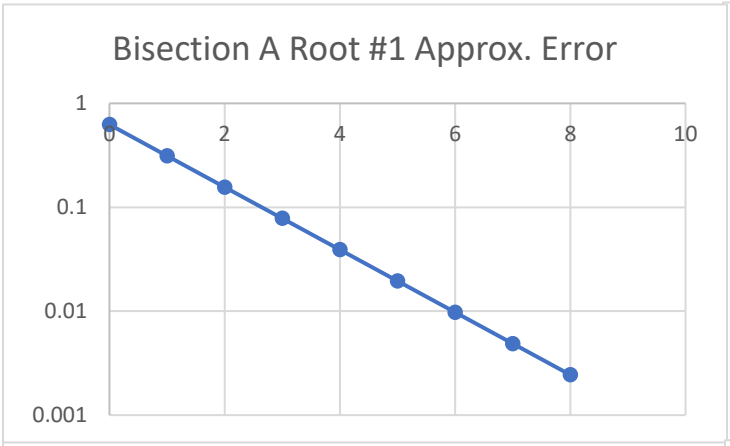
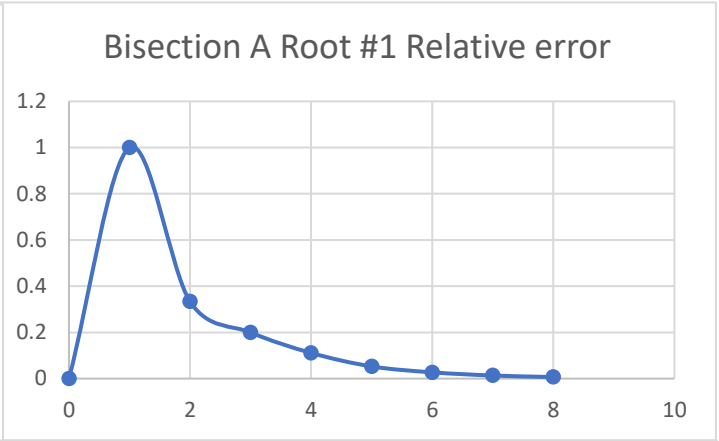
BISECTION METHOD

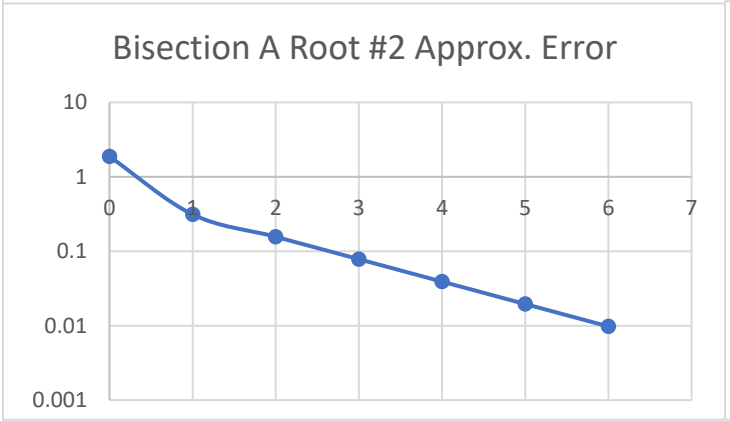
For the bisection method on part A, the approximate error is fairly linear and approaches zero quickly as the number of iterations increase. For the relative error, it rises quickly than falls towards zero as the number of iterations increase.

