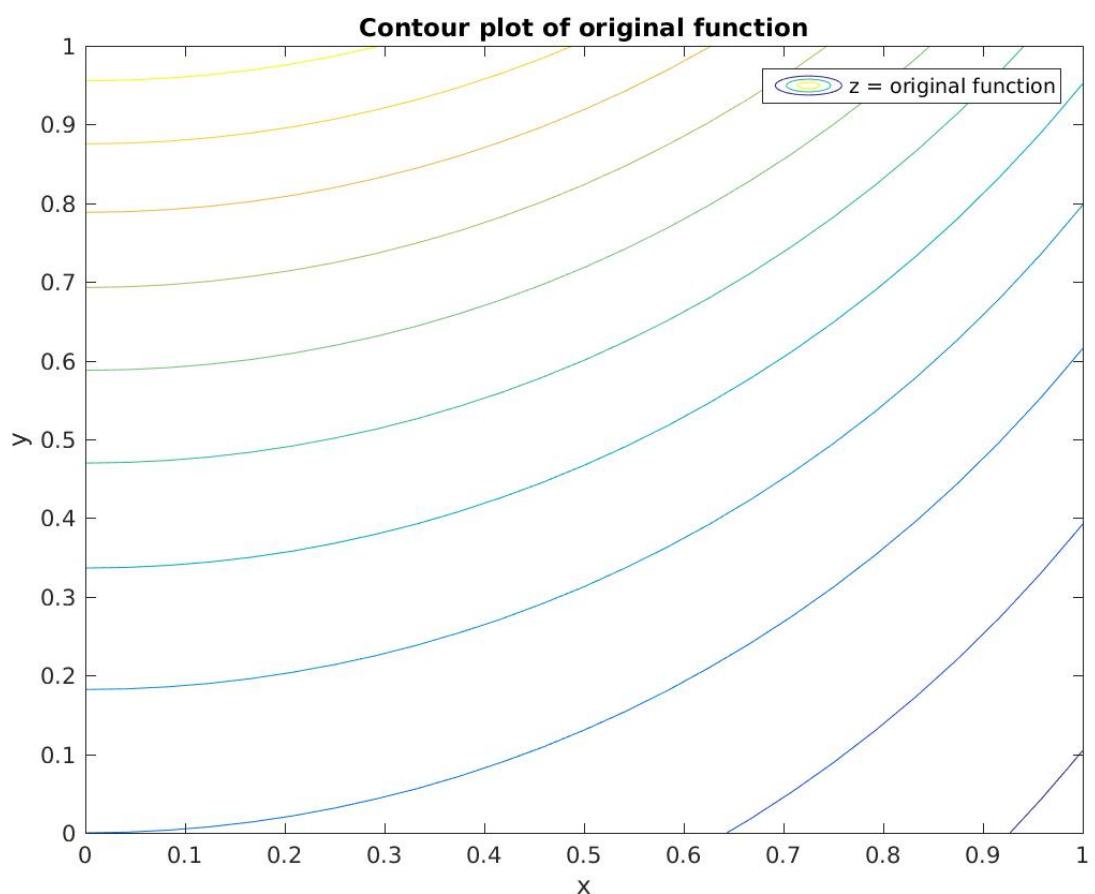
 z = original function



**Contour plot of original function**

 z = original function

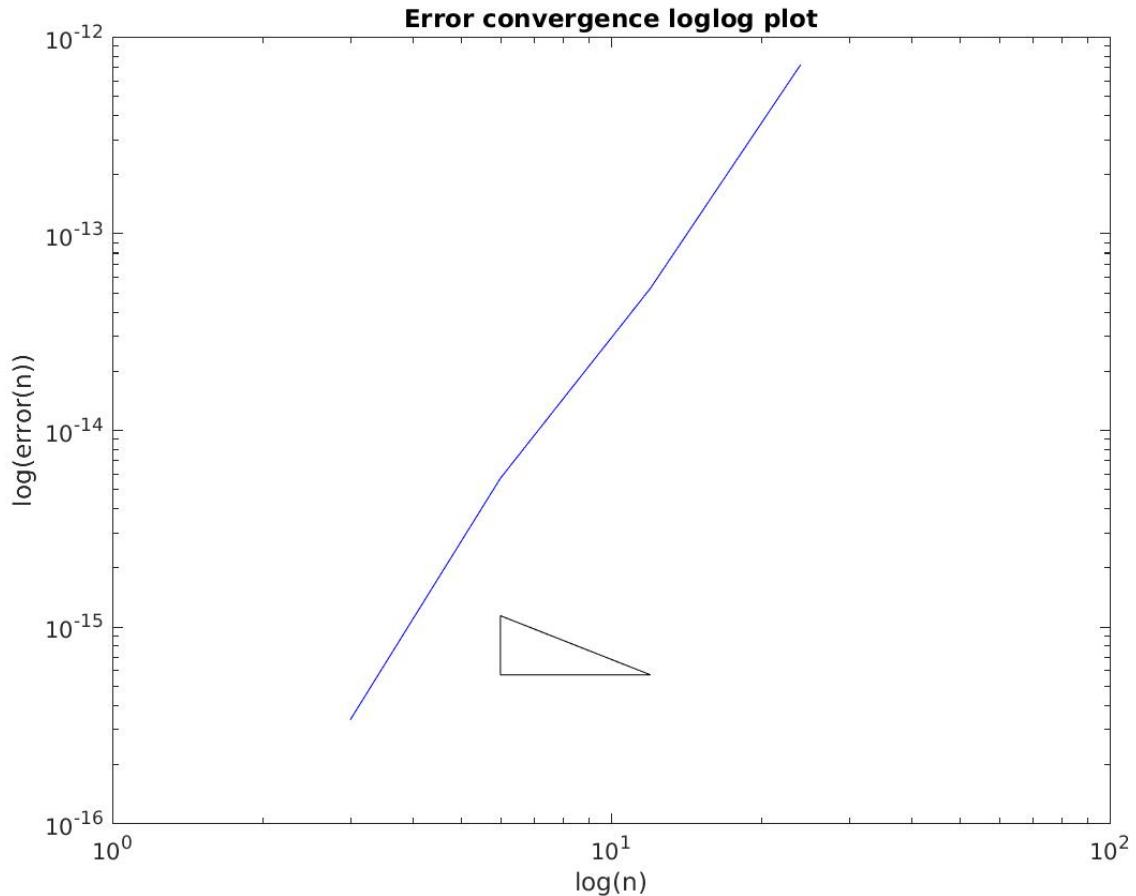




## Question 2 (Gauss-Seidel)

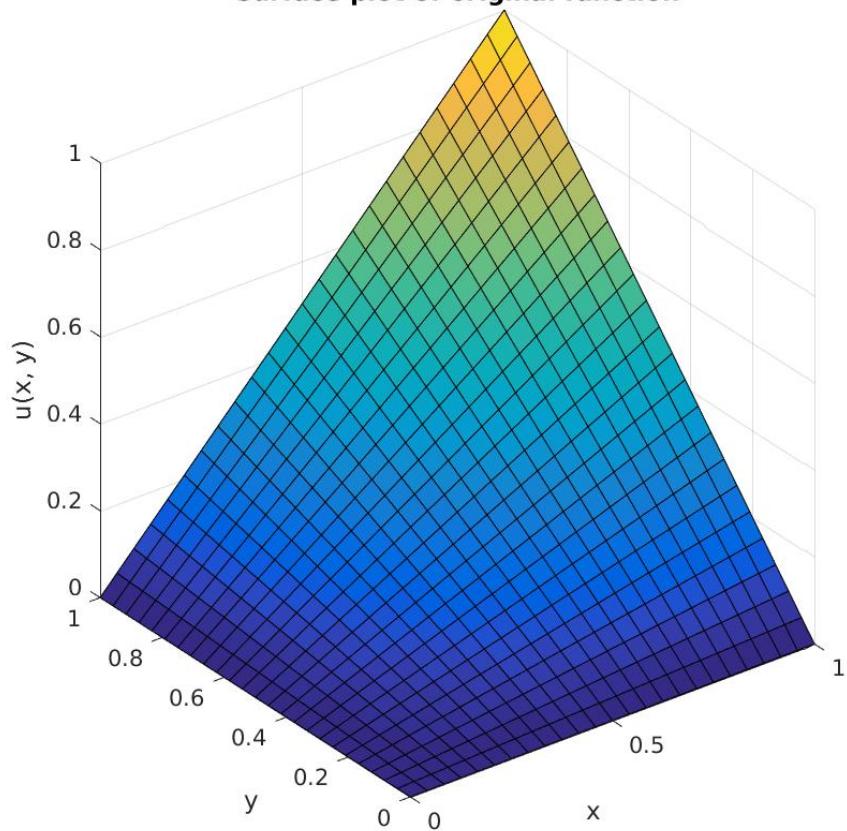
A) The function is of order 2 so there is no truncation error. The only error is roundoff, and it does not have a order 2 convergence.

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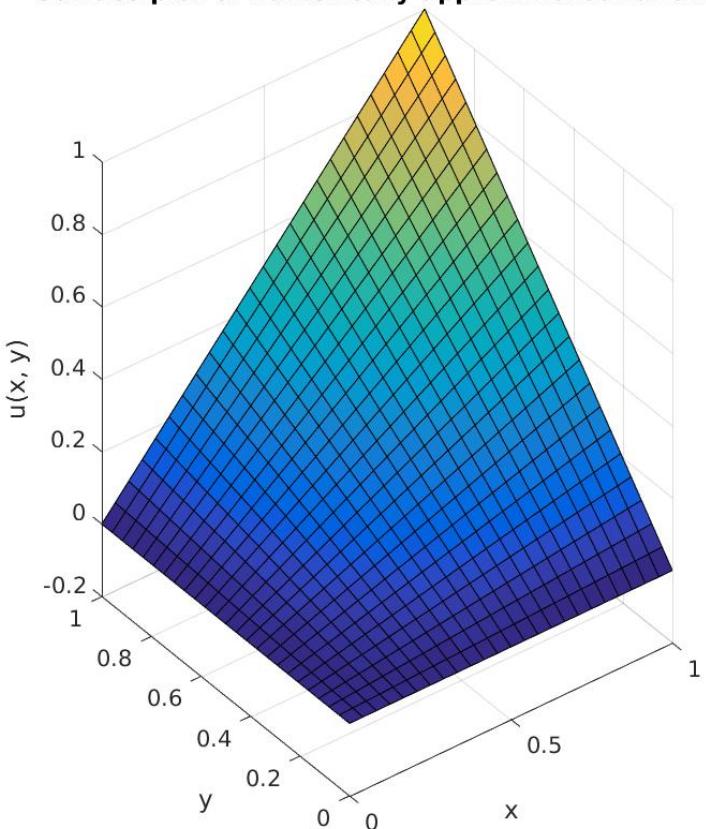
**Surface plot of original function**

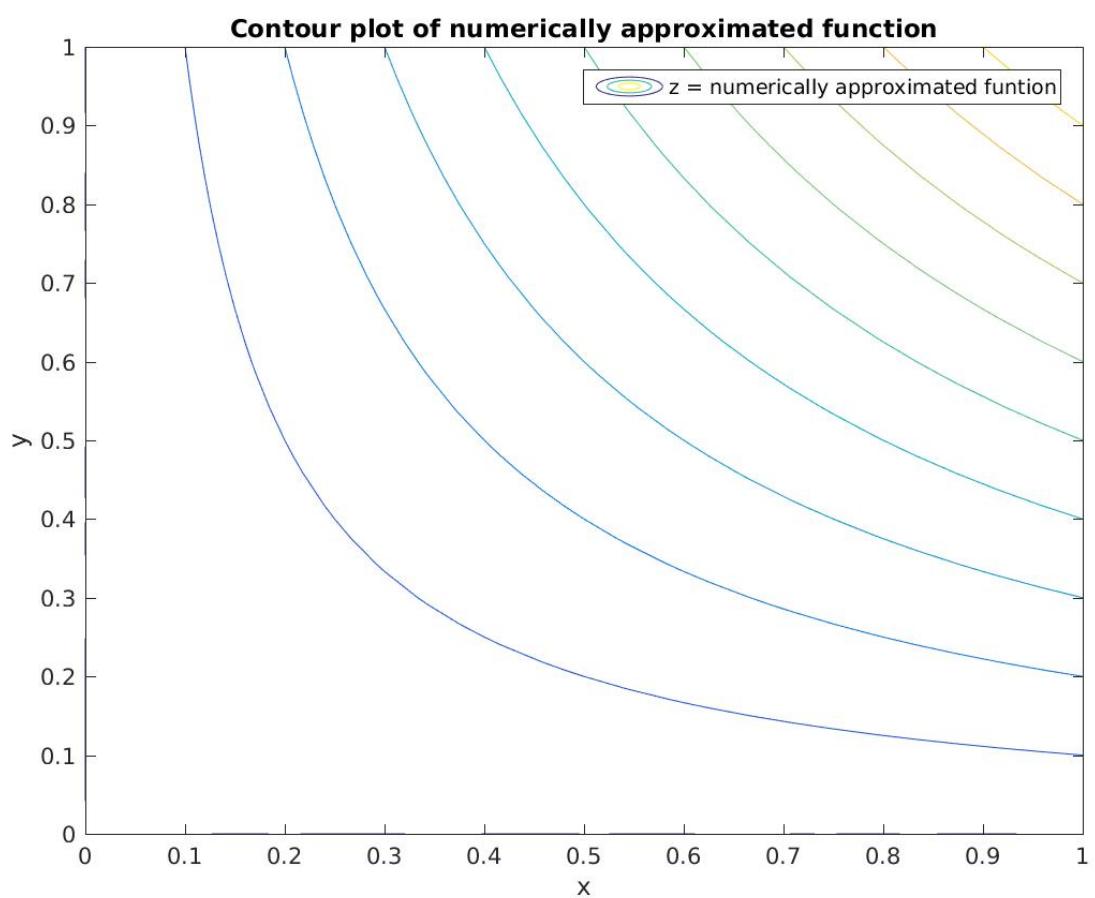
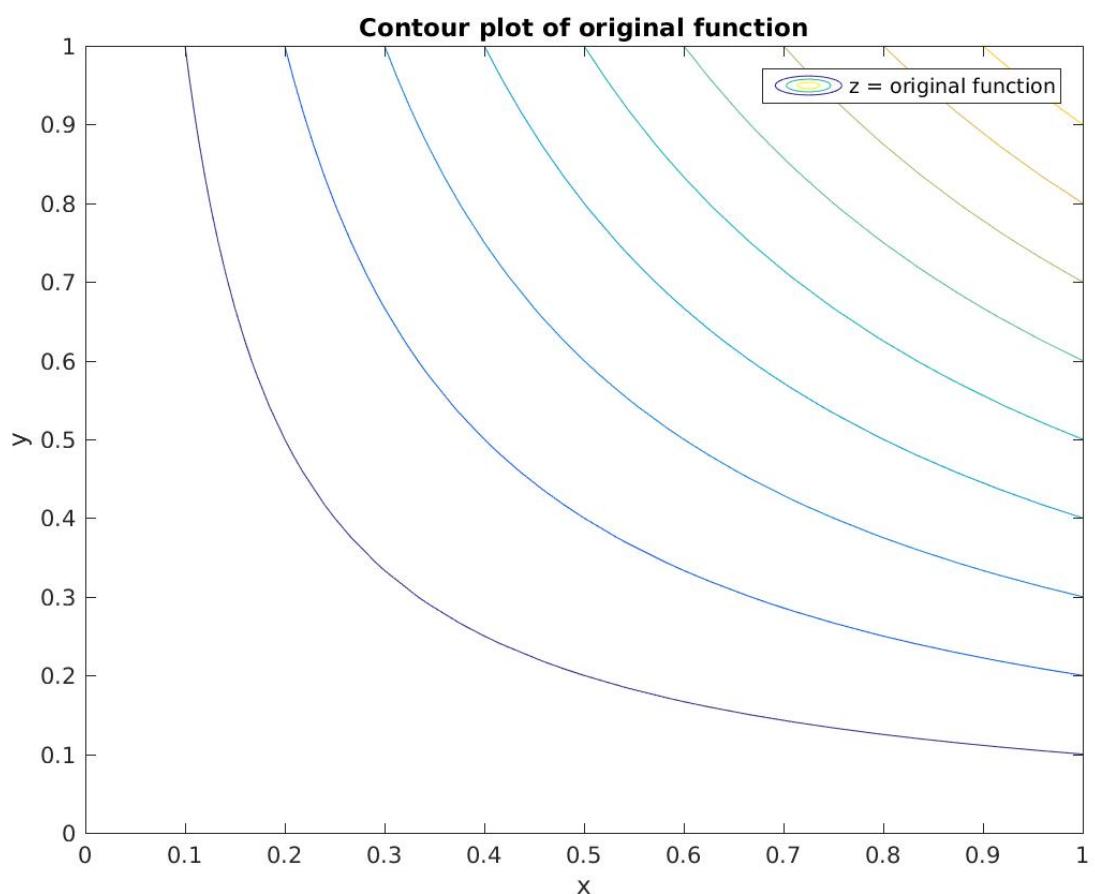
 z = original function

