Inna Williams

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Section 5.1

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Computer problem 1 using Excel

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1. Make a table of the error of the three-point centered-difference formula for f(0), Where f (x) = sin x − cosx, with h = 10−1, . . . ,10−12, as in the table in Section 5.1.2. Draw a plot of the results. Does the minimum error correspond to the theoretical expectation?

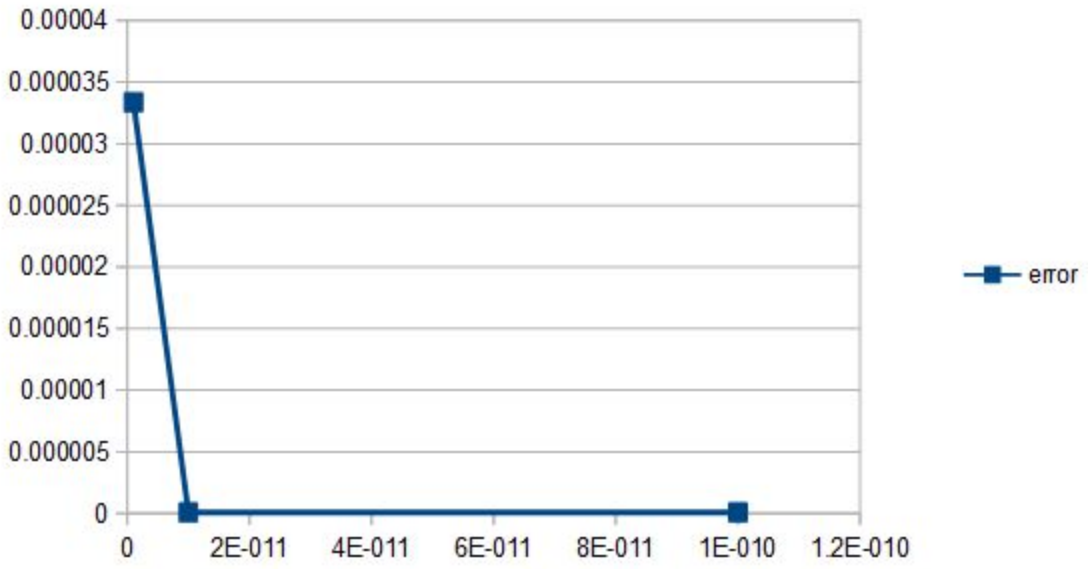
x0	F'(0)	h	value	error
0	1	0.1	0.9983341665	0.0016658335
0	1	0.01	0.9999833334	1.66665833349899E-005
0	1	0.001	0.9999998333	1.66666624279443E-007
0	1	0.0001	0.9999999983	1.66711033866562E-009
0	1	**0.00001**	1	**1.56537005580049E-011**
0	1	0.000001	1	2.6755819781954E-011
0	1	0.0000001	0.9999999995	5.26356291885577E-010
0	1	0.00000001	0.9999999995	5.26356402907879E-010
0	1	0.000000001	1.0000000272	2.72292193237433E-008
0	1	1E-010	1.0000000827	8.27403705550012E-008
0	1	1E-011	1.0000000827	8.27403703329566E-008
0	1	1E-012	1.0000333894	3.33894311090876E-005
			Minimum Error	**1.56537005580049E-011**
			h	**0.00001**

We can see that

minimum error = 1.56537005580*10^(-11)

Occurs at h = 10^(-5)