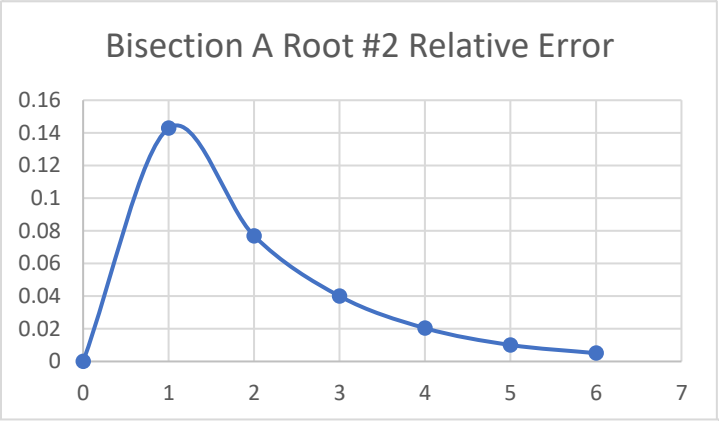
A_Root #1								
N	An	Bn	Cn	f(An)	f(Bn)	f(Cn)	Approx. Error	Relative Error
0	0	1.25	0.625	-5	2.75	1.98047	0.625	0
1	0	0.625	0.3125	-5	1.98047	-0.550293	0.3125	1
2	0.3125	0.625	0.46875	-0.550293	1.98047	0.932068	0.15625	0.333333
3	0.3125	0.46875	0.390625	-0.550293	0.932068	0.247993	0.078125	0.2
4	0.3125	0.390625	0.351562	-0.550293	0.247993	-0.136516	0.0390625	0.111111
5	0.351562	0.390625	0.371094	-0.136516	0.247993	0.0593528	0.0195312	0.0526316
6	0.351562	0.371094	0.361328	-0.136516	0.0593528	-0.0376724	0.00976562	0.027027
7	0.361328	0.371094	0.366211	-0.0376724	0.0593528	0.0110667	0.00488281	0.0133333
8	0.361328	0.366211	0.36377	-0.0376724	0.0110667	-0.0132461	0.00244141	0.00671141
A_Root #2								
N	An	Bn	Cn	f(An)	f(Bn)	f(Cn)	Approx.	Error
0	1.25	2.5	1.875	2.75	-2.625	0.238281	1.875	0
1	1.875	2.5	2.1875	0.238281	-2.625	-1.33252	0.3125	0.142857
2	1.875	2.1875	2.03125	0.238281	-1.33252	-0.559021	0.15625	0.0769231
3	1.875	2.03125	1.95312	0.238281	-0.559021	-0.160484	0.078125	0.04
4	1.875	1.95312	1.91406	0.238281	-0.160484	0.0392275	0.0390625	0.0204082
5	1.91406	1.95312	1.93359	0.0392275	-0.160484	-0.0605909	0.0195312	0.010101
6	1.91406	1.93359	1.92383	0.0392275	-0.0605909	-0.0106667	0.00976562	0.00507614
A_Root #3								
N	An	Bn	Cn	f(An)	f(Bn)	f(Cn)	Approx.	Error
0	2.5	4	3.25	-2.625	6.6	-2.4	3.25	0
1	3.25	4	3.625	-2.4	6.6	0.686719	0.375	0.103448
2	3.25	3.625	3.4375	-2.4	0.686719	-1.17041	0.1875	0.0545455
3	3.4375	3.625	3.53125	-1.17041	0.686719	-0.325232	0.09375	0.0265487
4	3.53125	3.625	3.57812	-0.325232	0.686719	0.159279	0.046875	0.0131004
5	3.53125	3.57812	3.55469	-0.325232	0.159279	-0.0882654	0.0234375	0.00659341

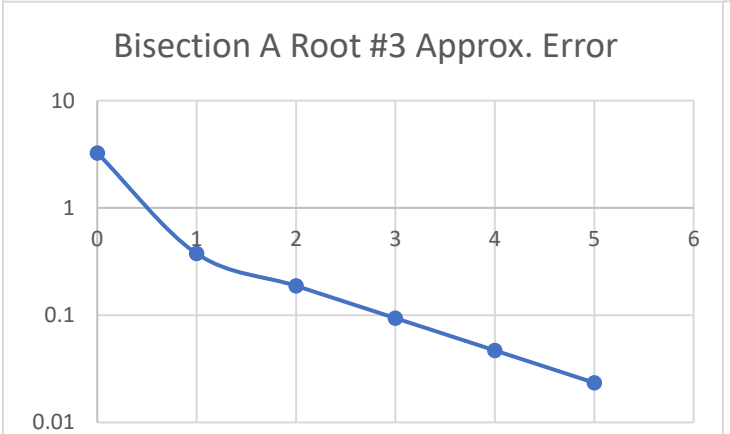
B_Root								
N	An	Bn	Cn	f(An)	f(Bn)	f(Cn)	Approx. Error	Relative Error
0	120	130	125	-0.568246	0.265497	-0.134046	125	0
1	125	130	127.5	-0.134046	0.265497	0.0697896	2.5	0.0196078
2	125	127.5	126.25	-0.134046	0.0697896	-0.0310806	1.25	0.00990099