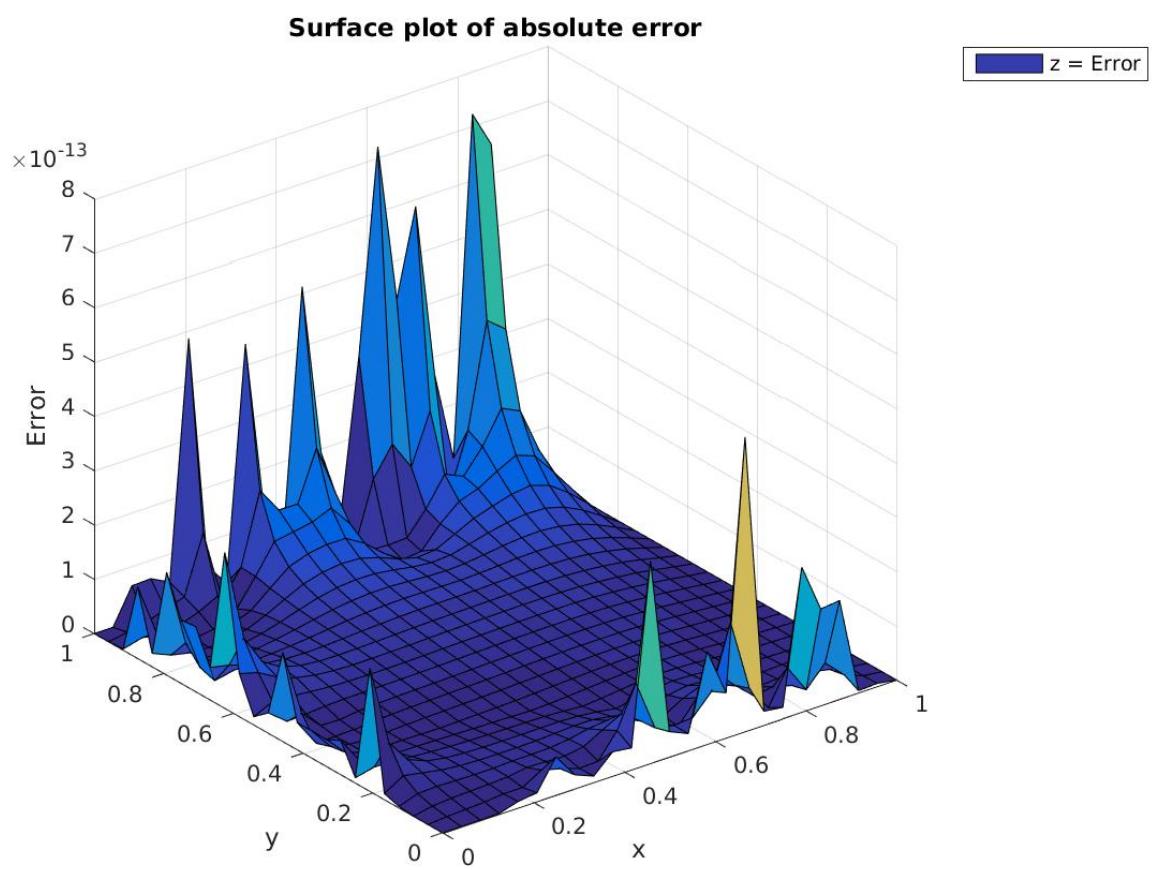


**Surface plot of numerically approximated function**

 z = numerically approximated funtion

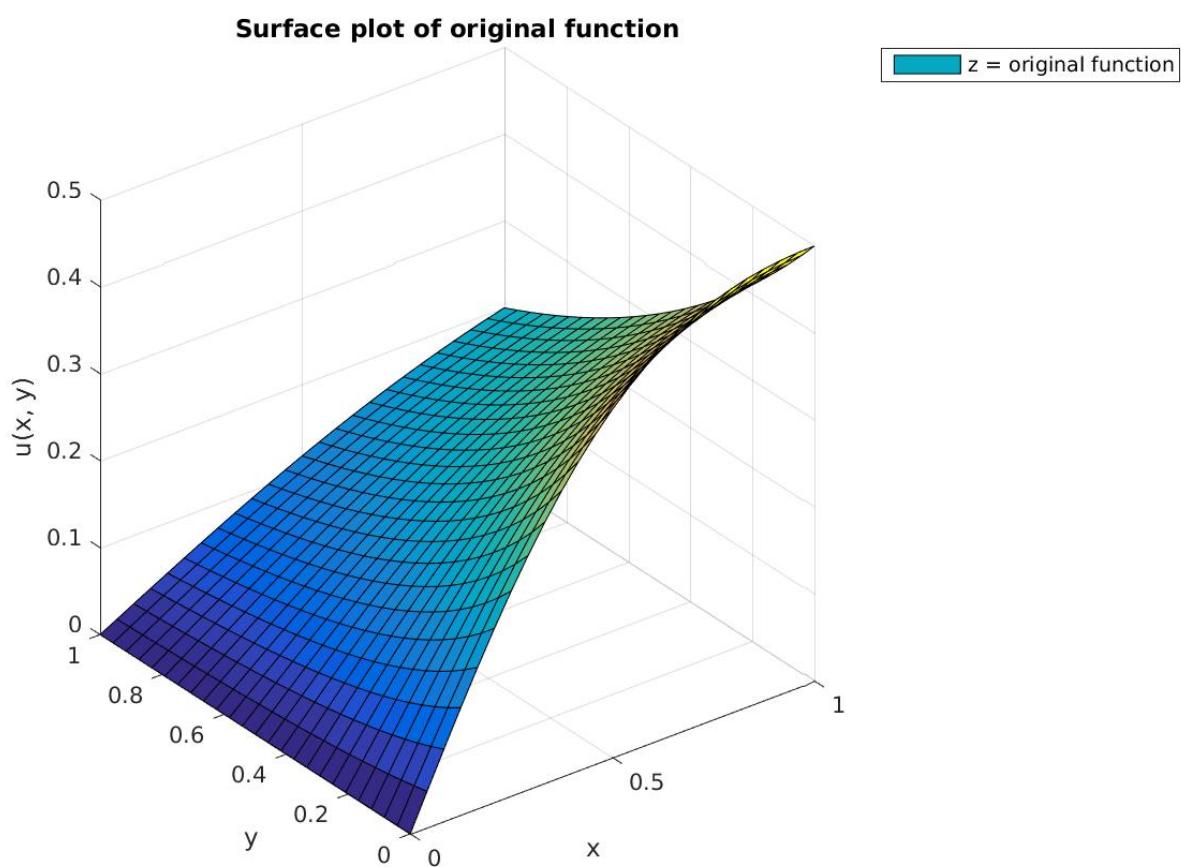
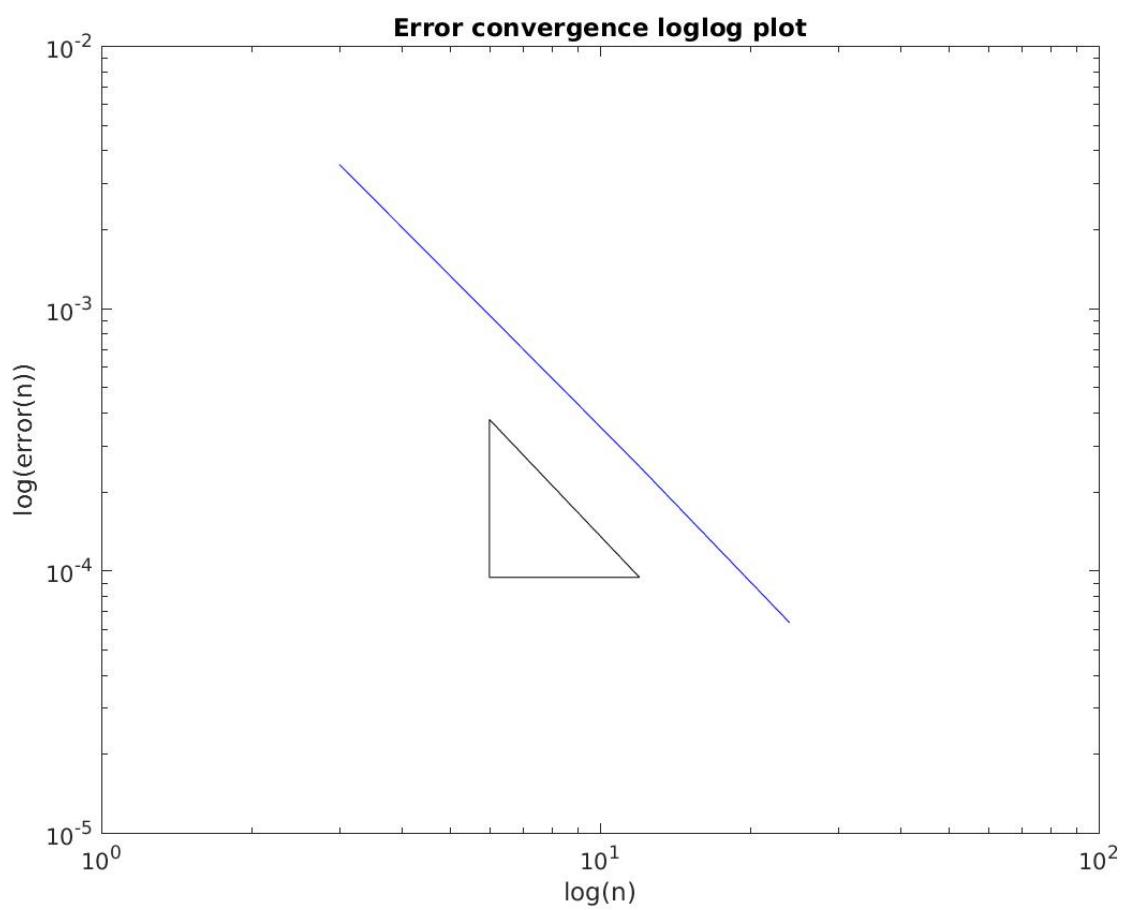




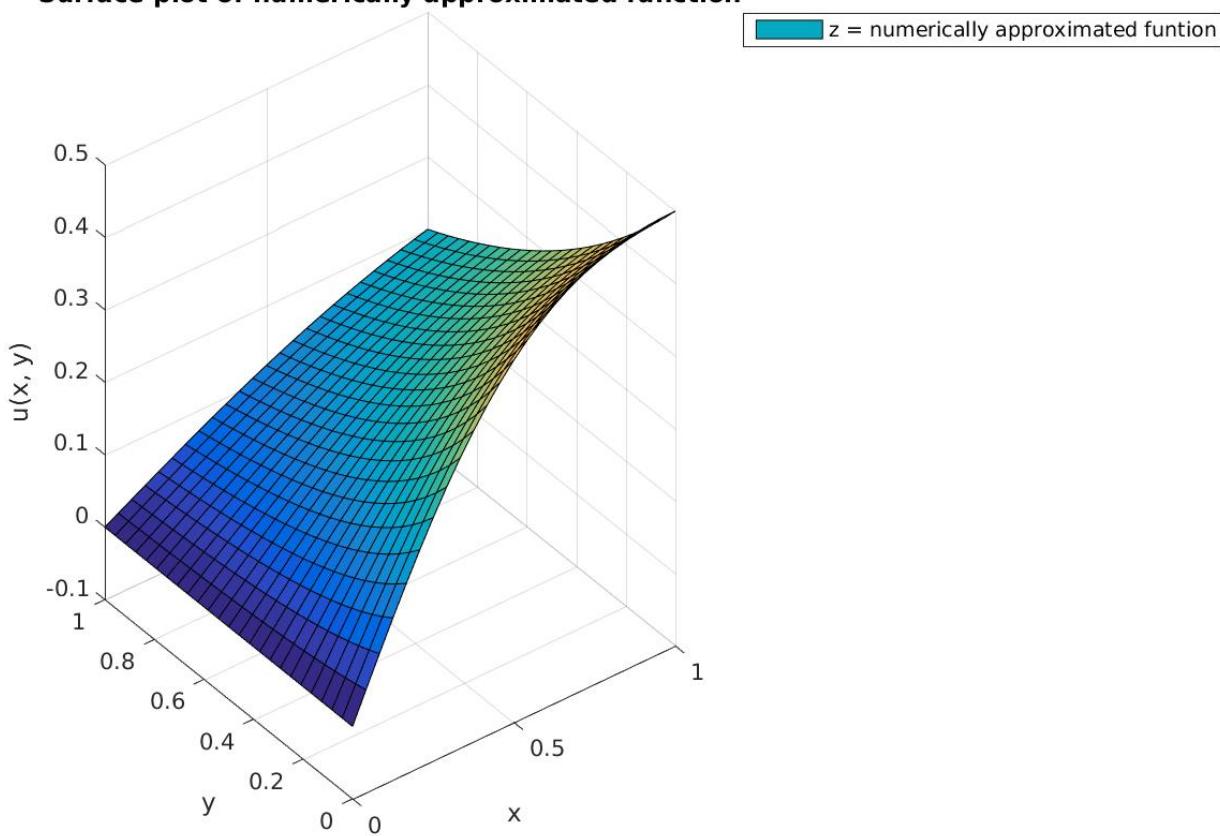


(B)

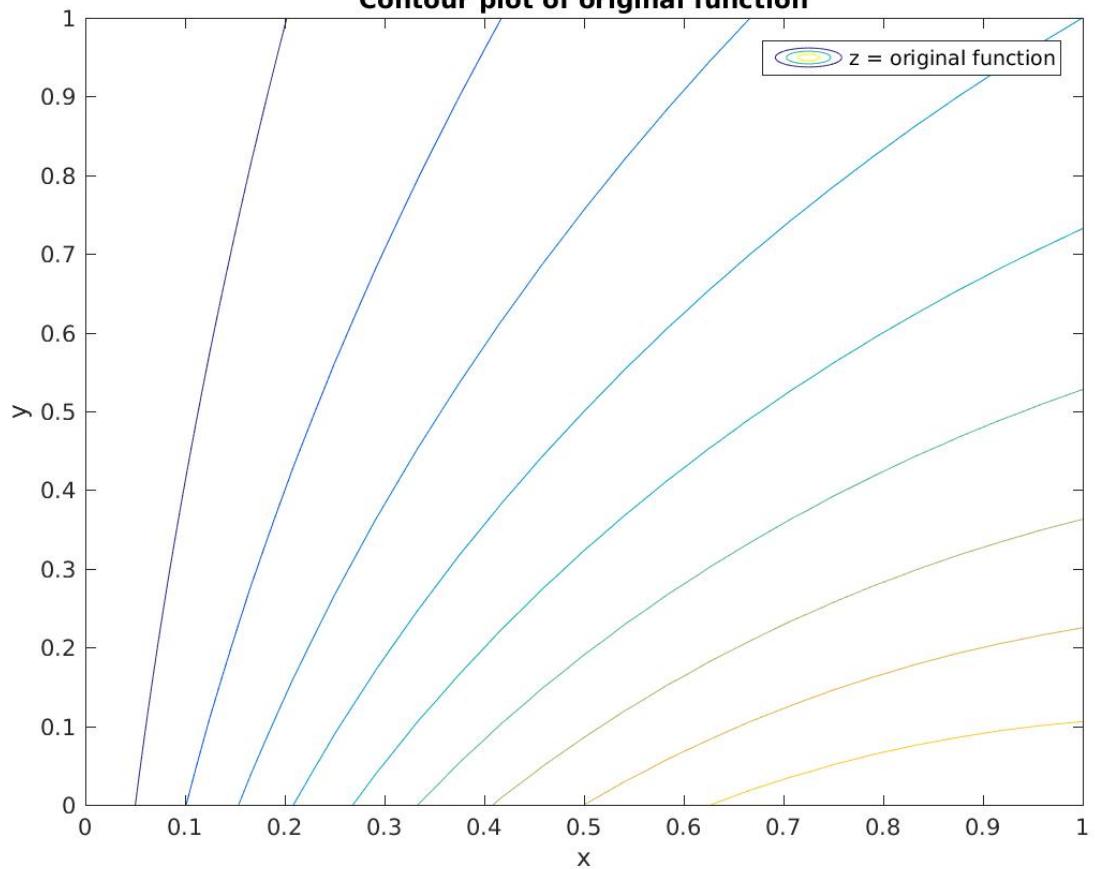
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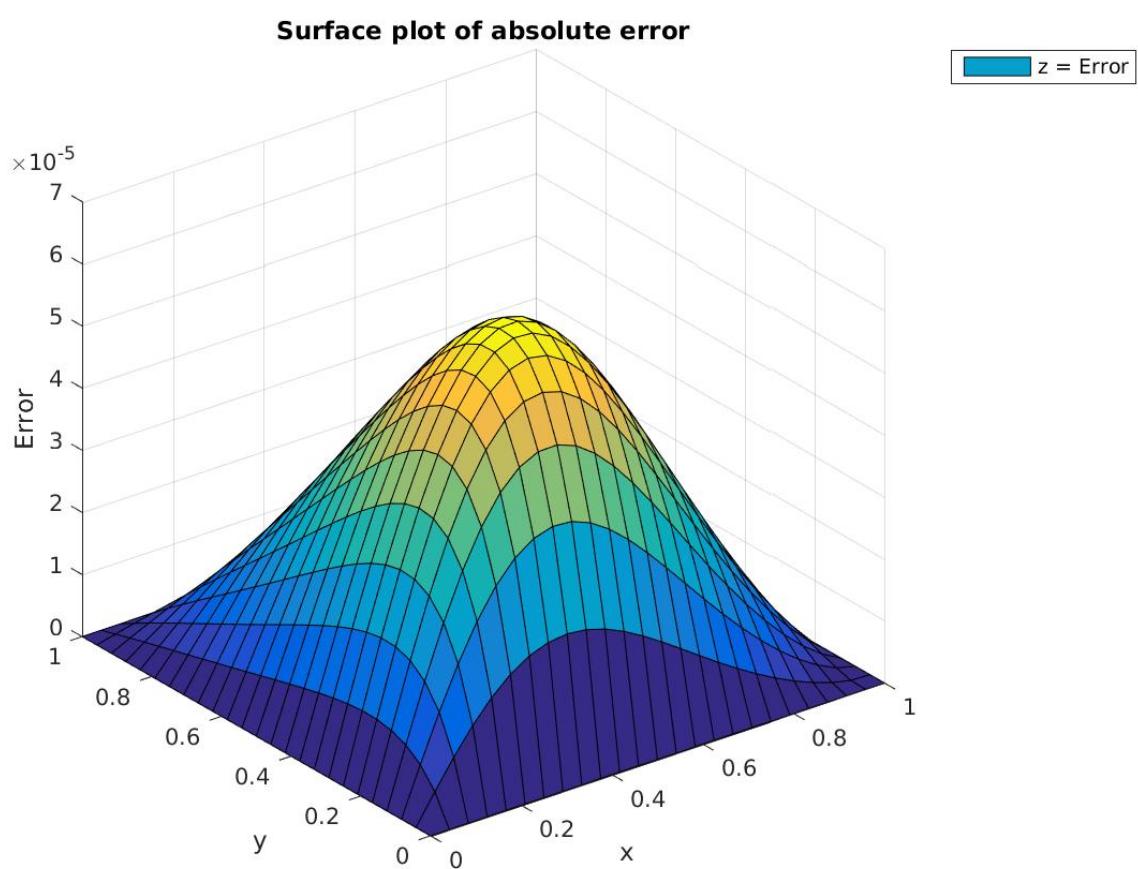
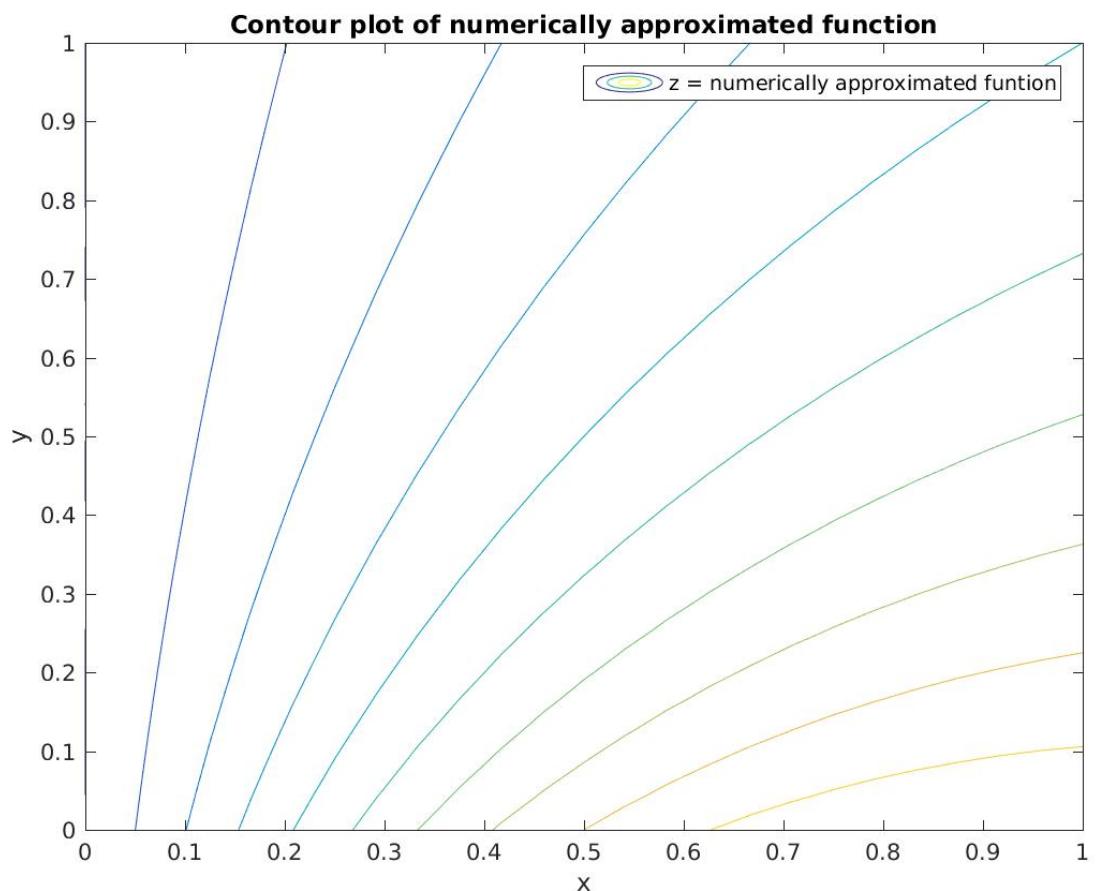


**Surface plot of numerically approximated function**



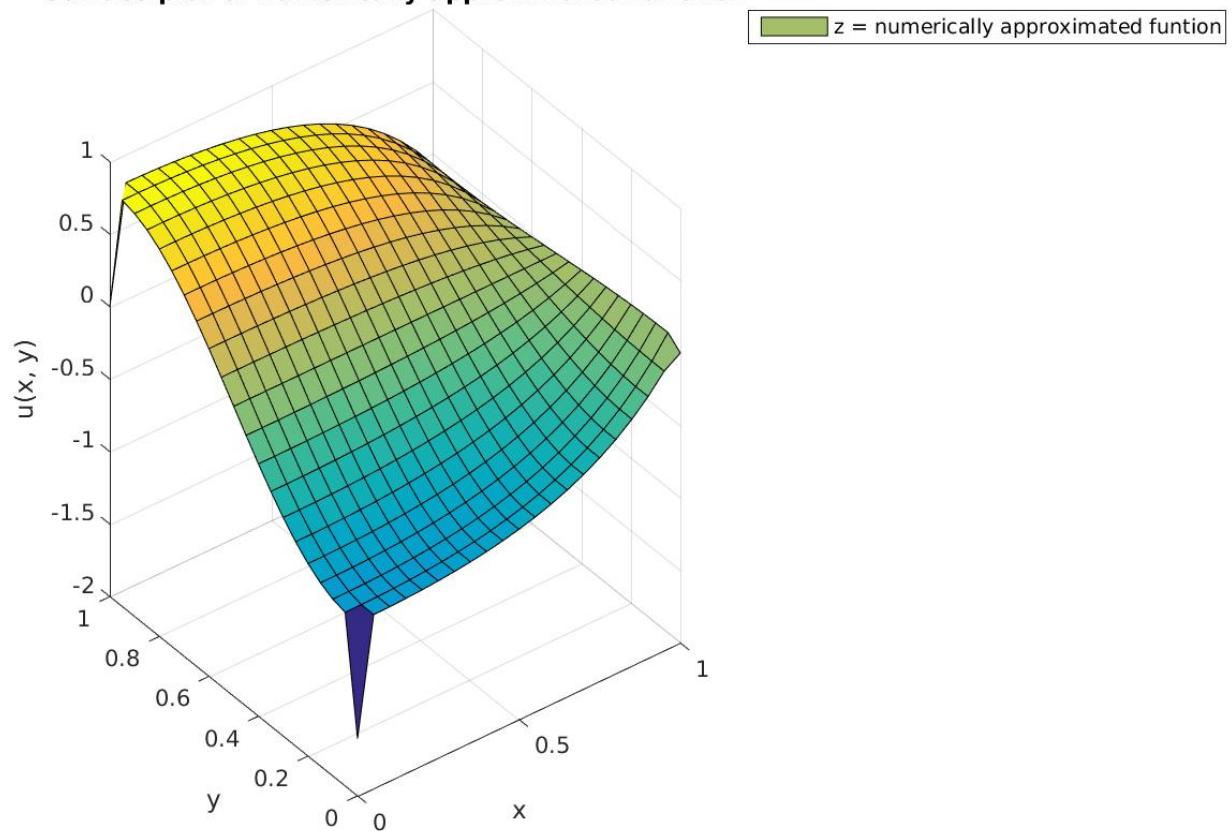
**Contour plot of original function**



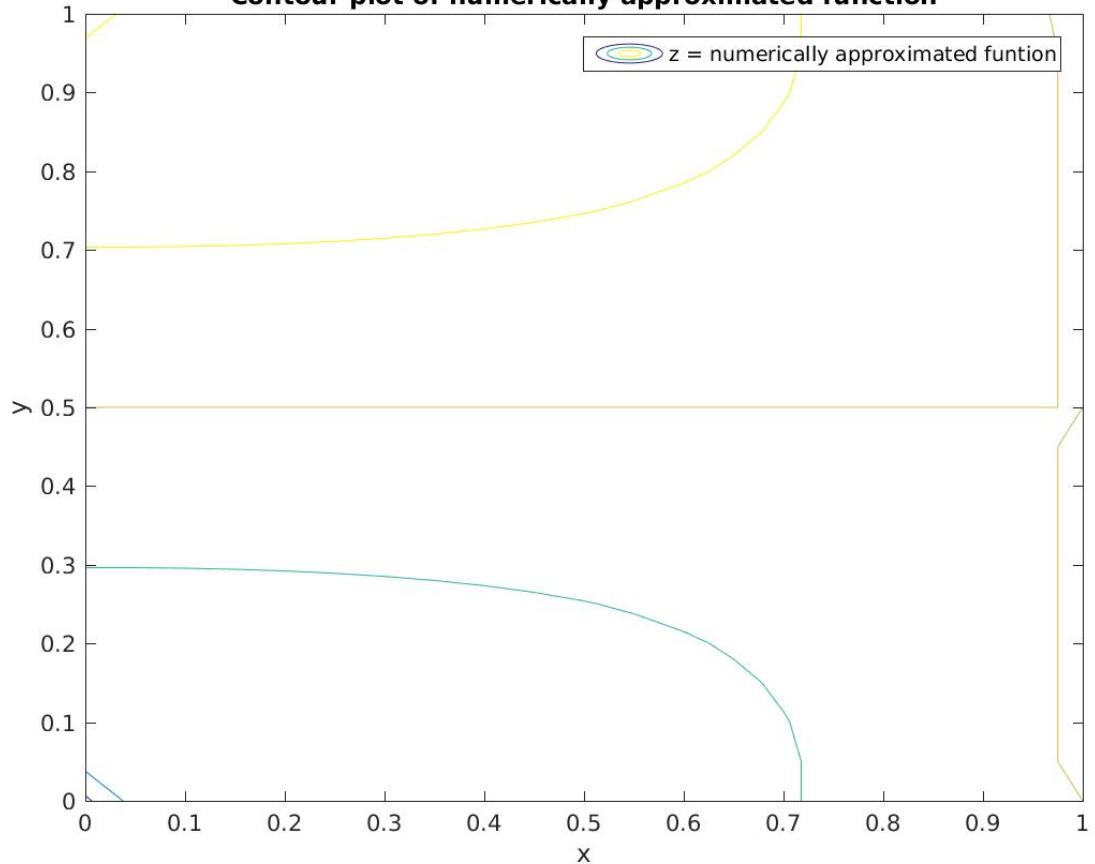


(C) (Original function not available)