It is corresponds to epsilon-machine about 10^(-5)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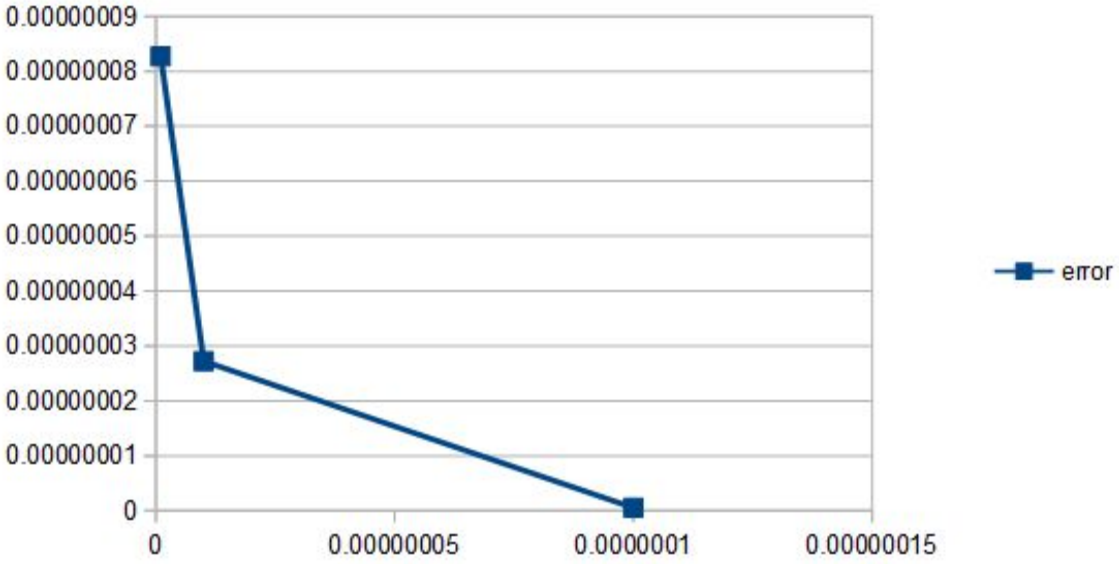
0.00003
0.000025
0.00002
0.000015
0.00001
0.000005
0
0
2E-011
4E-011
6E-011
8E-011
1E-010
1.2E-010
error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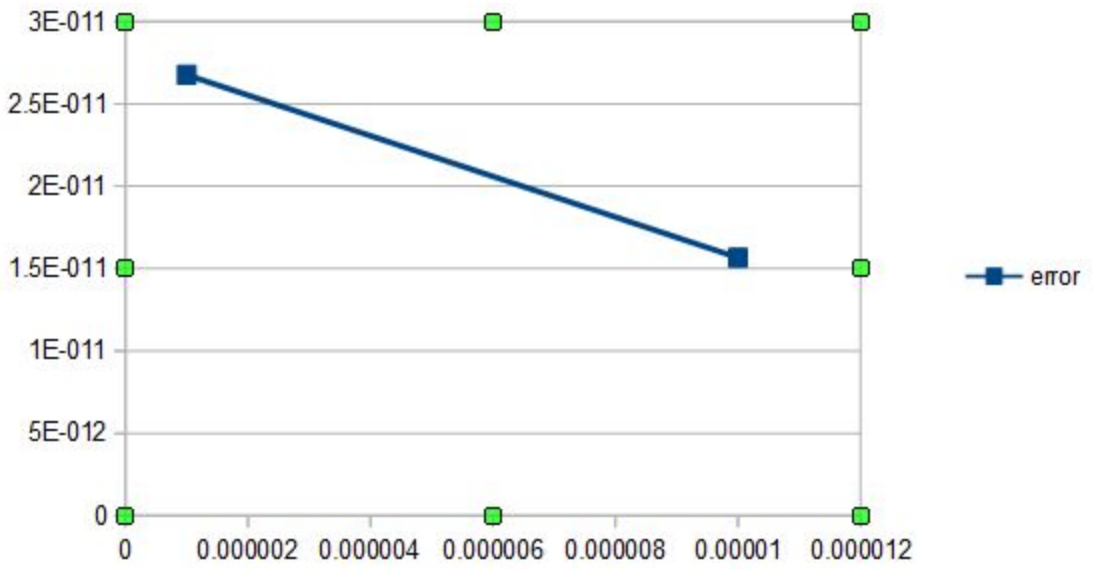
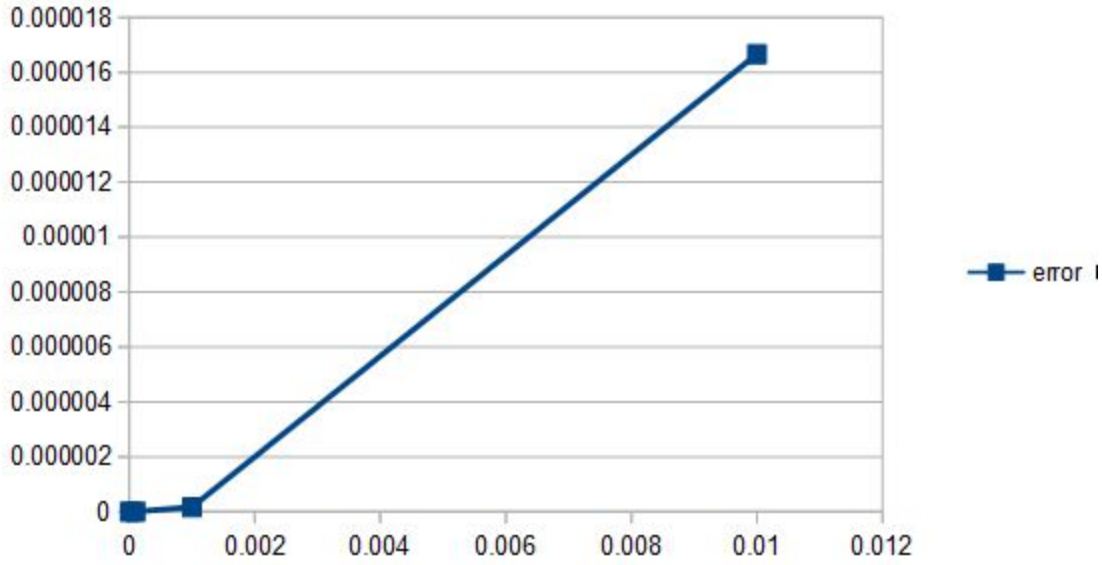
