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Lab 2

Data Analysis

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In this lab the goal was to understand three different methods of approximating the derivative of a function: forward, backward and centered difference formulas. As well as understanding their derivations. Given the function sin(x), we were to use the prescribed algorithms to analyze the output of our programs, built around these algorithms. We were to use an X value of 2 and iterate 20 times, each iteration bringing our term (x+h, x-h or both) closer to x. We can see that to a point, as our value h becomes smaller, which I will refer to as Δx, our approximation becomes more and more accurate. We also see though that when Δx is sufficiently small the approximation becomes less accurate.

	Forward Difference		
i	h	value	error
0	0.2500000000	-0.5248969198	0.1087500832
1	0.0625000000	-0.4442822565	0.0281354199
2	0.0156250000	-0.4232336453	0.0070868088
3	0.0039062500	-0.4179217475	0.0017749110
4	0.0009765625	-0.4165907633	0.0004439267
5	0.0002441406	-0.4162578306	0.0001109941
6	0.0000610352	-0.4161745858	0.0000277493
7	0.0000152588	-0.4161537739	0.0000069374
8	0.0000038147	-0.4161485709	0.0000017343
9	0.0000009537	-0.4161472701	0.0000004336
10	0.0000002384	-0.4161469452	0.0000001087
11	0.0000000596	-0.4161468633	0.0000000267
12	0.0000000149	-0.4161468446	0.0000000081
13	0.0000000037	-0.4161468446	0.0000000081
14	0.0000000009	-0.4161468744	0.0000000379
15	0.0000000002	-0.4161467552	0.0000000813
16	0.0000000001	-0.4161472321	0.0000003955
17	0.0000000000	-0.4161453247	0.0000015118
18	0.0000000000	-0.4161376953	0.0000091412
19	0.0000000000	-0.4161376953	0.0000091412
	Backward Difference		

i	h	value	error
0	0.2500000000	-0.2987540802	0.1173927564
1	0.0625000000	-0.3874696646	0.0286771720
2	0.0156250000	-0.4090261621	0.0071206745
3	0.0039062500	-0.4143698090	0.0017770276
4	0.0009765625	-0.4157027776	0.0004440590
5	0.0002441406	-0.4160358342	0.0001110024
6	0.0000610352	-0.4161190867	0.0000277498
7	0.0000152588	-0.4161398991	0.0000069374
8	0.0000038147	-0.4161451022	0.0000017343
9	0.0000009537	-0.4161464029	0.0000004336
10	0.0000002384	-0.4161467282	0.0000001083
11	0.0000000596	-0.4161468092	0.0000000273
12	0.0000000149	-0.4161468297	0.0000000068
13	0.0000000037	-0.4161468446	0.0000000081
14	0.0000000009	-0.4161468744	0.0000000379
15	0.0000000002	-0.4161467552	0.0000000813
16	0.0000000001	-0.4161472321	0.0000003955
17	0.0000000000	-0.4161453247	0.0000015118
18	0.0000000000	-0.4161376953	0.0000091412
19	0.0000000000	-0.4161376953	0.0000091412
	Centered Difference		
i	h	value	error
0	0.2500000000	-0.4118255000	0.0043213366
1	0.0625000000	-0.4158759605	0.0002708760
2	0.0156250000	-0.4161299037	0.0000169329
3	0.0039062500	-0.4161457782	0.0000010583
4	0.0009765625	-0.4161467704	0.0000000661
5	0.0002441406	-0.4161468324	0.0000000041
6	0.0000610352	-0.4161468363	0.0000000003
7	0.0000152588	-0.4161468365	0.0000000000
8	0.0000038147	-0.4161468365	0.0000000000
9	0.0000009537	-0.4161468365	0.0000000000
10	0.0000002384	-0.4161468367	0.0000000002
11	0.0000000596	-0.4161468362	0.0000000003
12	0.0000000149	-0.4161468372	0.0000000006
13	0.0000000037	-0.4161468446	0.0000000081
14	0.0000000009	-0.4161468744	0.0000000379
15	0.0000000002	-0.4161467552	0.0000000813
16	0.0000000001	-0.4161472321	0.0000003955
17	0.0000000000	-0.4161453247	0.0000015118

18	0.0000000000	-0.4161376953	0.0000091412
19	0.0000000000	-0.4161376953	0.0000091412