**Surface plot of numerically approximated function**

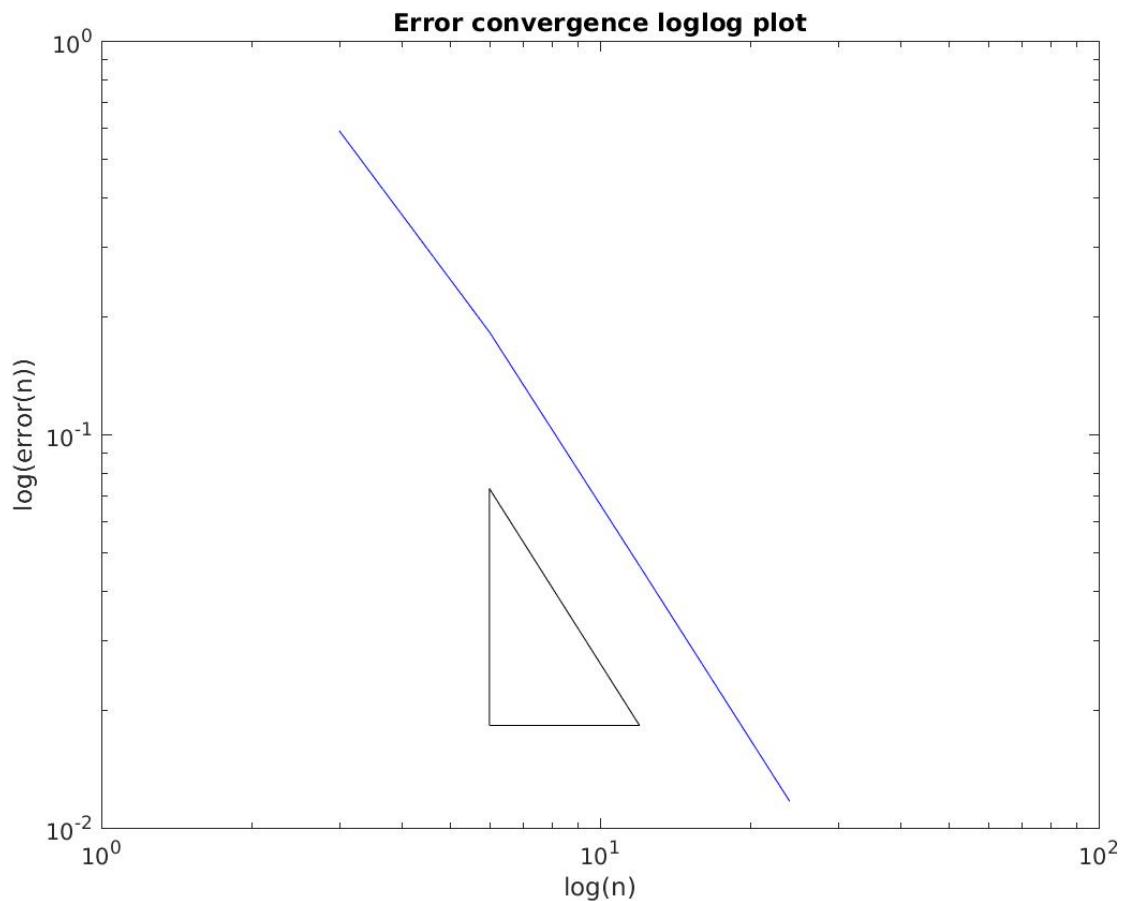


**Contour plot of numerically approximated function**



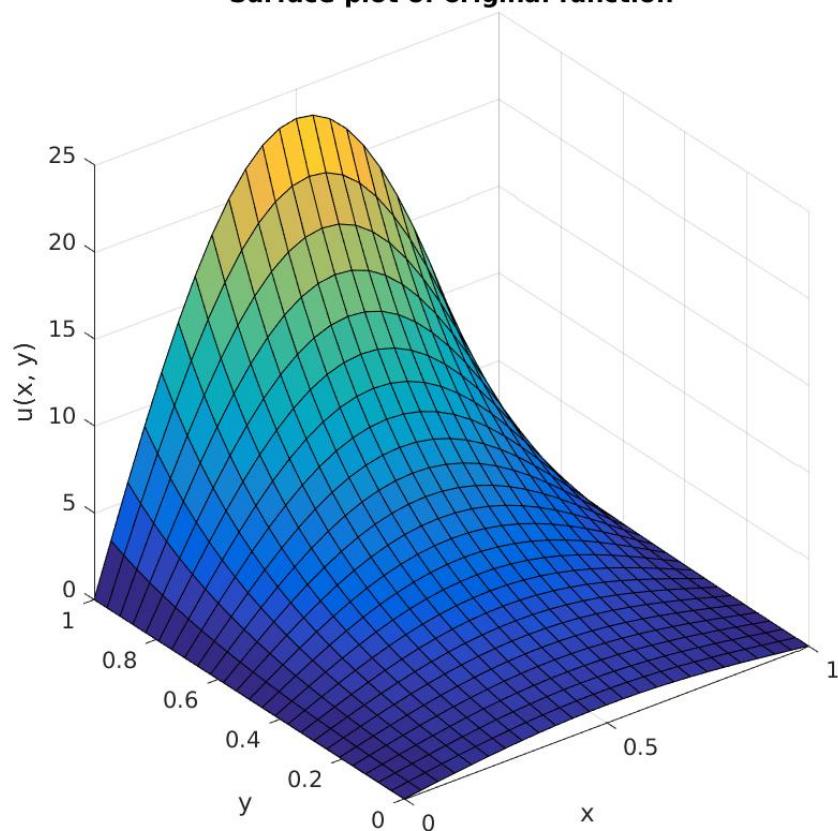
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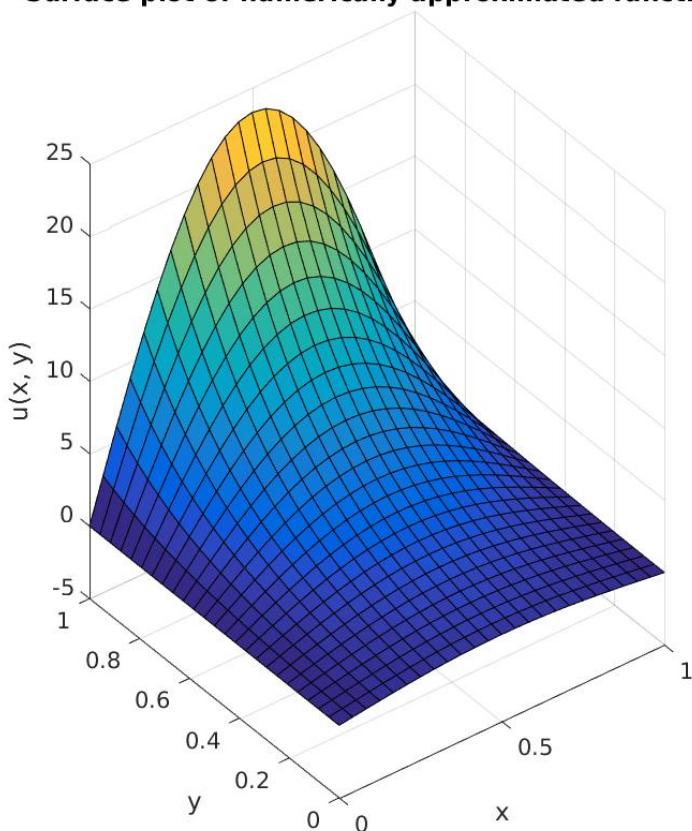
**Surface plot of original function**

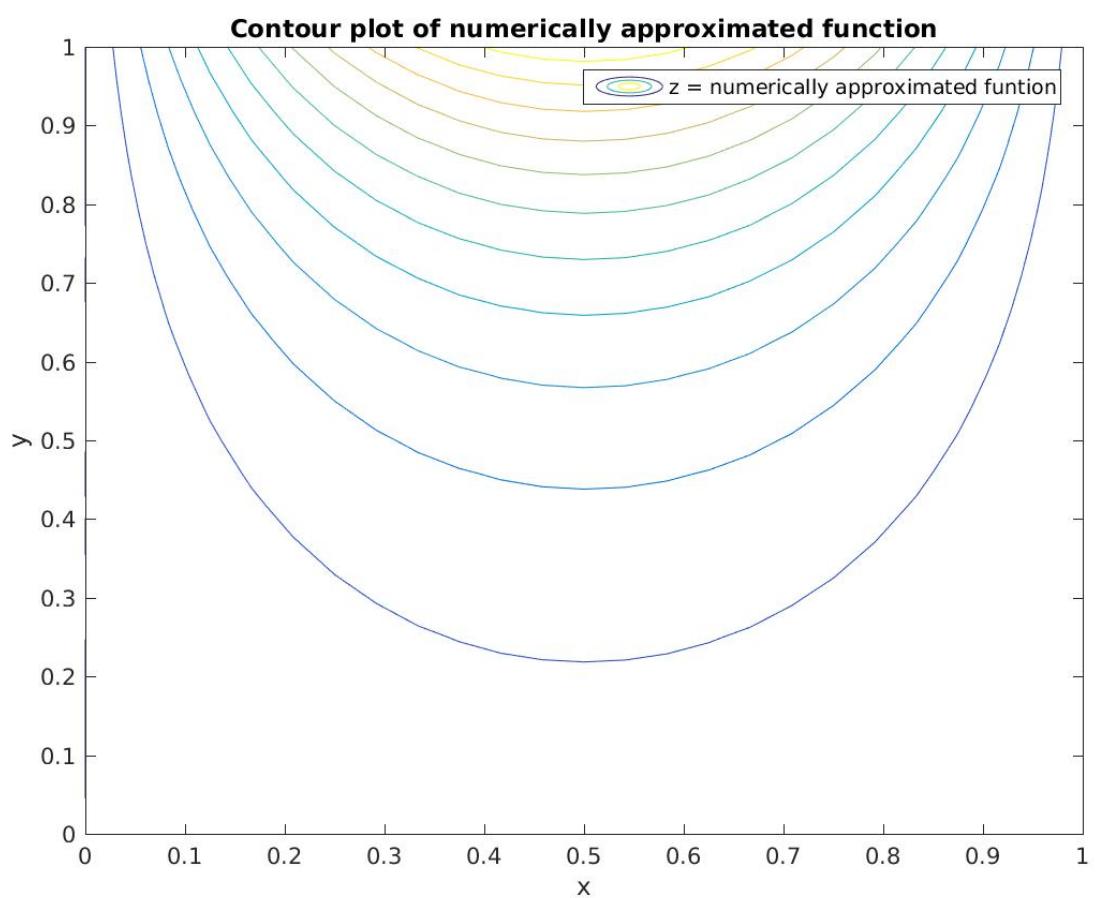
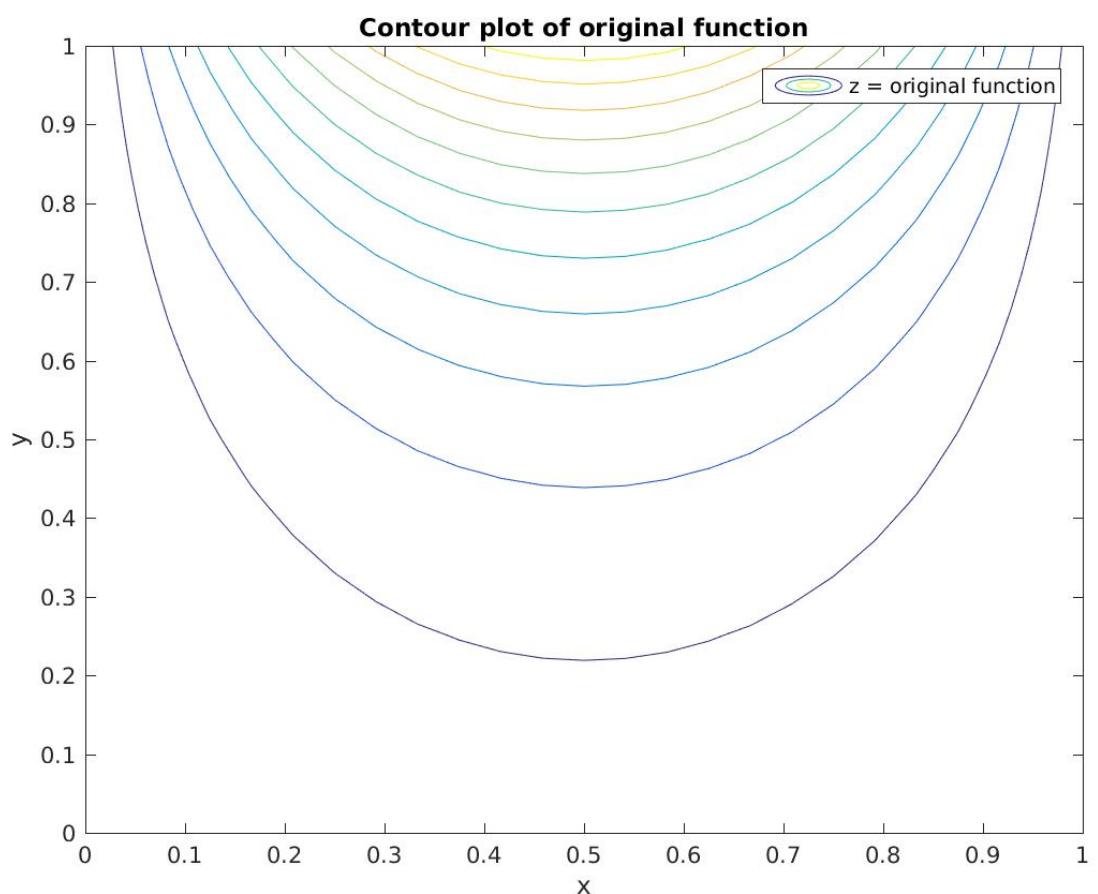
 z = original function

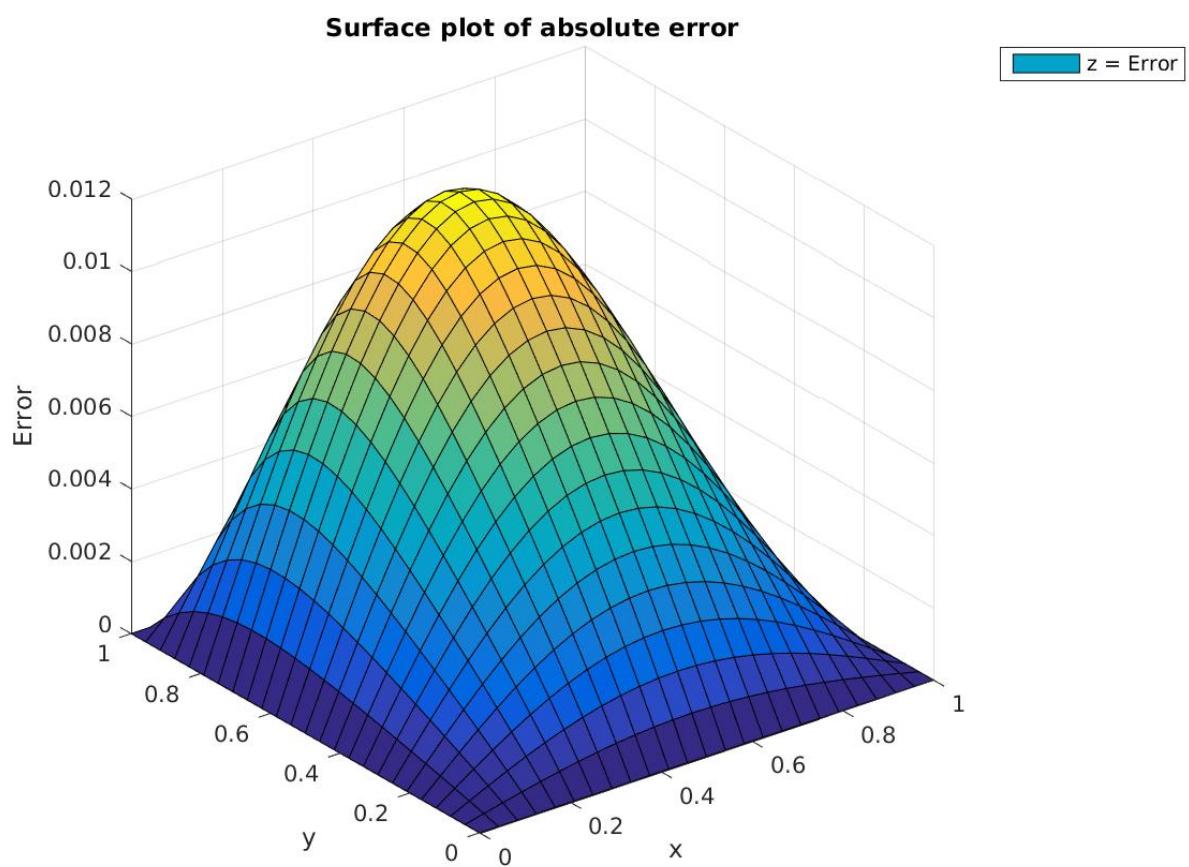


**Surface plot of numerically approximated function**

 z = numerically approximated funtion

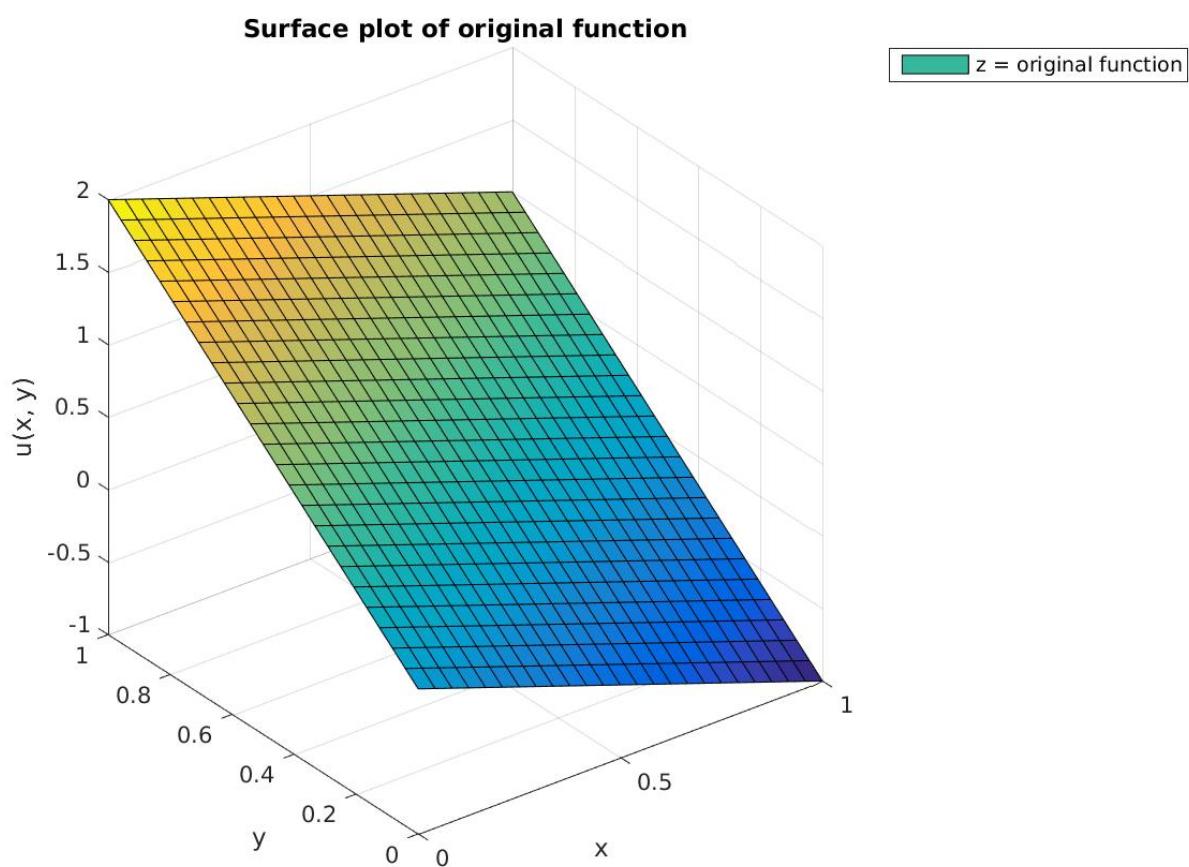
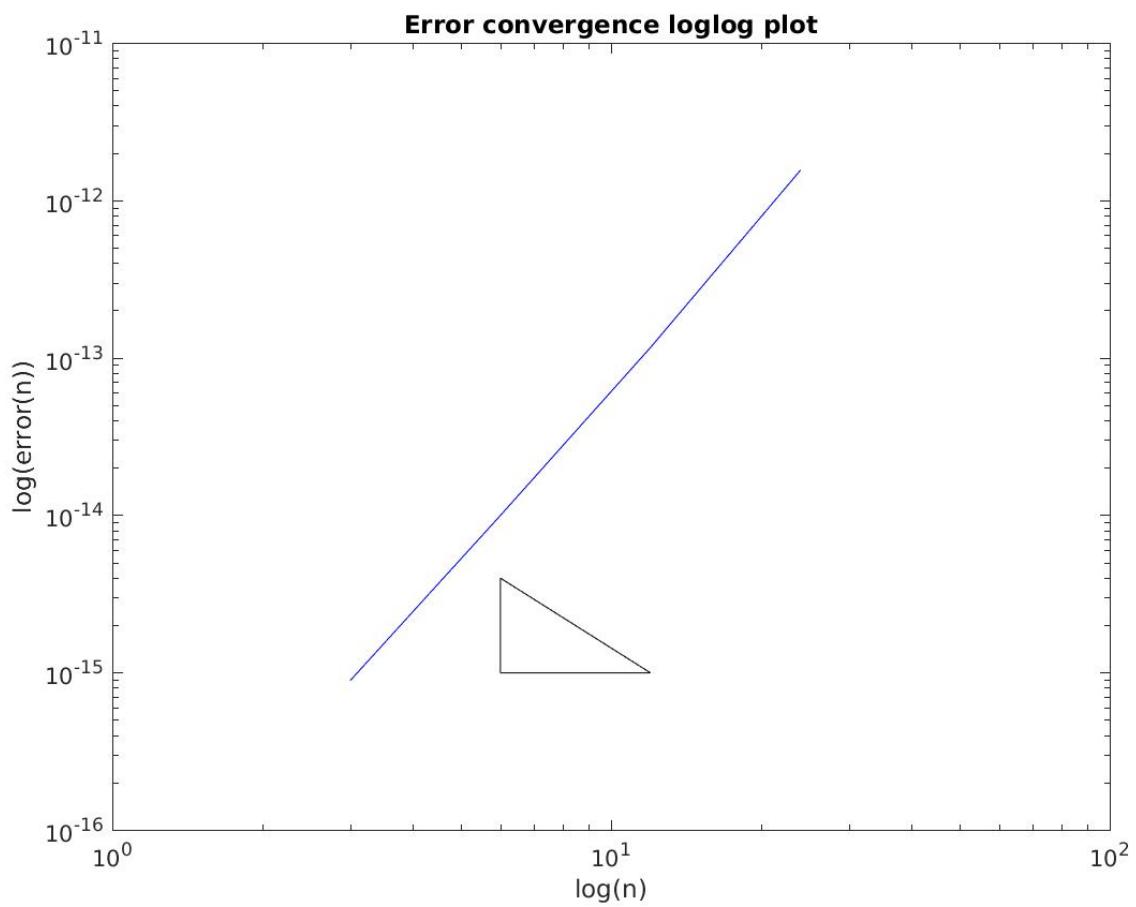