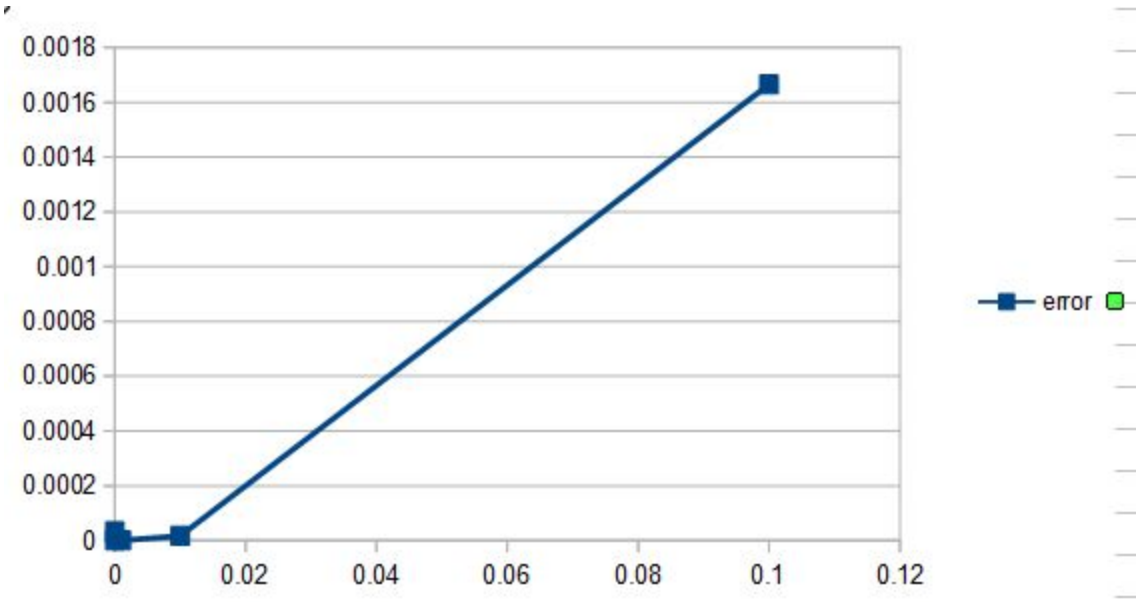
0.00000008
0.00000007
0.00000006
0.00000005
0.00000004
0.00000003
0.00000002
0.00000001
0
0
0.00000005
0.0000001
0.00000015
error



We can see that minimum error at H=0.00001



All together graph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0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
0
0.02
0.04
0.06
0.08
0.1
0.12
error