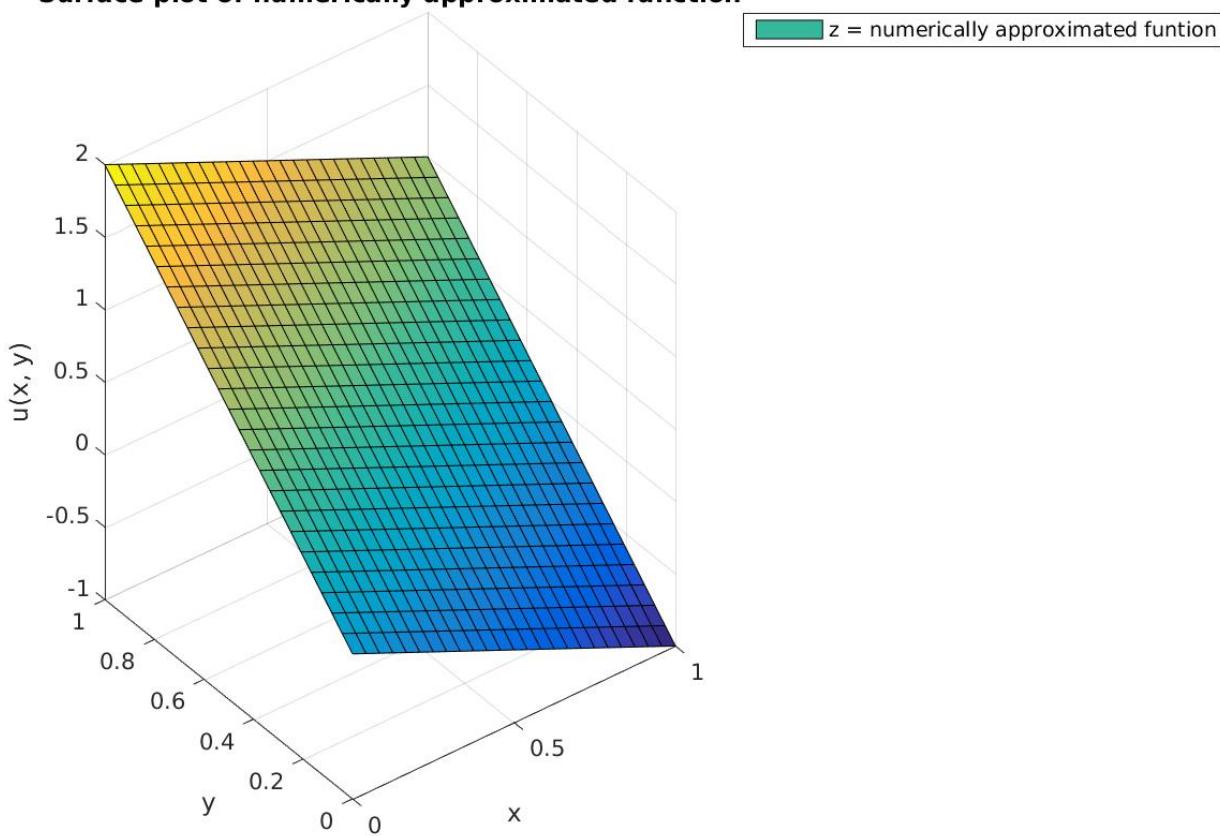


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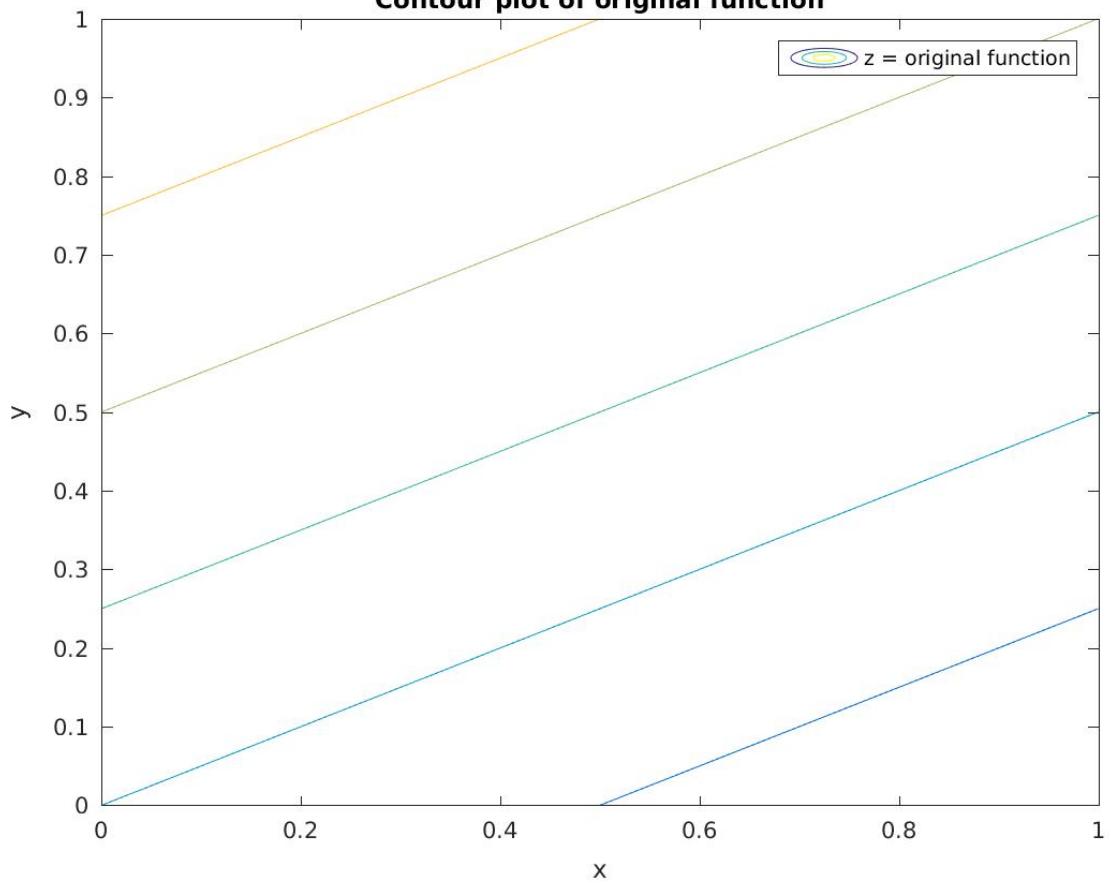
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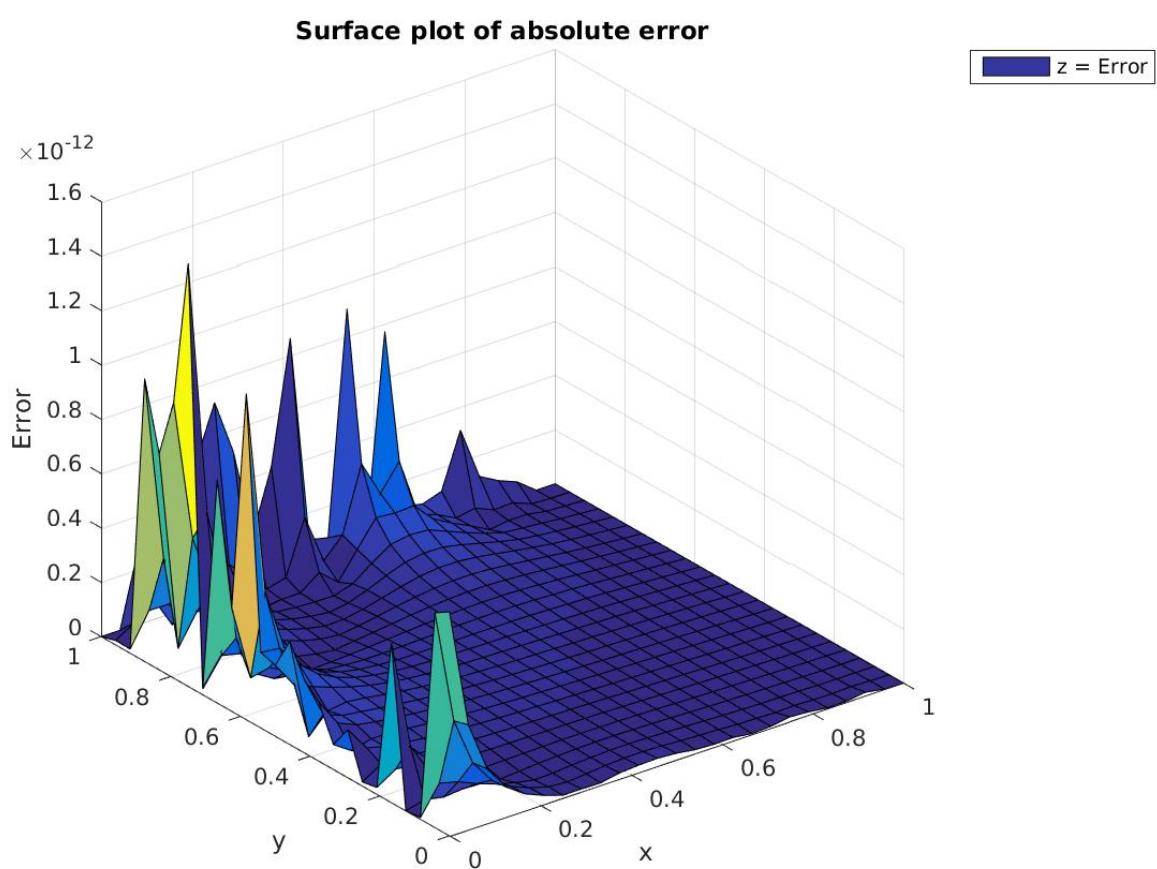
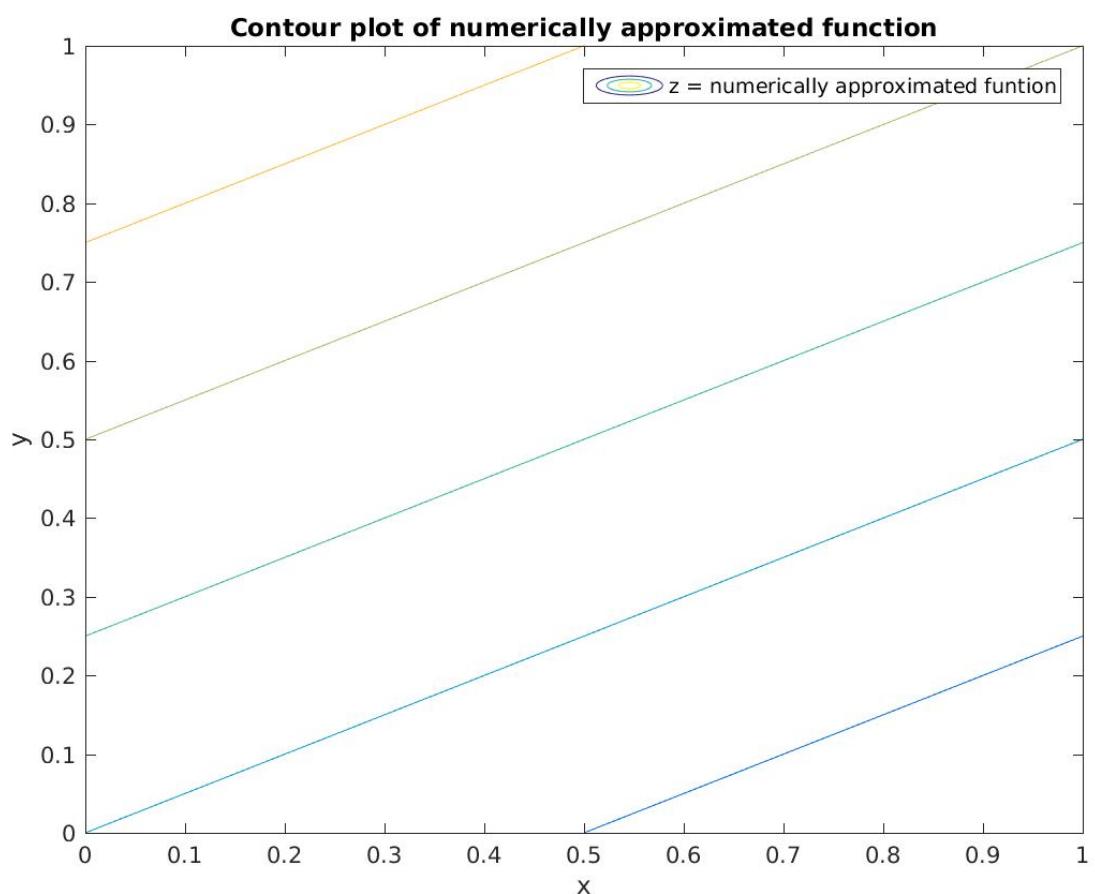


**Surface plot of numerically approximated function**



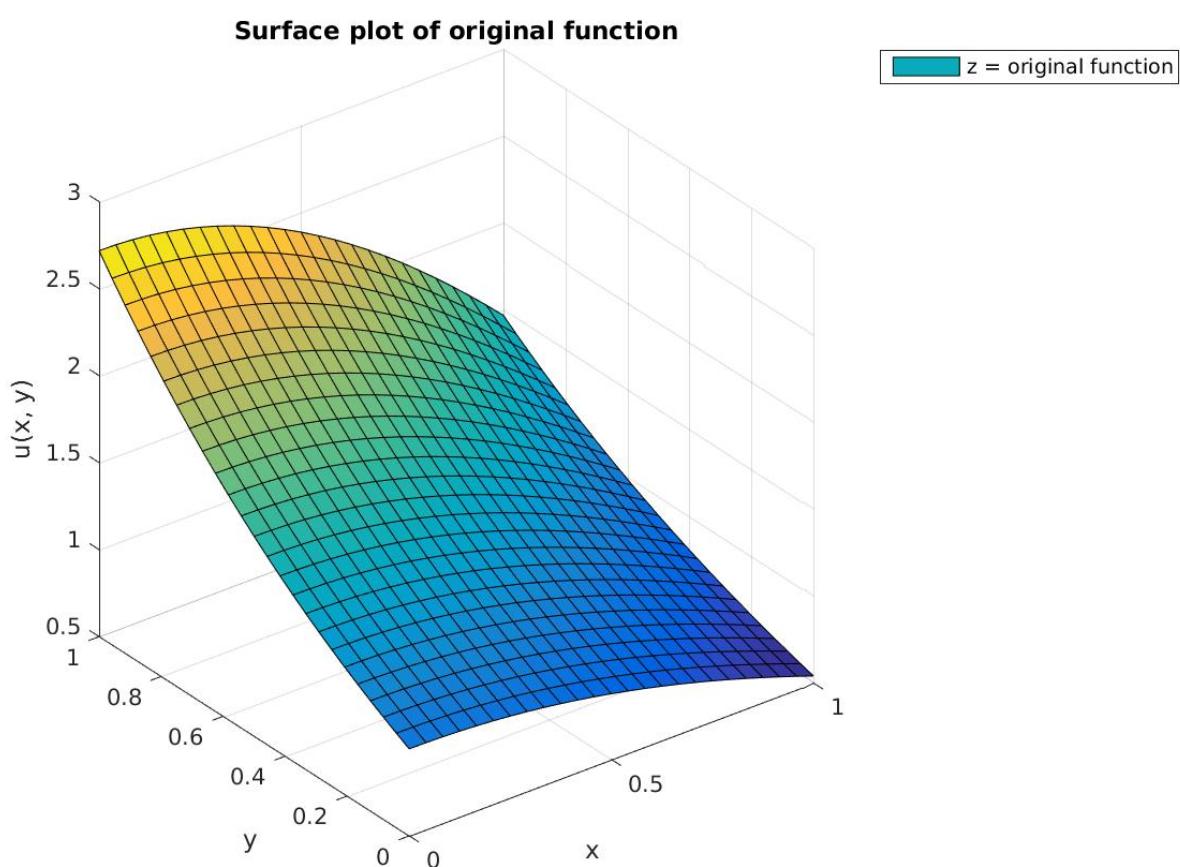
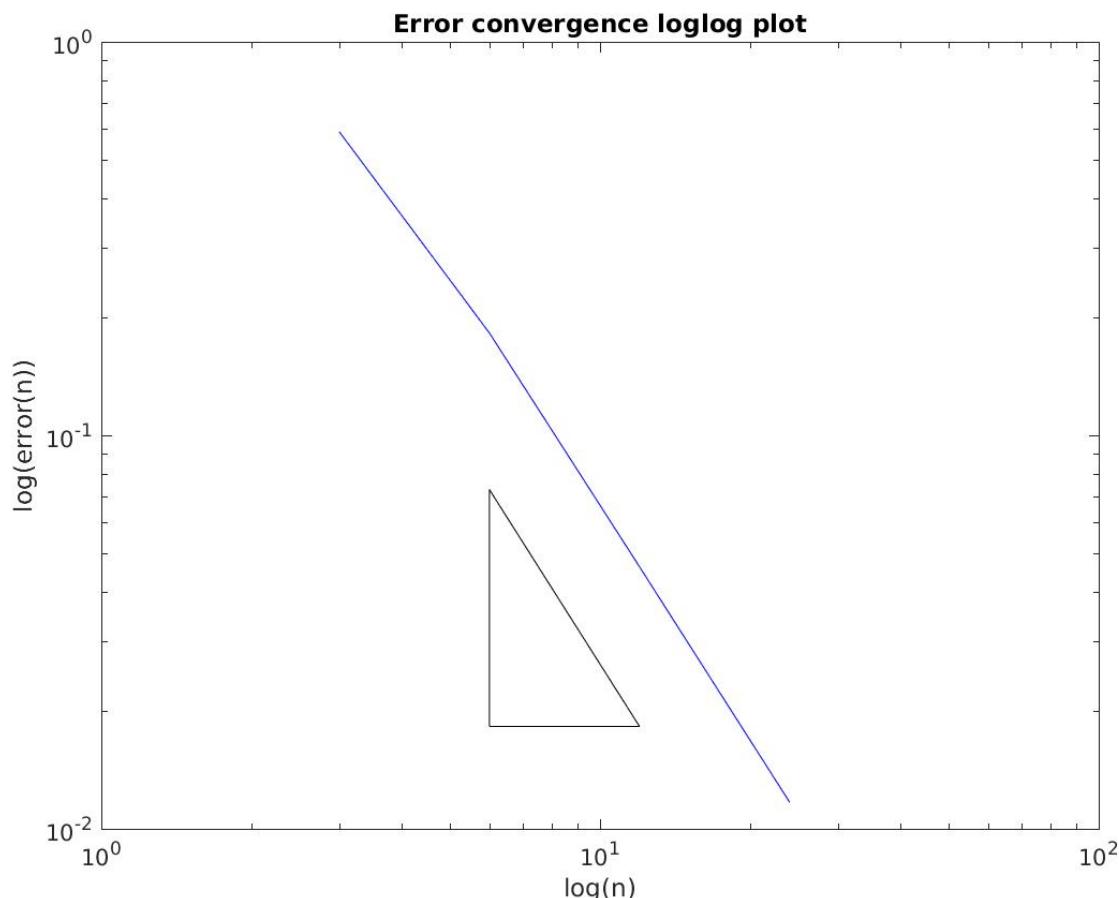
**Contour plot of original function**





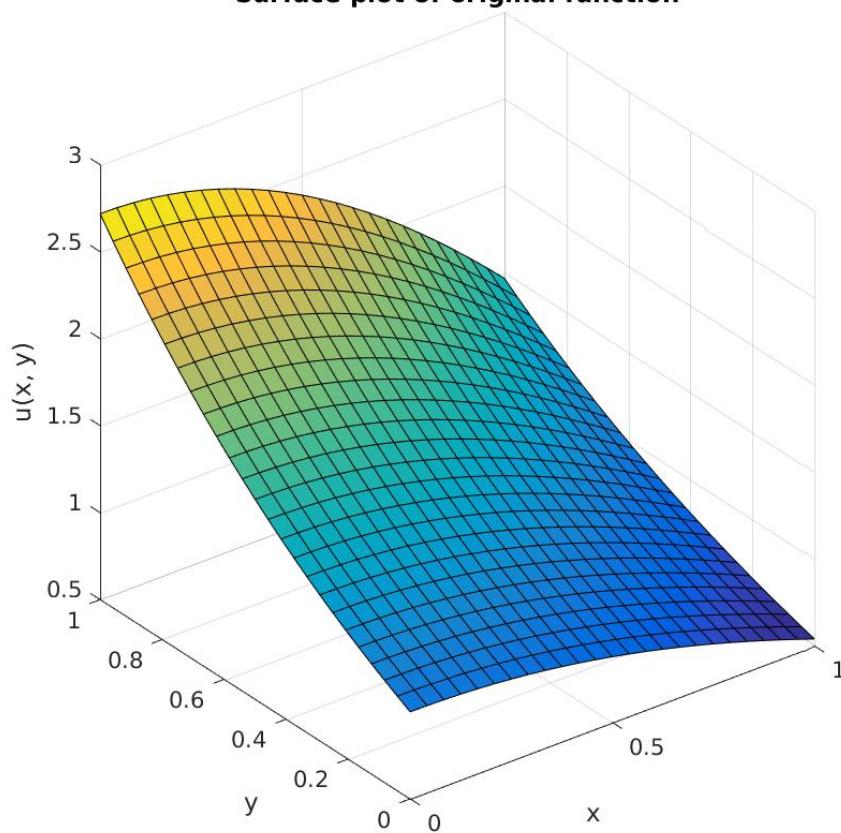
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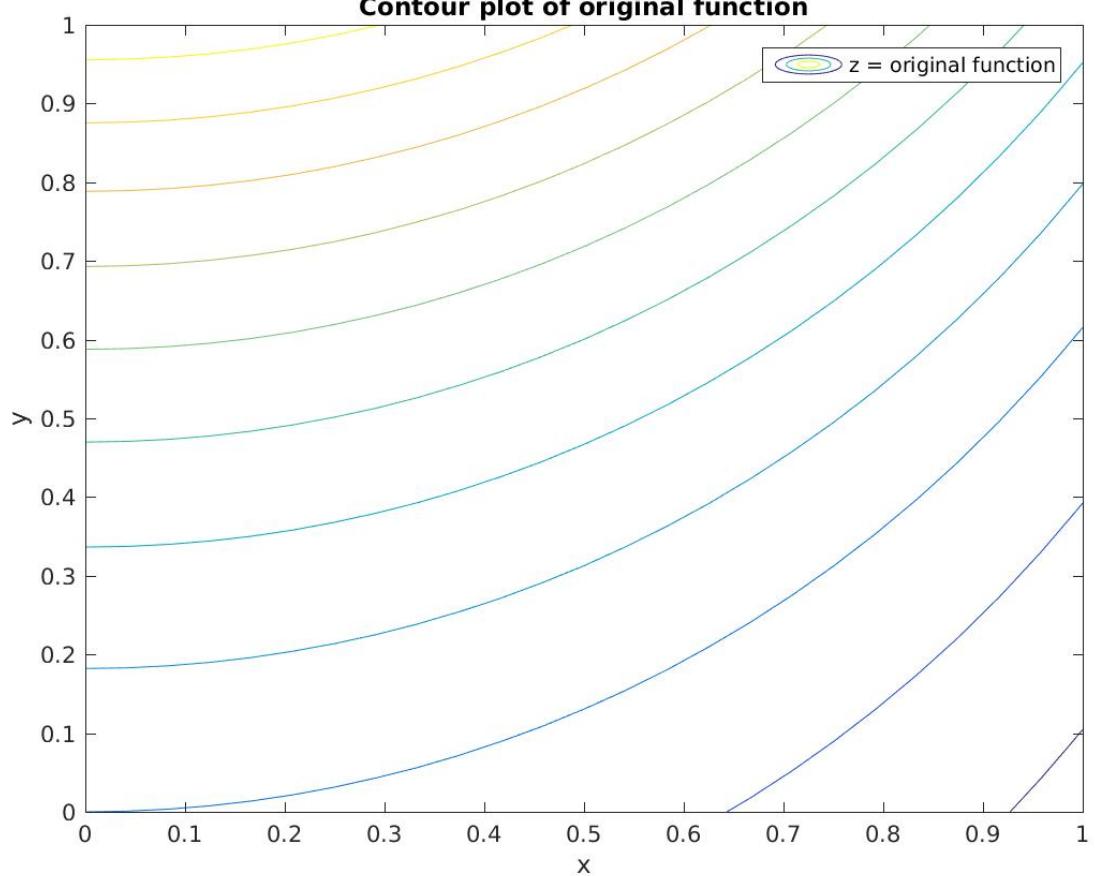
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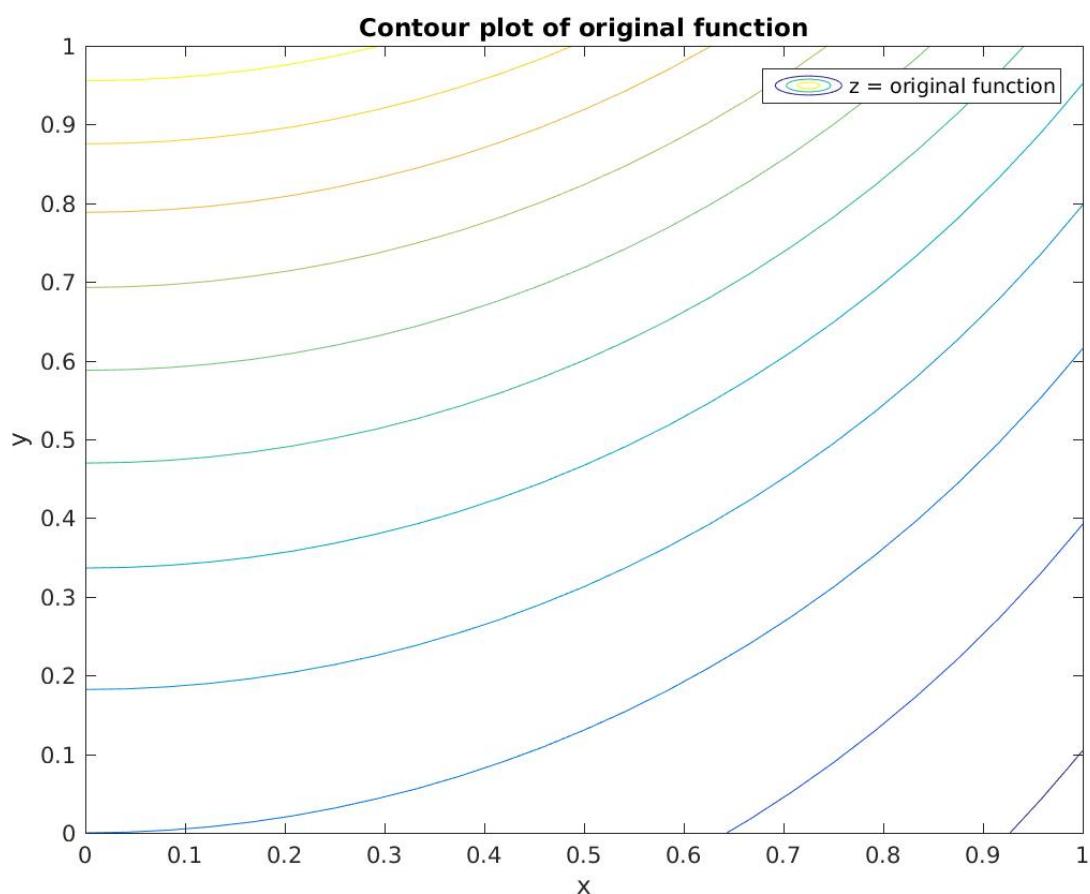
 z = original function



**Contour plot of original function**

 z = original function



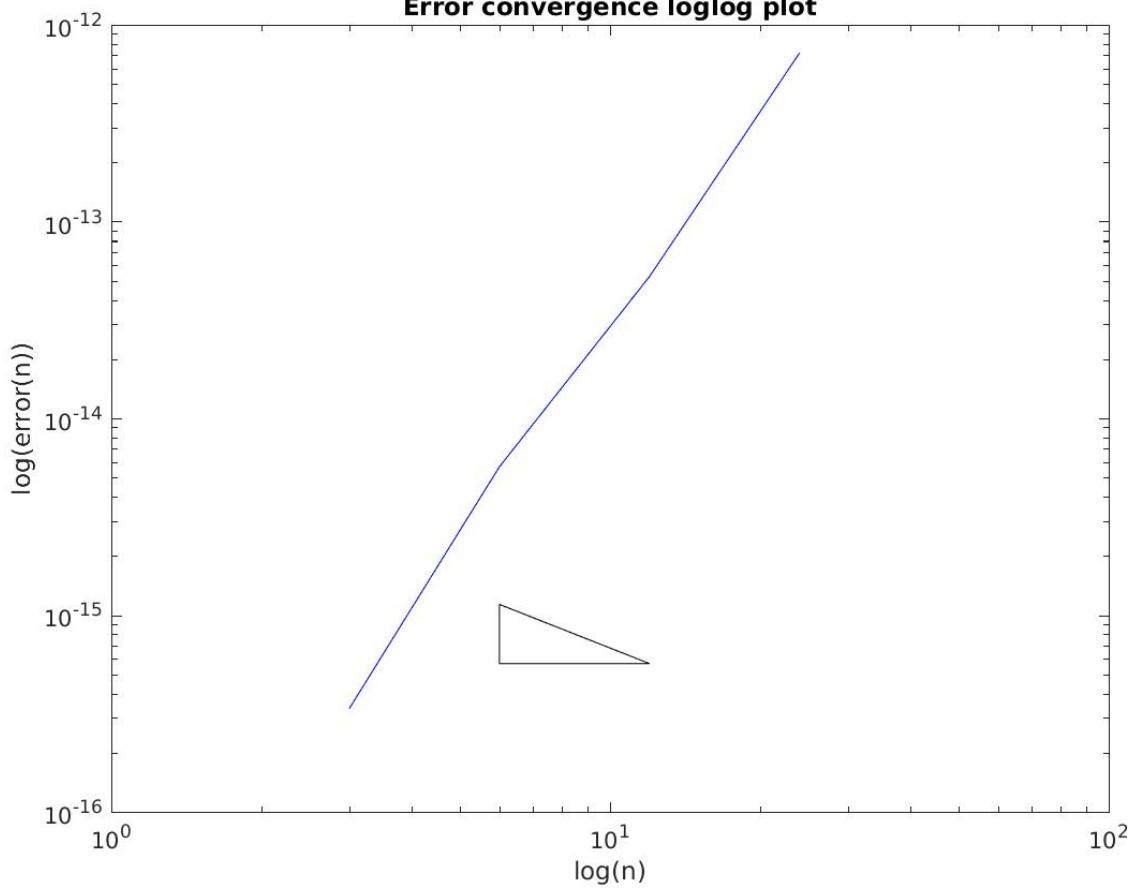


### Question 3 (Jacobi)

A) The function is of order 2 so there is no truncation error. The only error is roundoff, and it does not have a order 2 convergence.

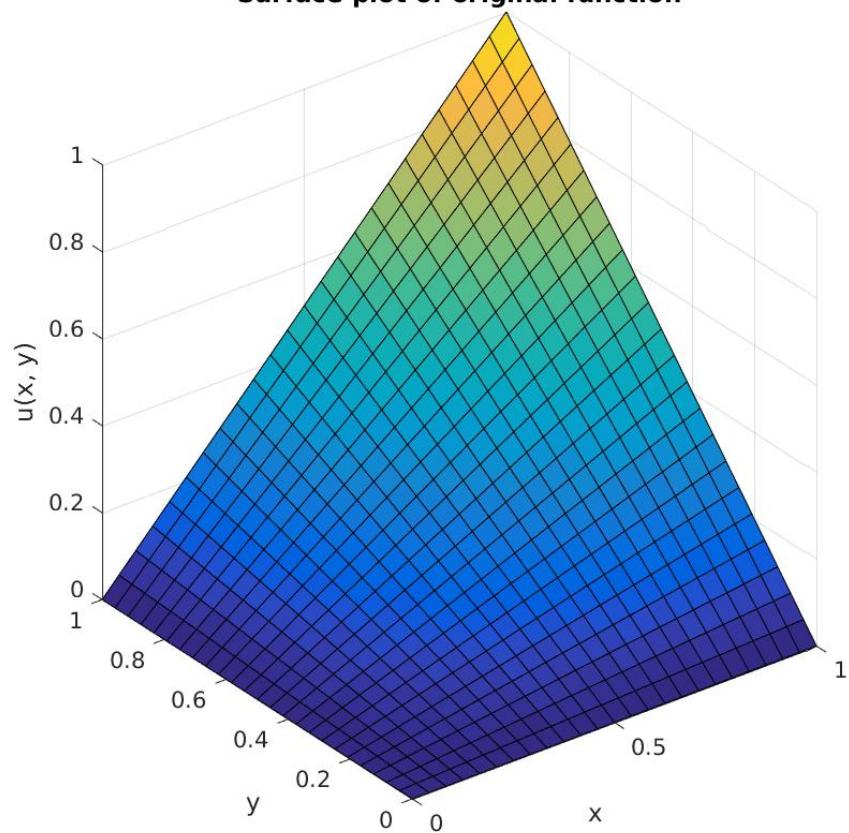
N	Error	Order
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6	5.668305e-15	-3.213053
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**Error convergence loglog plot**



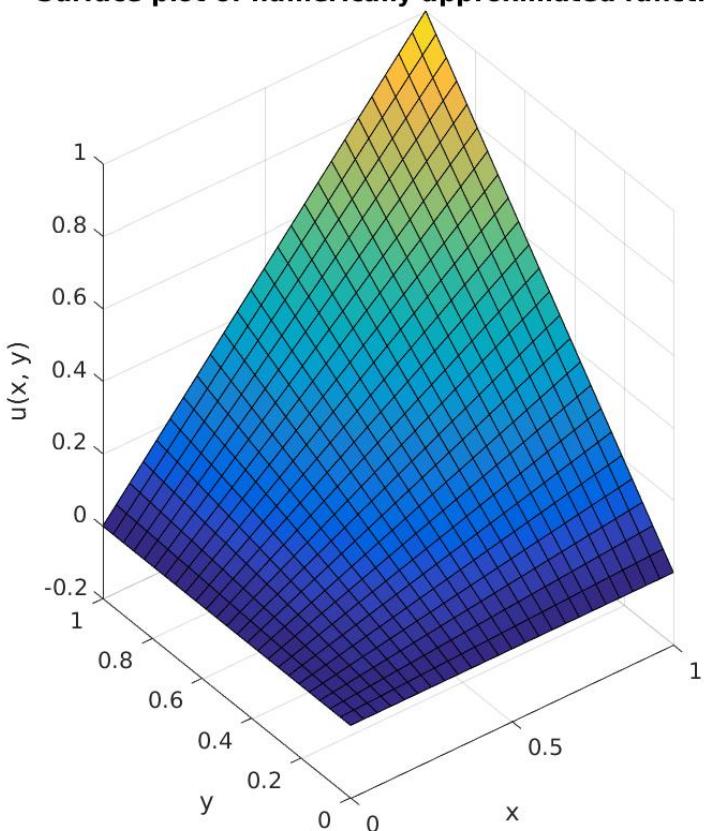
**Surface plot of original function**

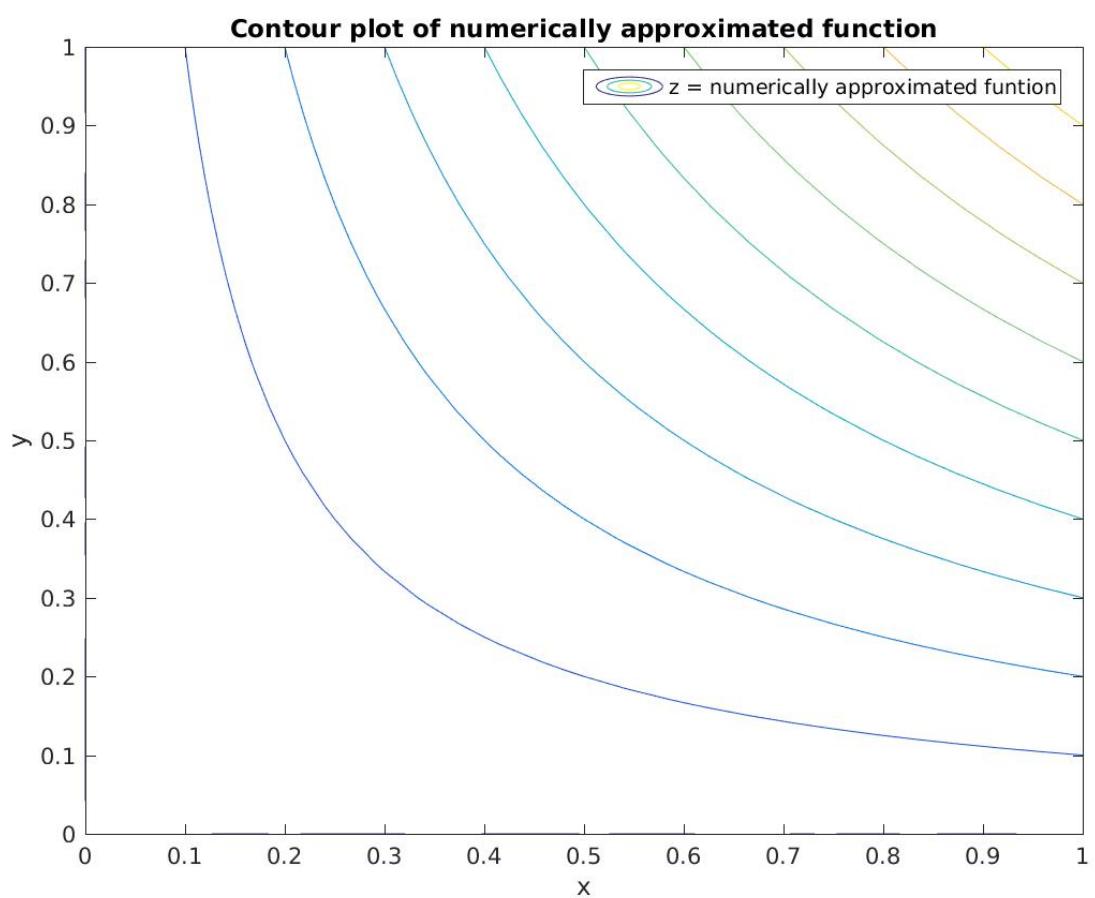
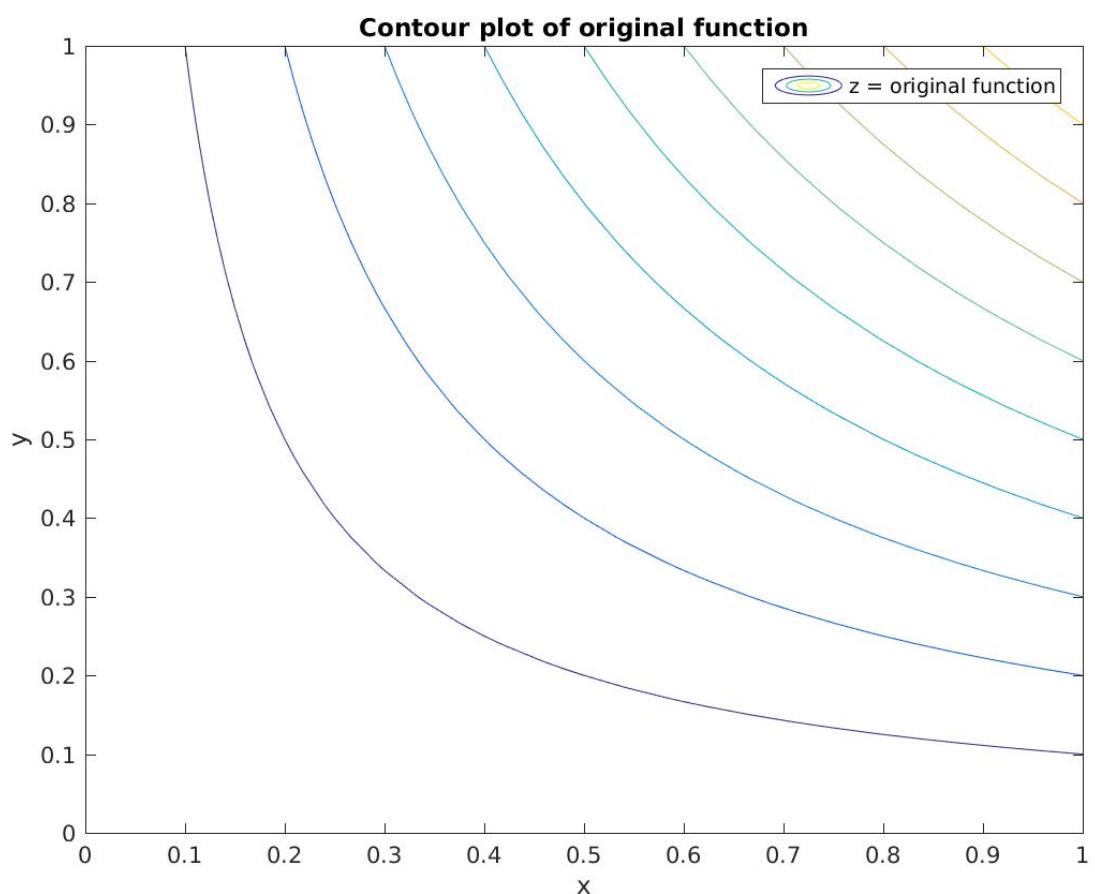
 z = original function

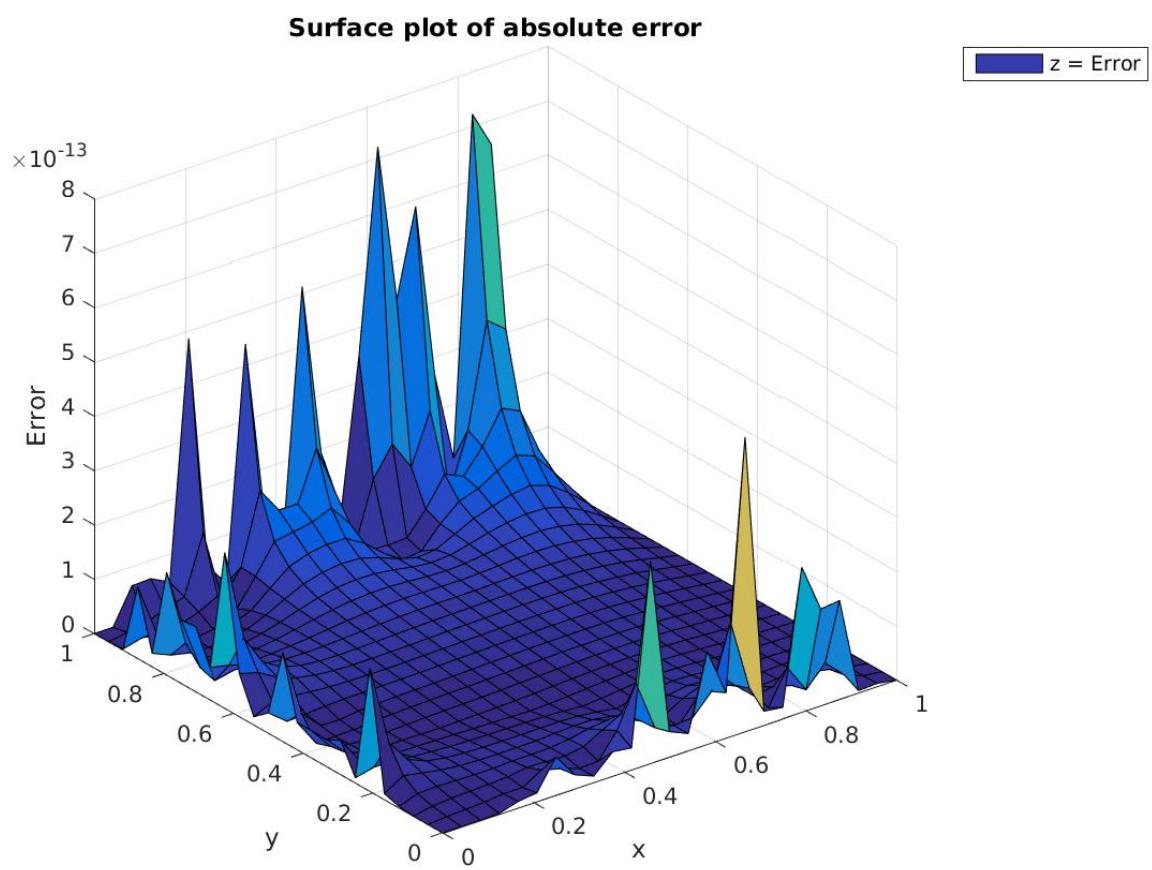


**Surface plot of numerically approximated function**

 z = numerically approximated funtion

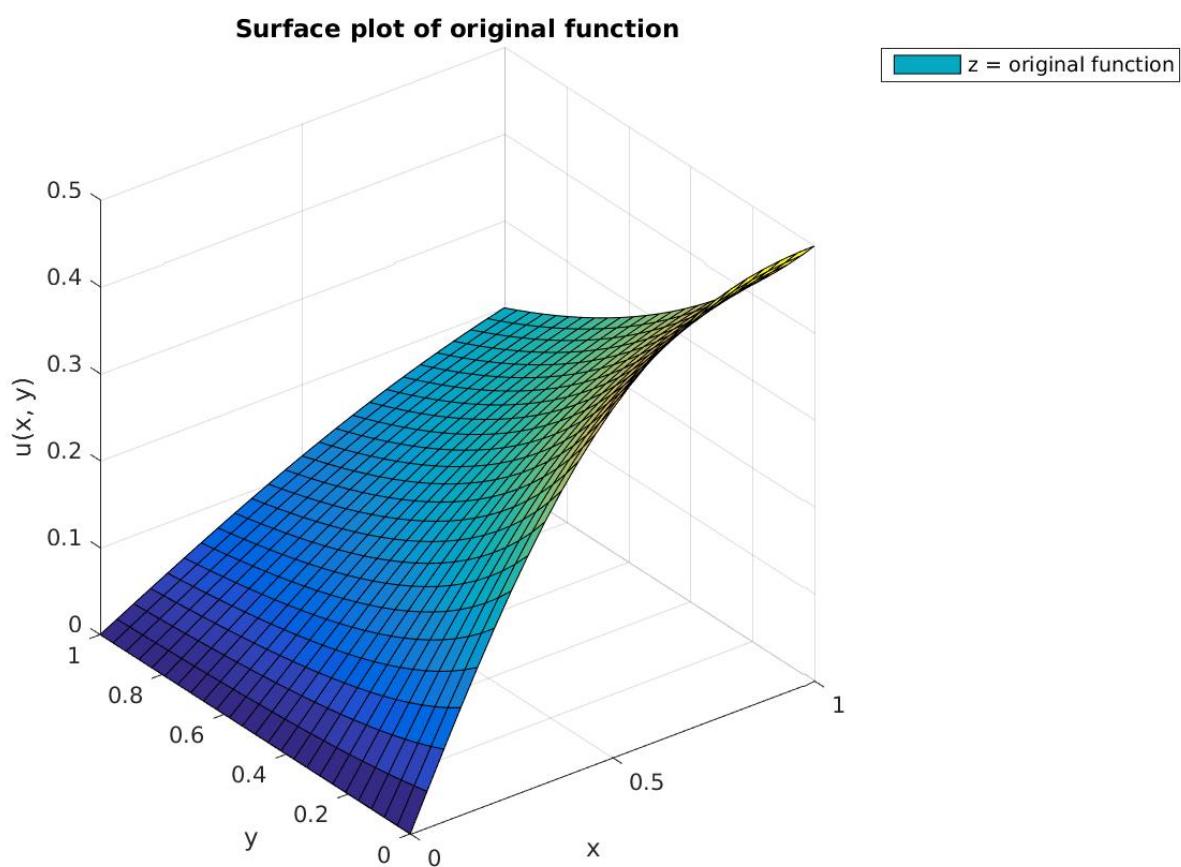
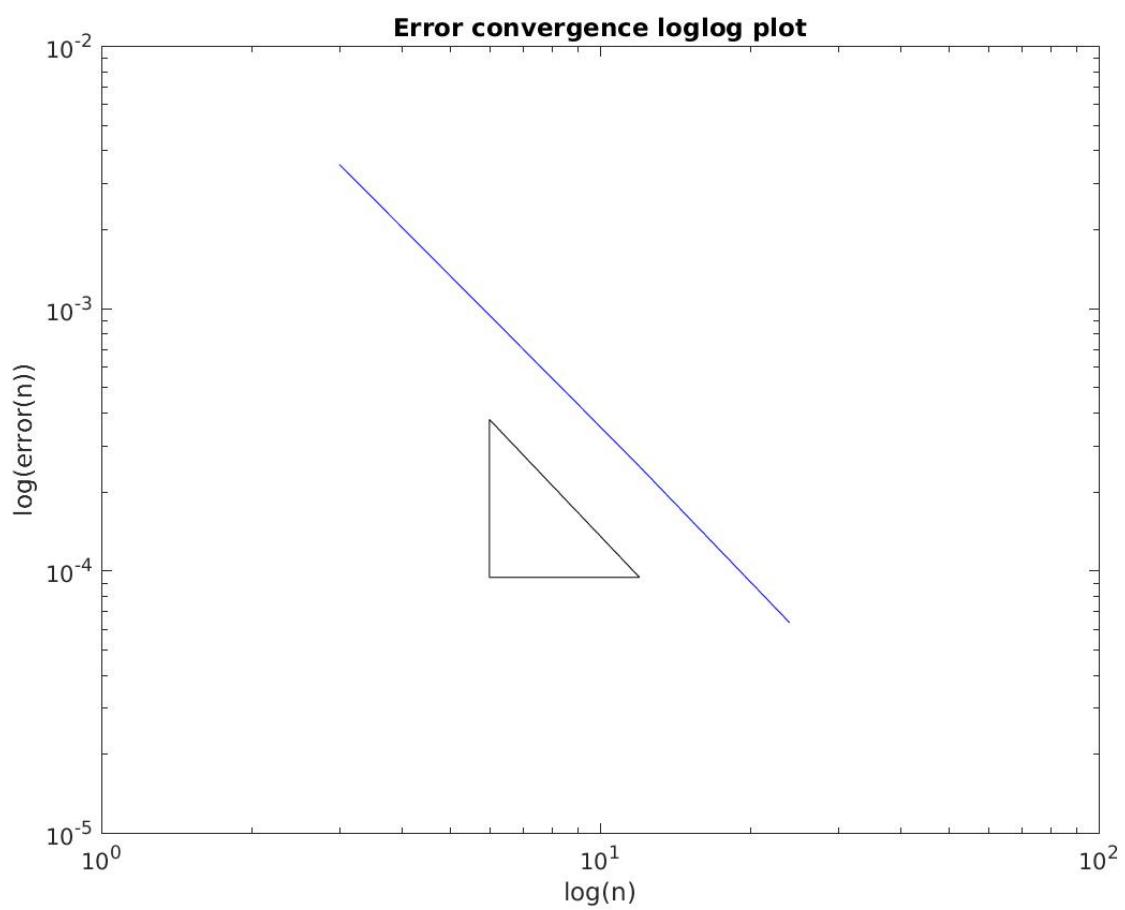




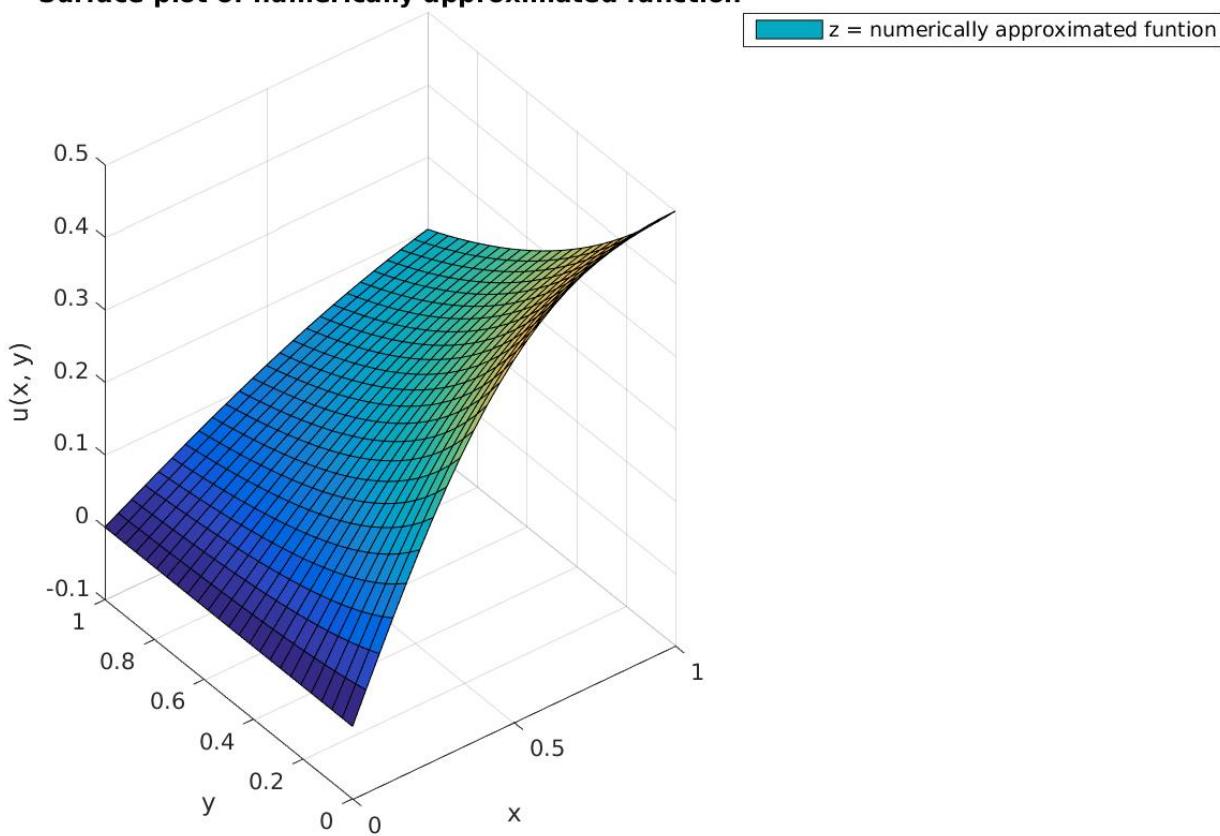


(B)

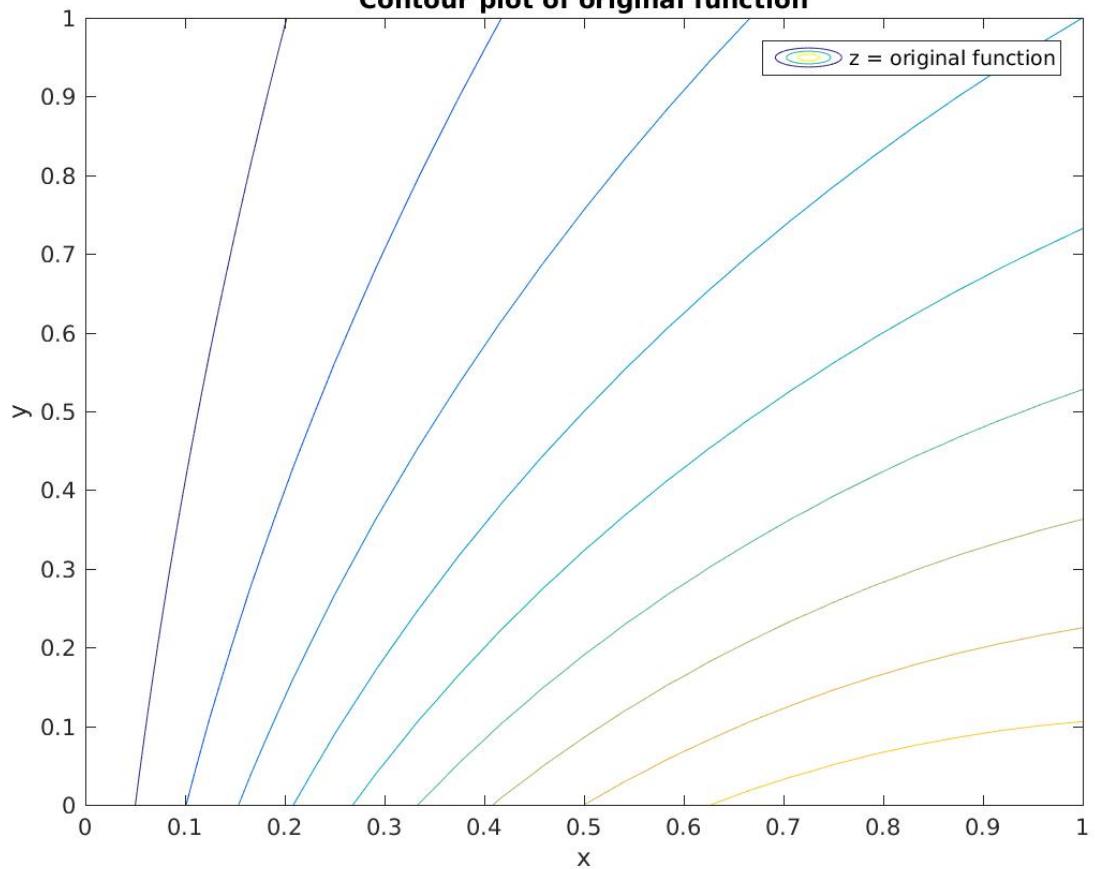
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12	2.492345e-04	1.978597

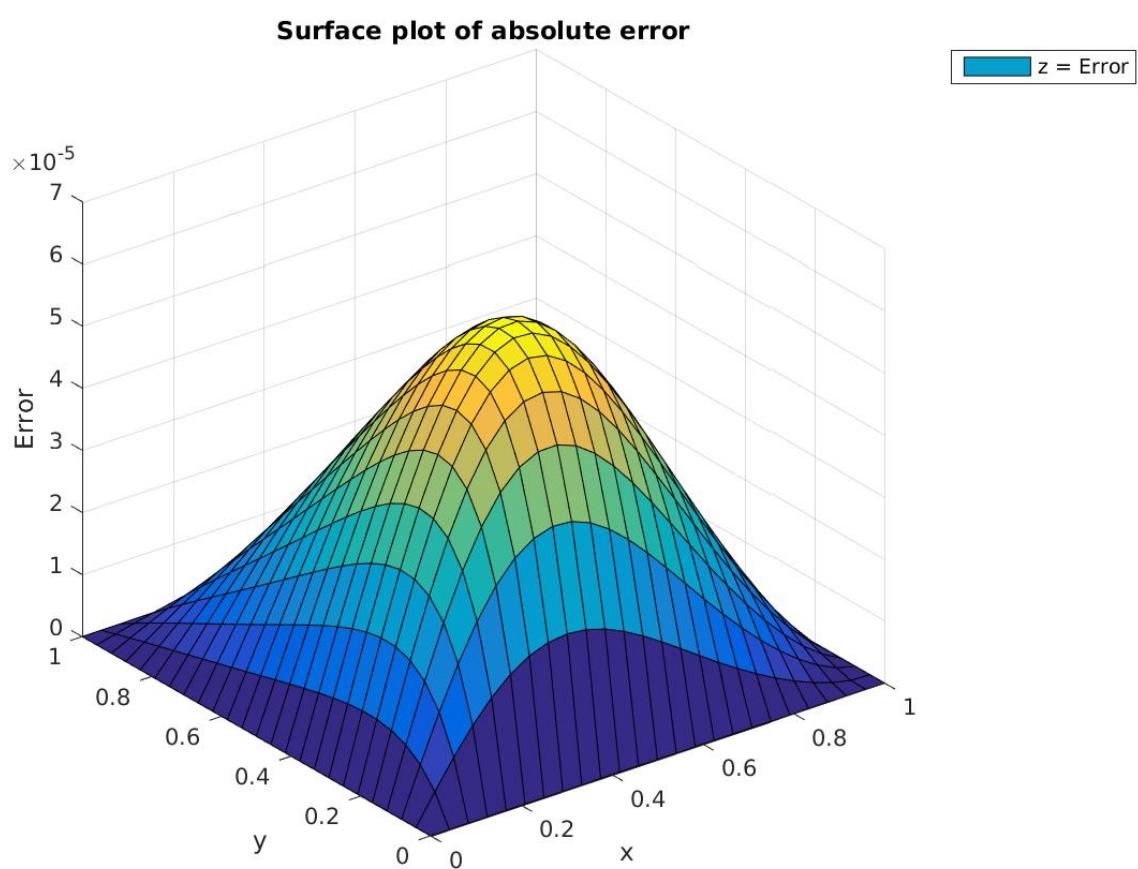
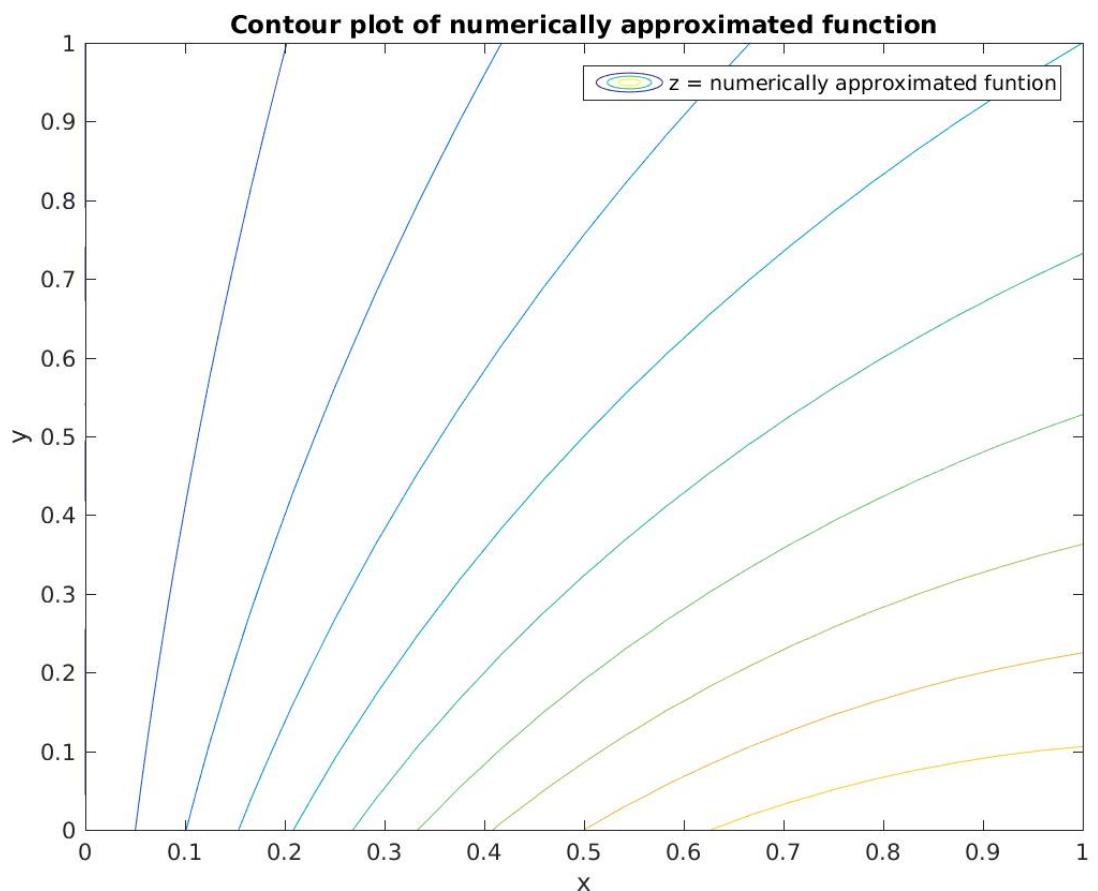


**Surface plot of numerically approximated function**



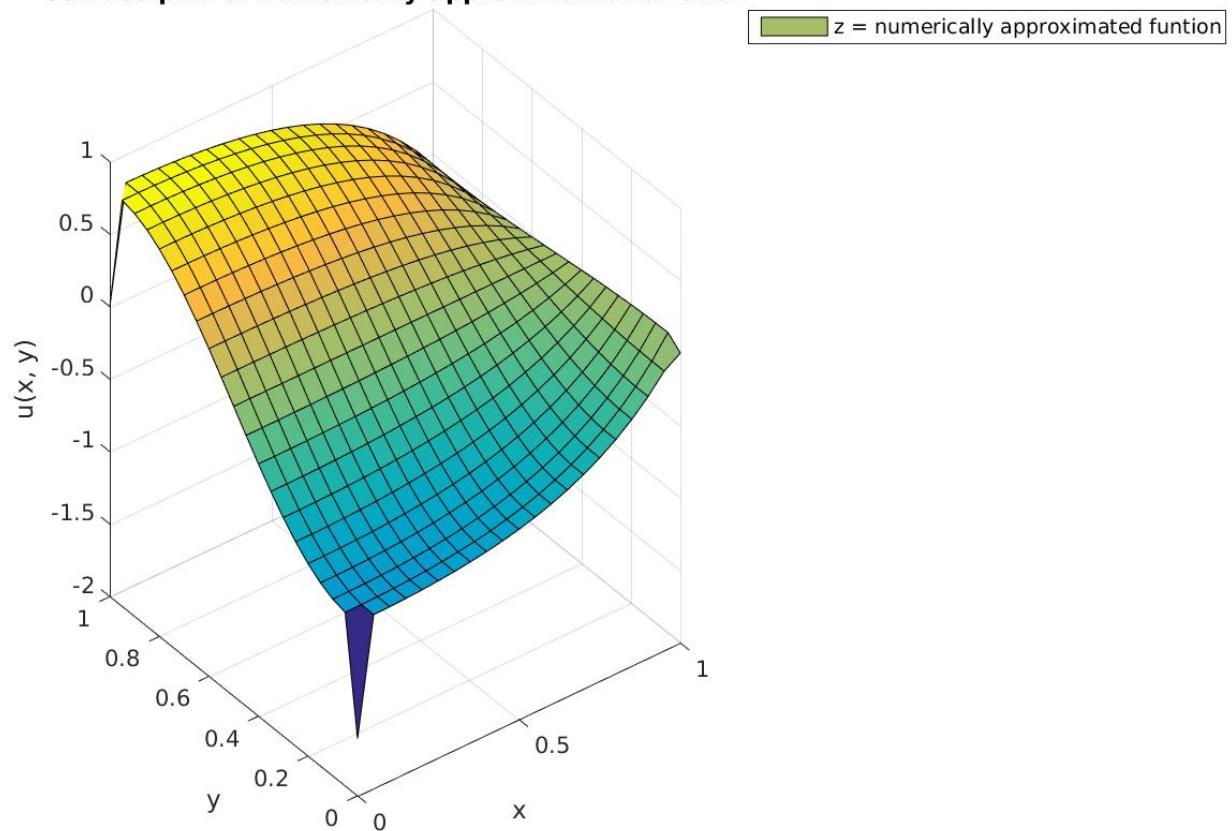
**Contour plot of original function**



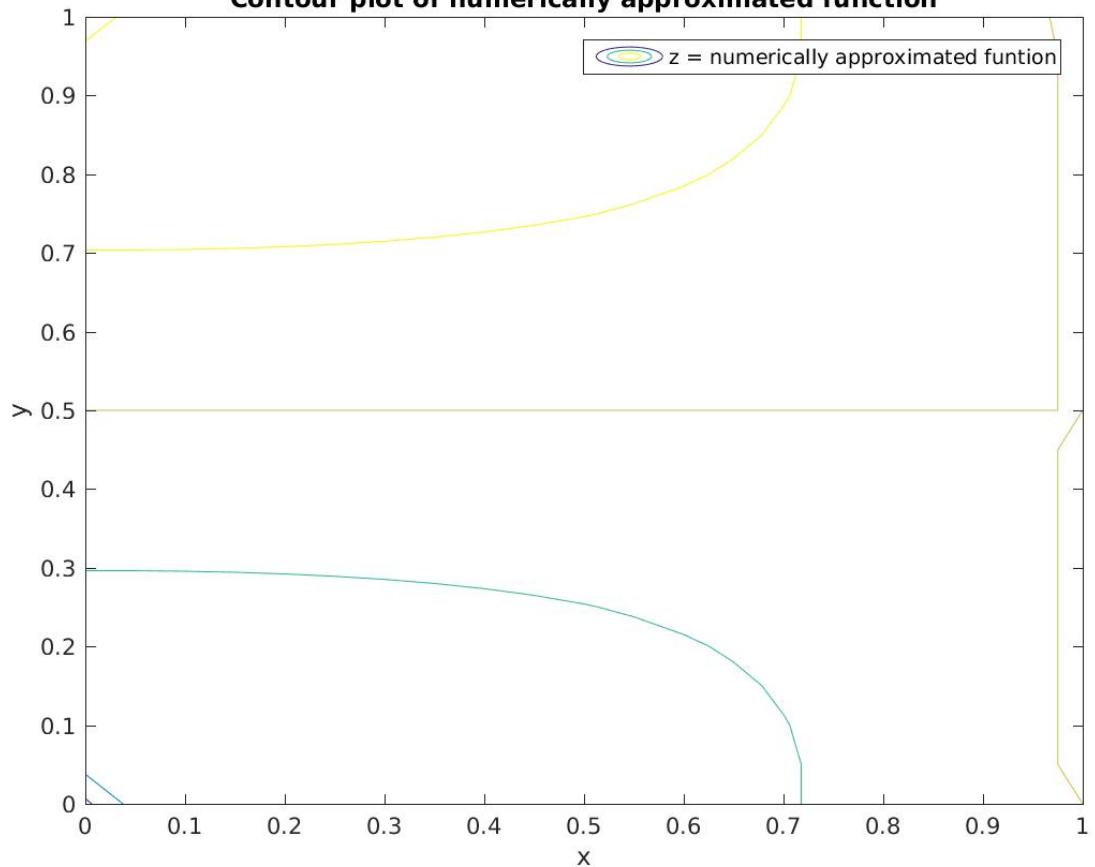


(C) (Original function not available)

**Surface plot of numerically approximated function**

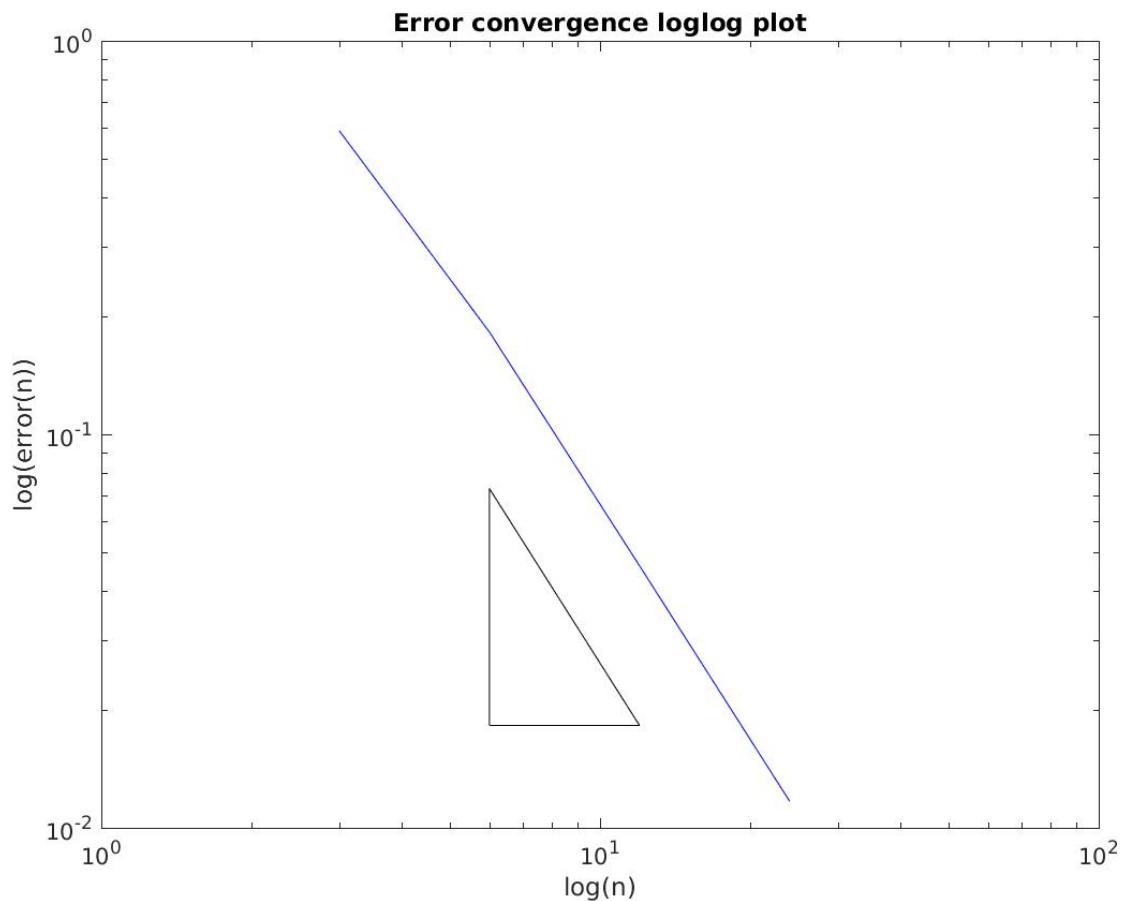


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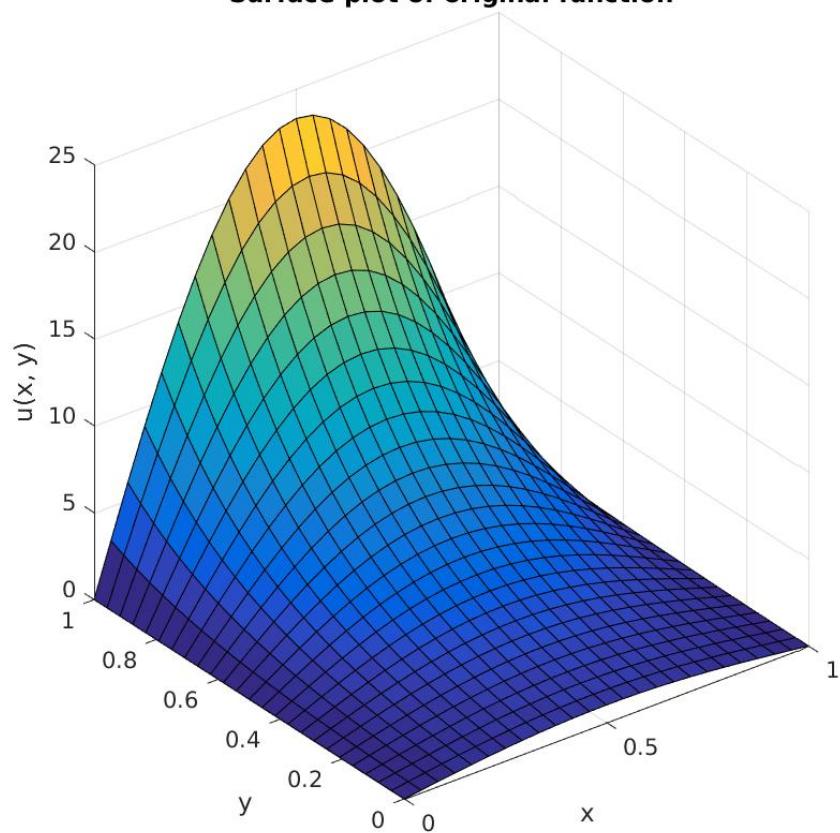
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6	1.820435e-01	1.973942
12	4.634037e-02	1.987778



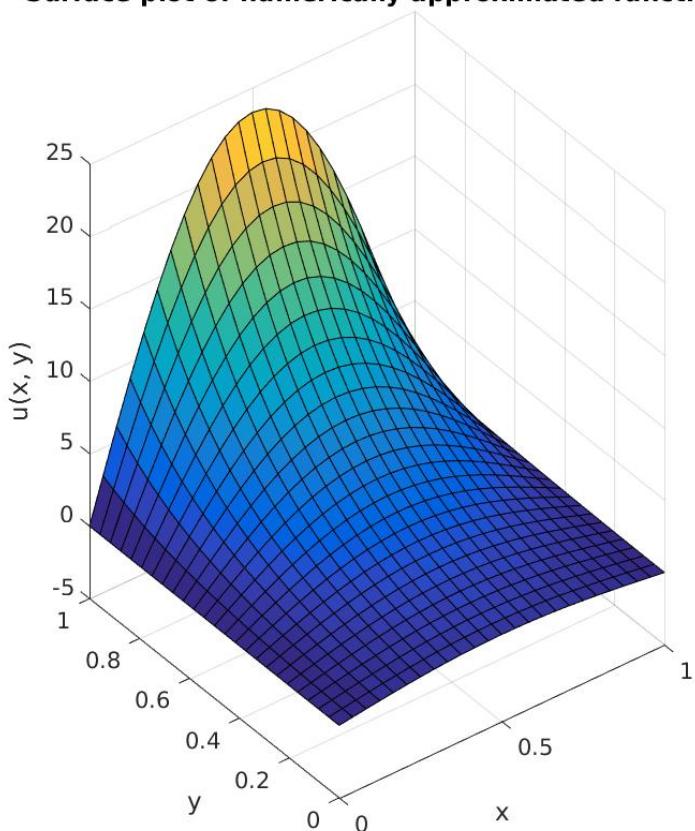
**Surface plot of original function**

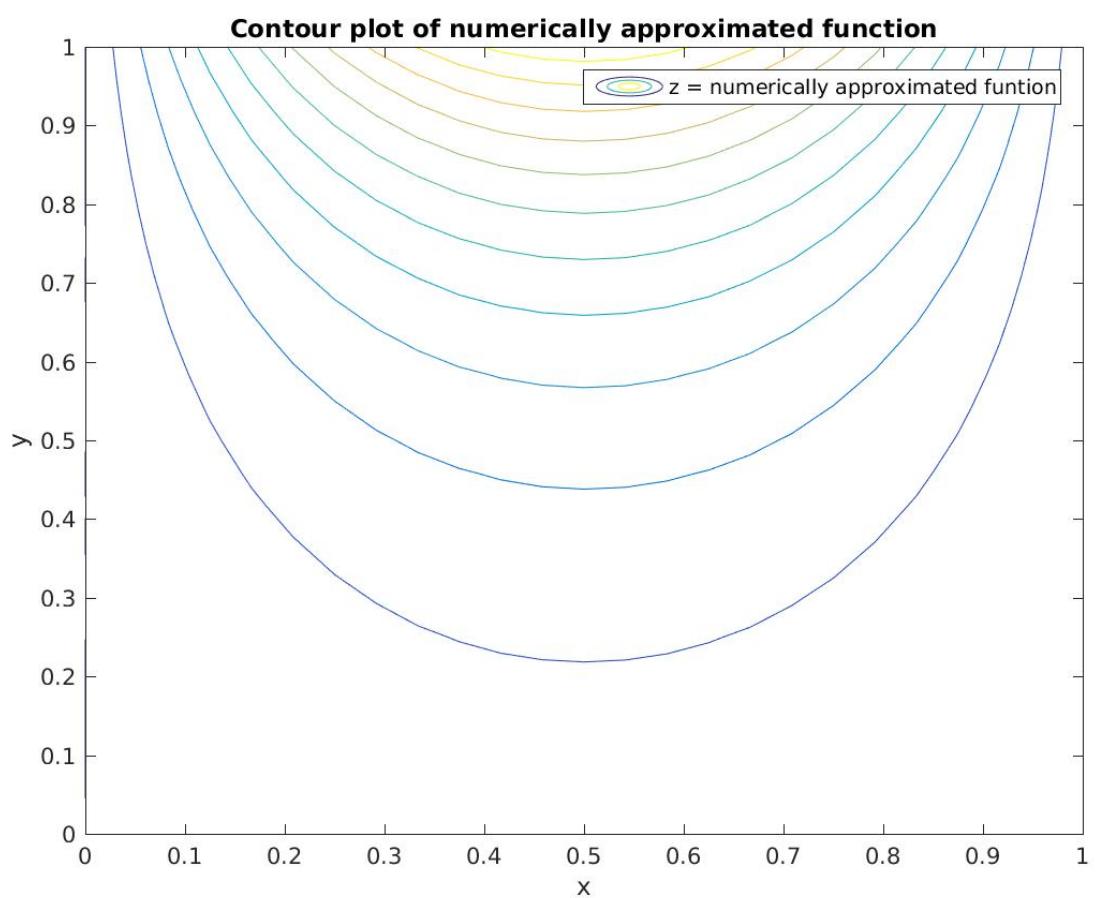
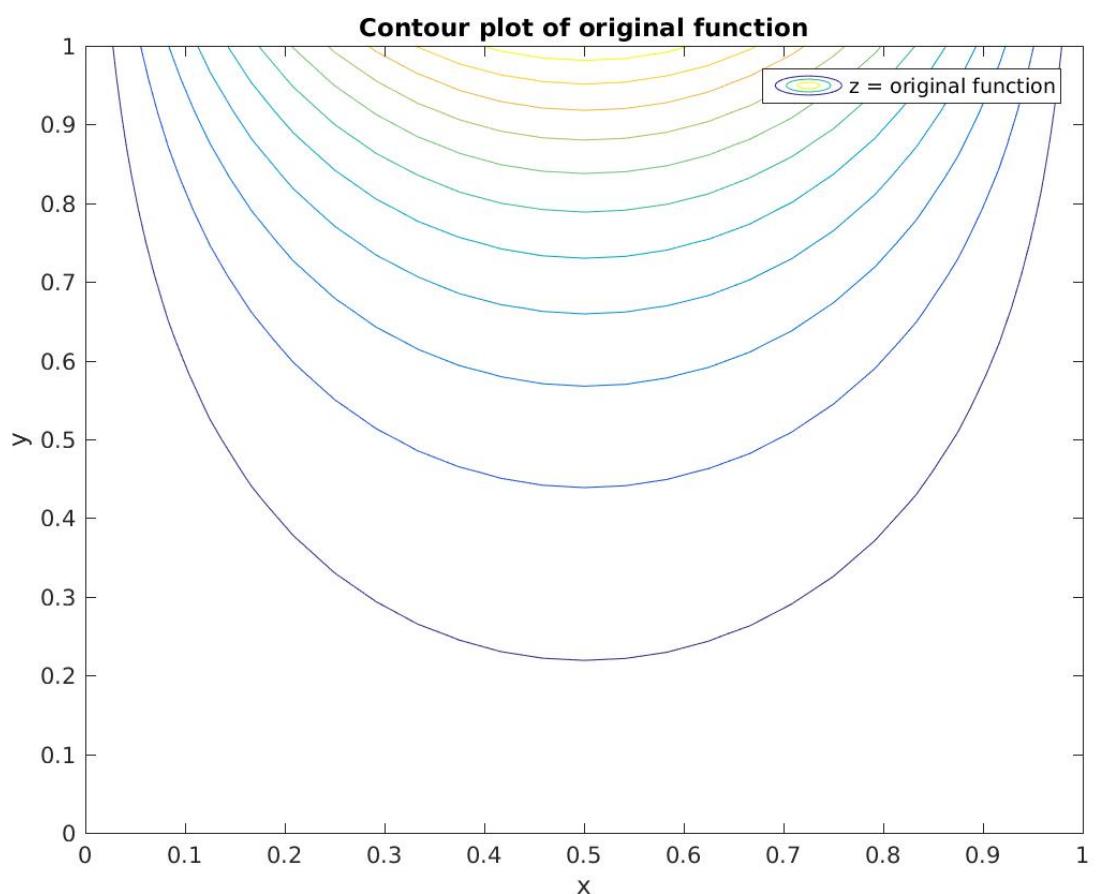
 z = original function

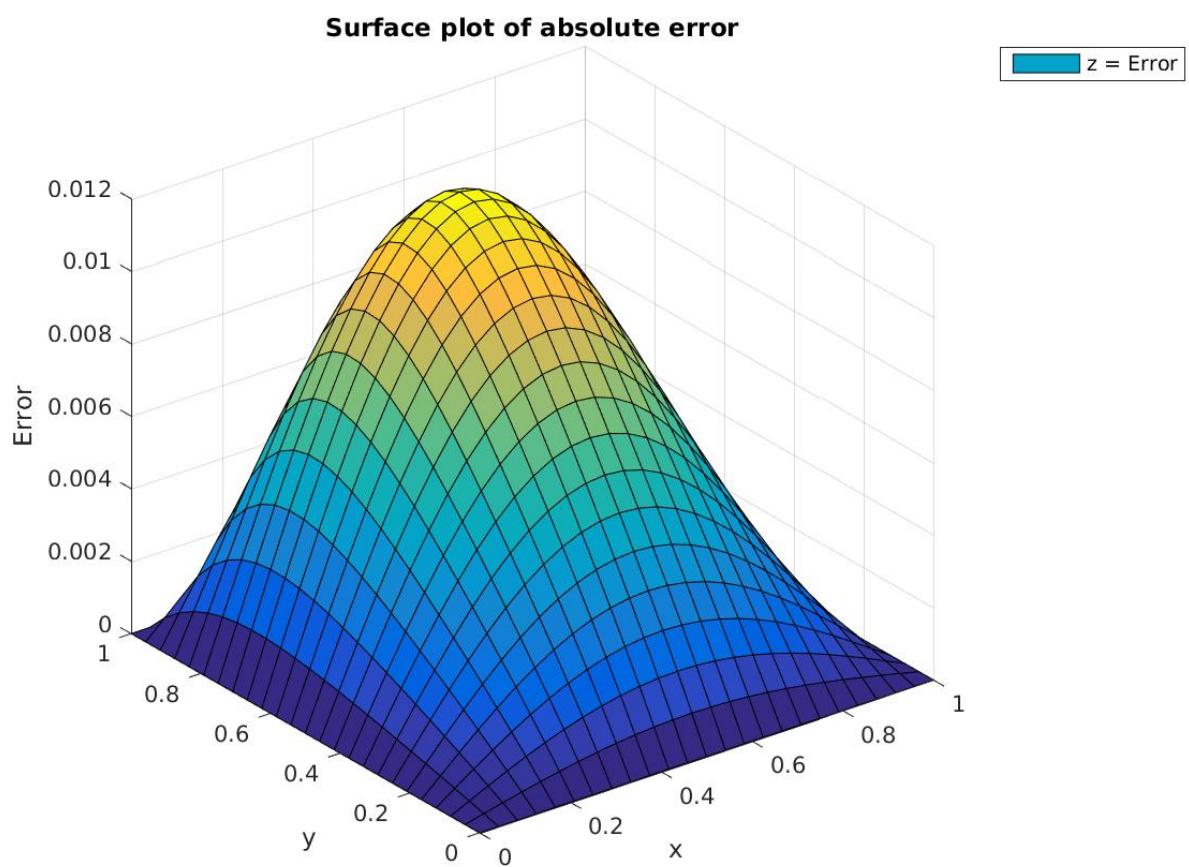


**Surface plot of numerically approximated function**

 z = numerically approximated funtion

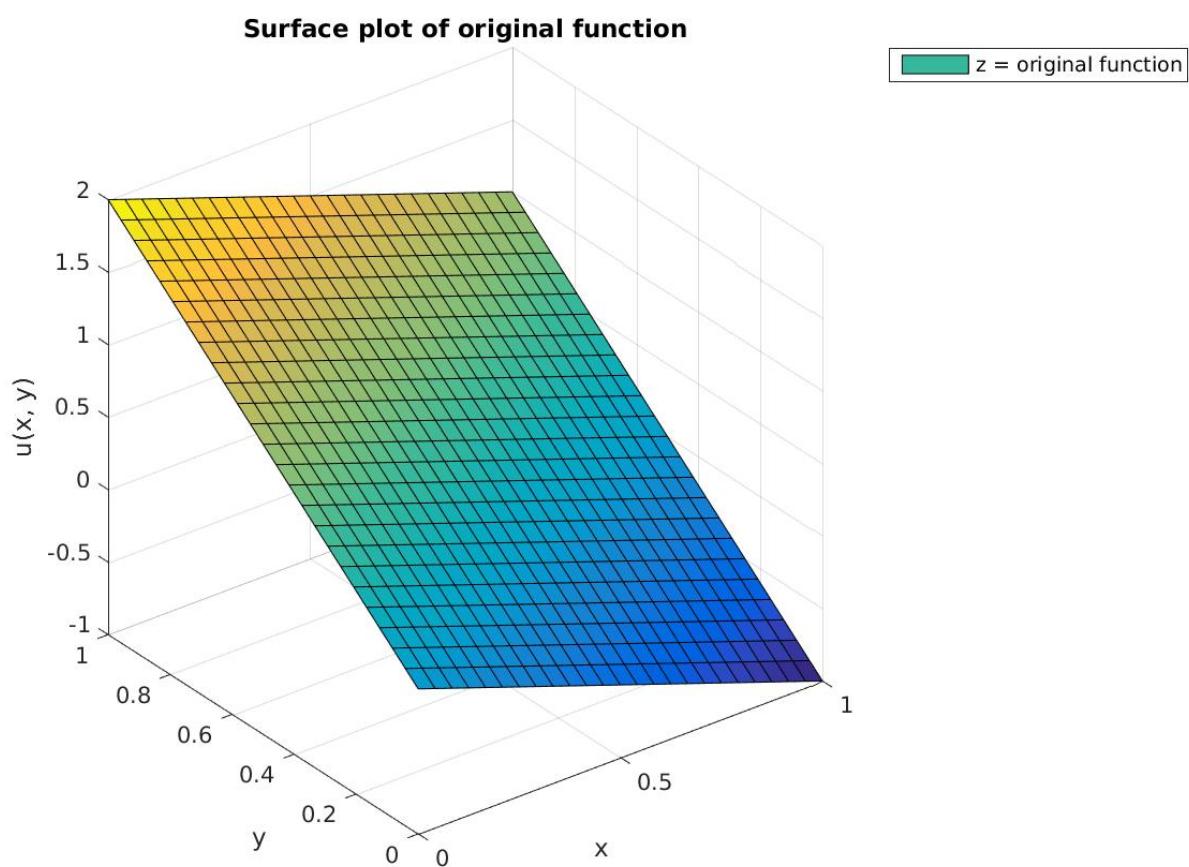
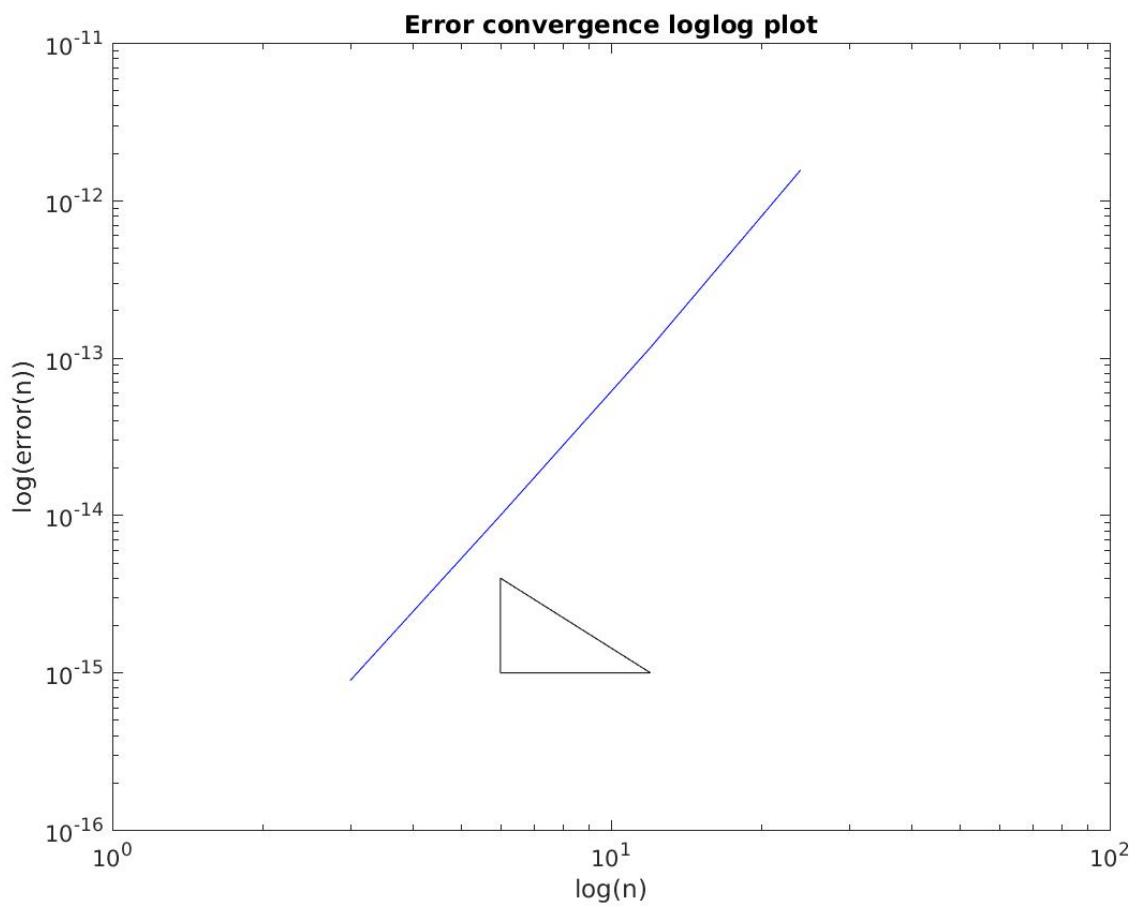




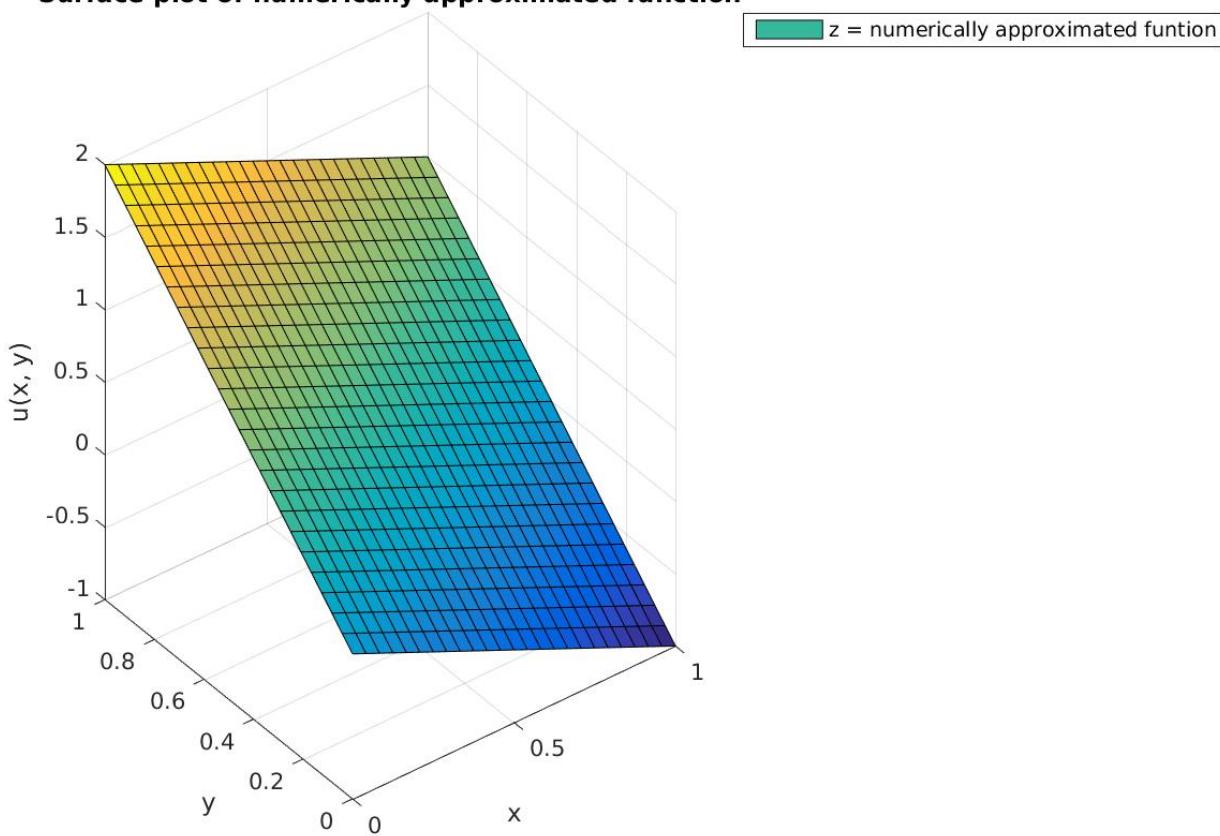


(E) The function is of order 1 so there is no truncation error. The only error is roundoff, and it does not have a order 2 convergence.

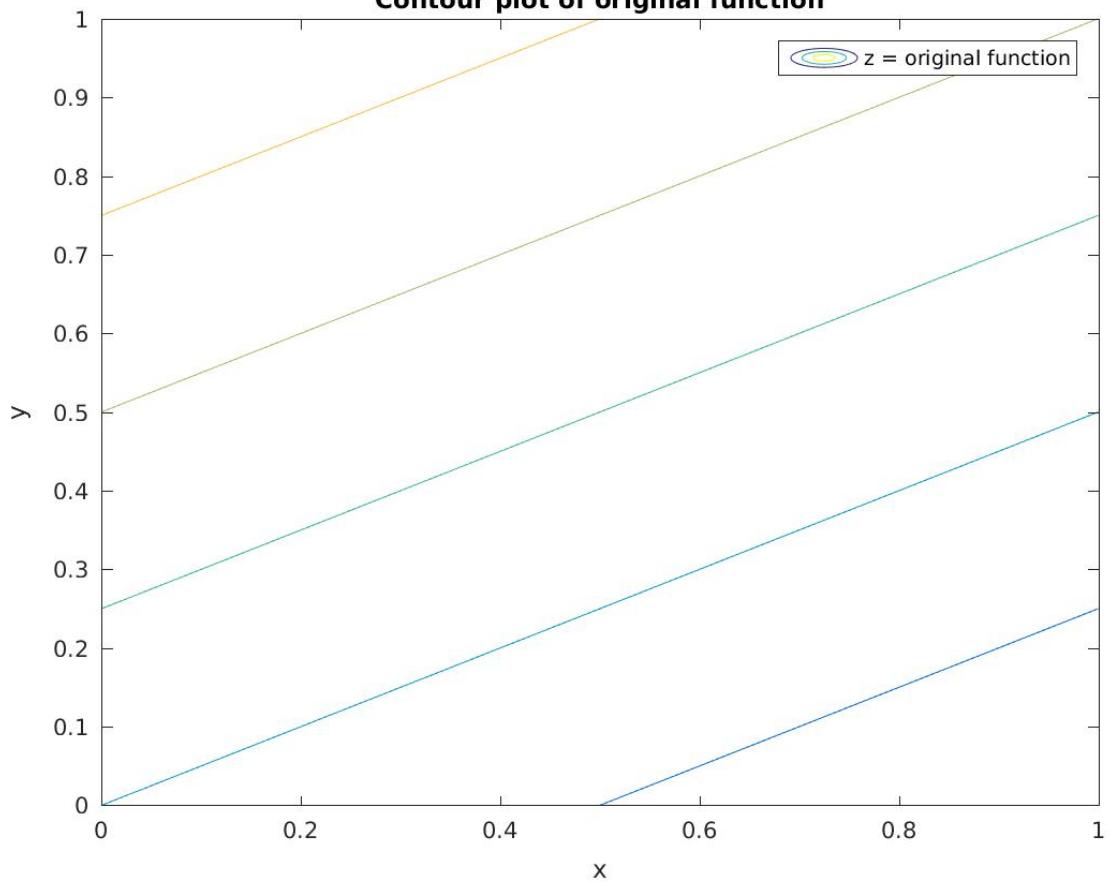
N	Error	Order
3	8.881784e-16	-3.483816
6	9.936496e-15	-3.545471
12	1.160183e-13	-3.745294

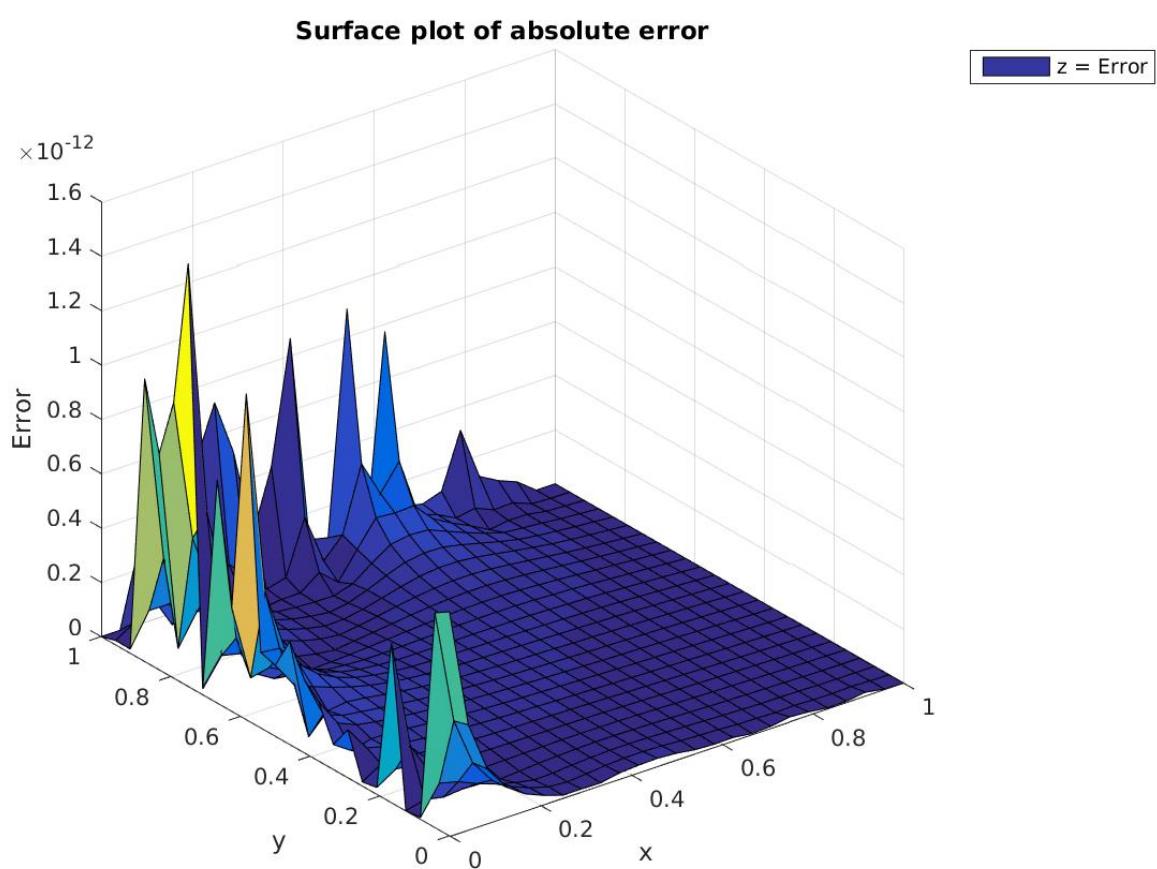
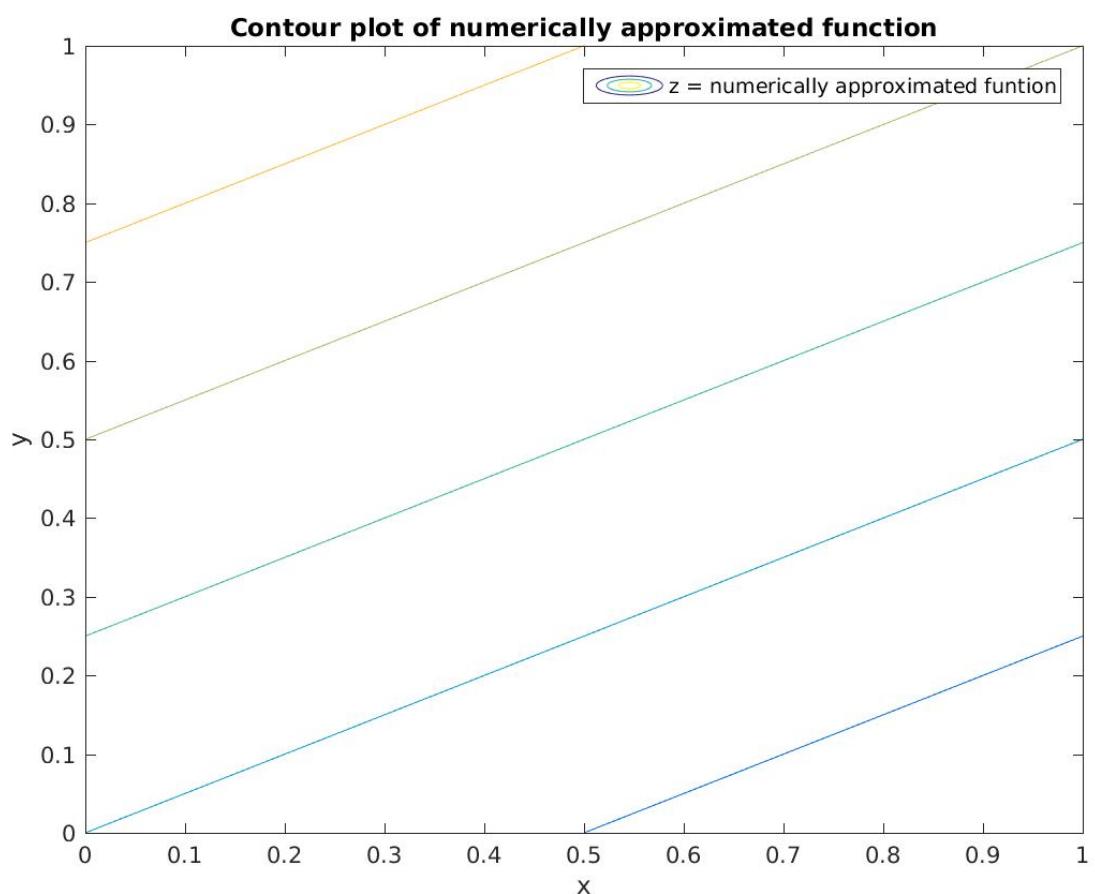


**Surface plot of numerically approximated function**



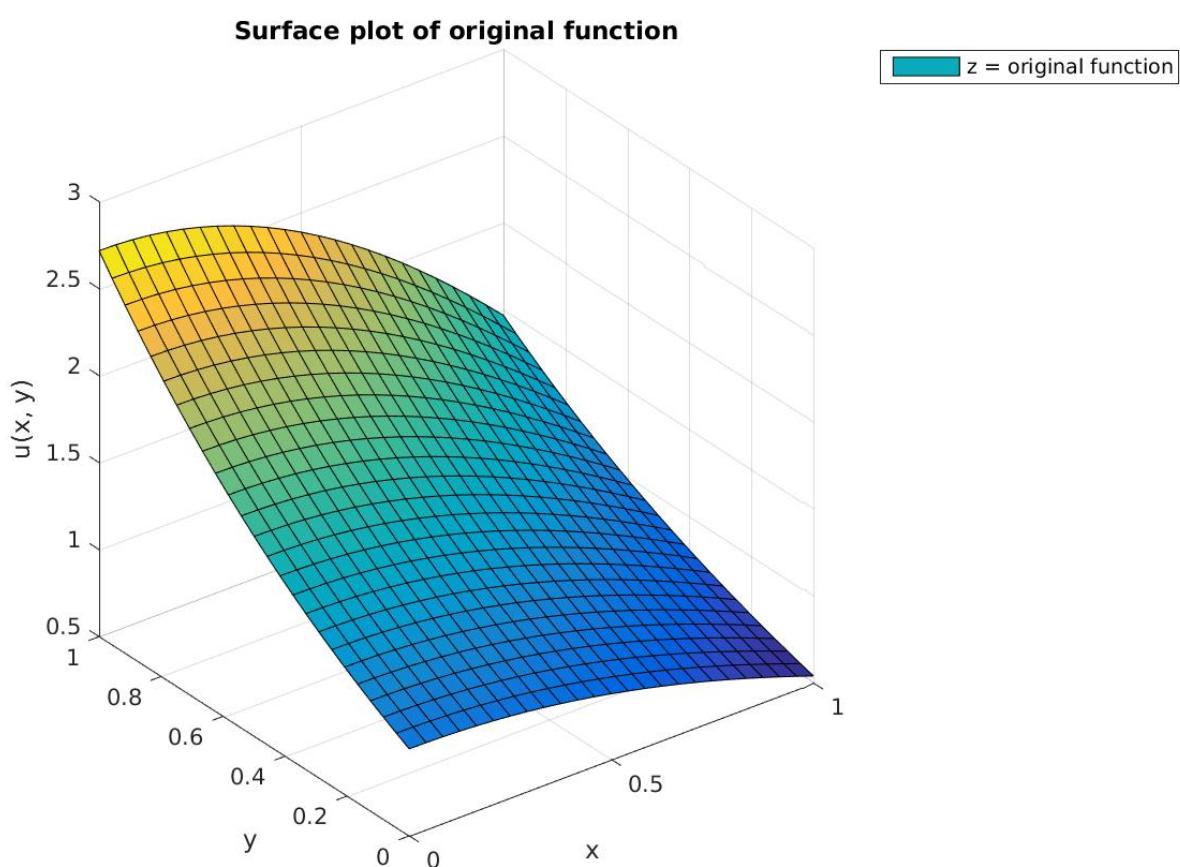
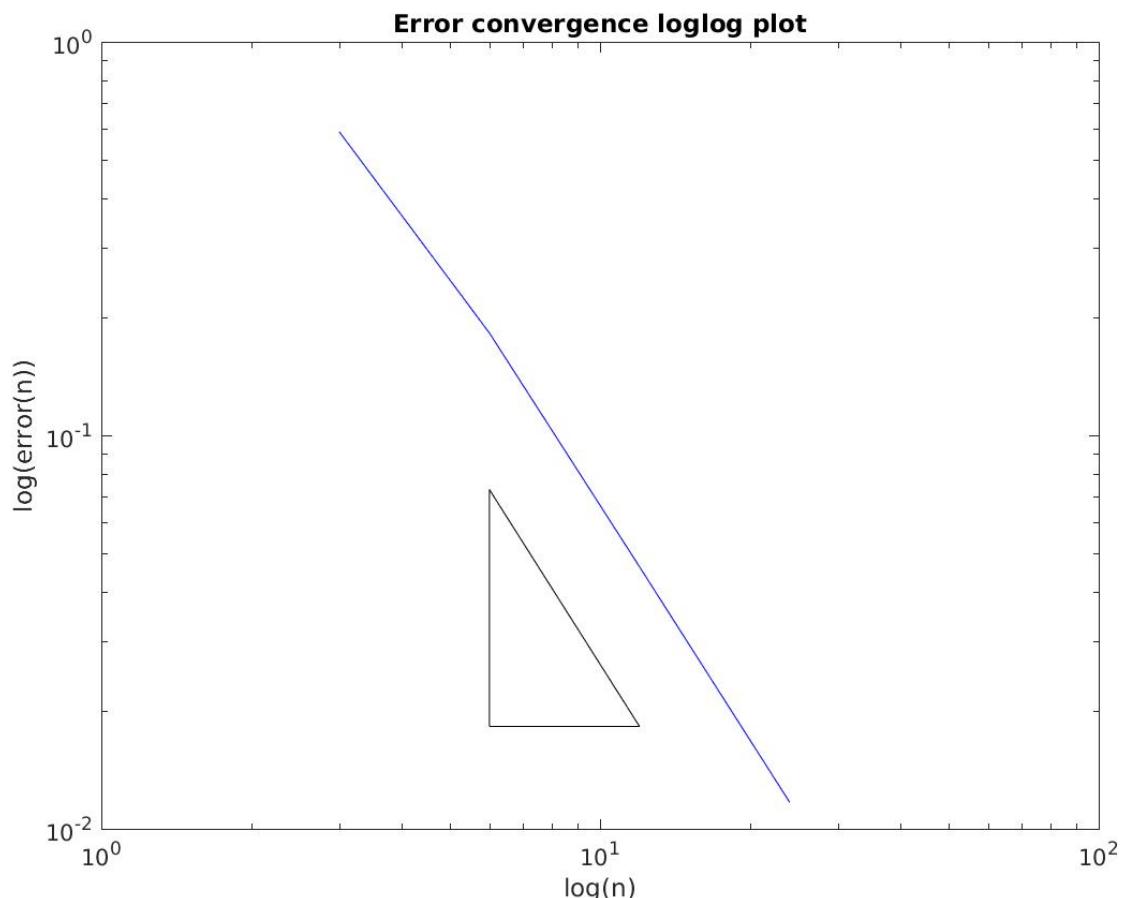
**Contour plot of original function**



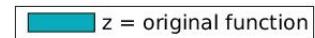


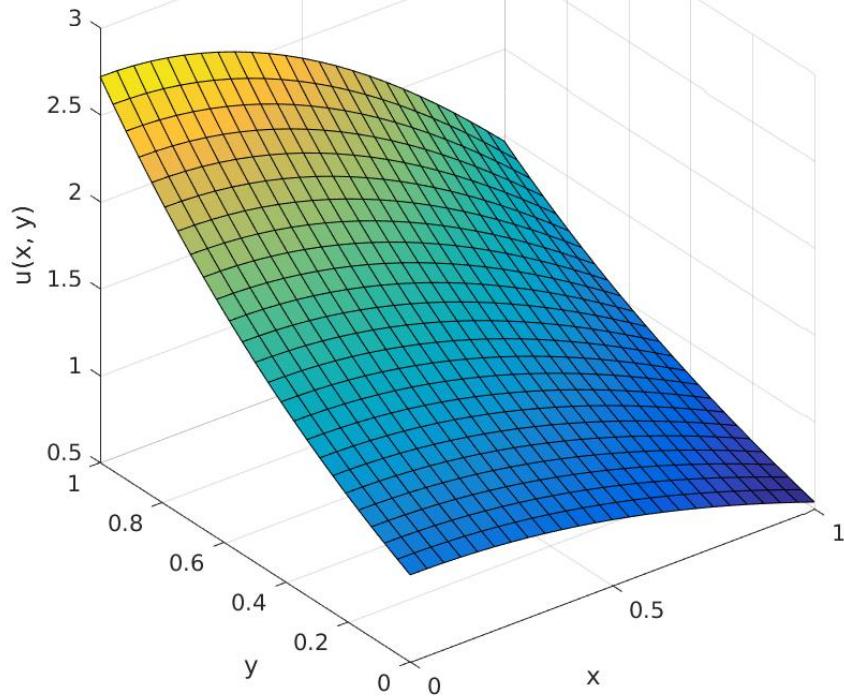
(F)

N	Error	Order
3	5.903116e-01	1.739355
6	1.768005e-01	2.783537

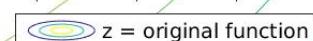


**Surface plot of original function**

 z = original function



**Contour plot of original function**

 z = original function