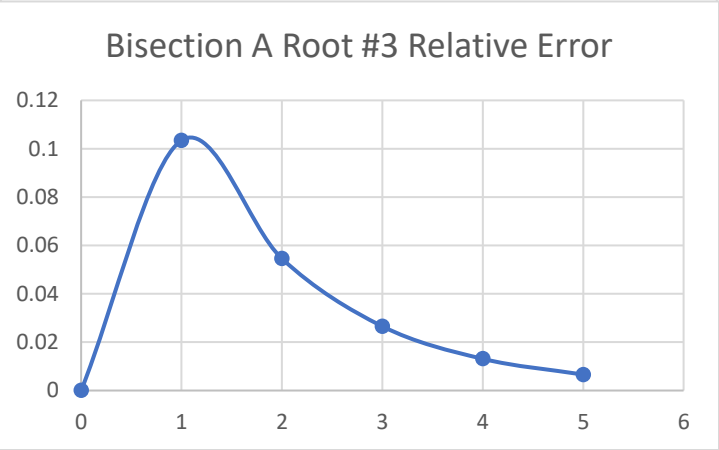

Bisection A Root #1 Approx. Error
1
0.1
0.01
0.001
0
2
4
6
8
10


Bisection A Root #1 Relative error
1.2
1
0.8
0.6
0.4
0.2
0
0
2
4
6
8
10


Bisection A Root #2 Approx. Error
10
1
0.1
0.01
0.001
0
1
2
3
4
5
6
7


Bisection A Root #2 Relative Error
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
1
2
3
4
5
6
7


Bisection A Root #3 Approx. Error
10
1
0.1
0.01
0
1
2
3
4
5
6


Bisection A Root #3 Relative Error
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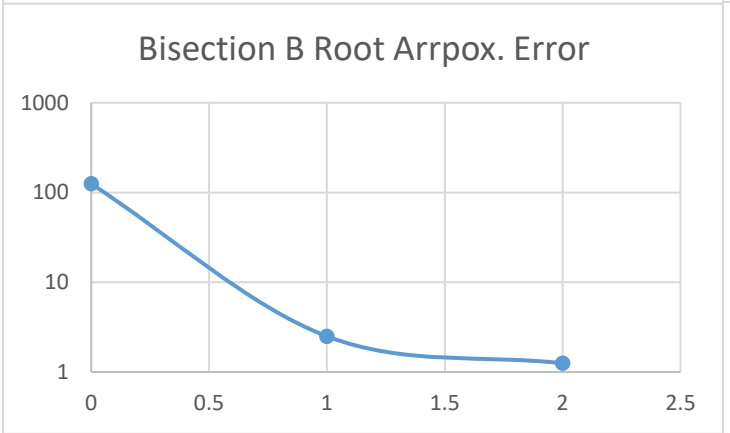
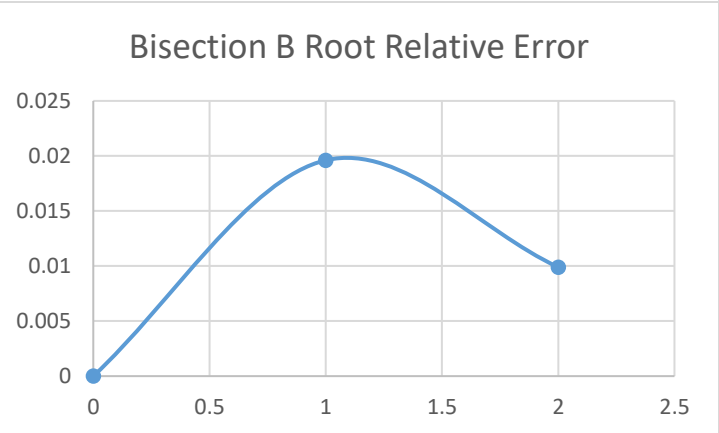
0.1
0.08
0.06
0.04
0.02
0
0
1
2
3
4
5
6


Bisection B Root Arrpox. Error
1000
100
10
1
0
0.5
1
1.5
2
2.5


Bisection B Root Relative Error
0.025
0.02
0.015
0.01
0.005
0
0
0.5
1
1.5
2
2.5

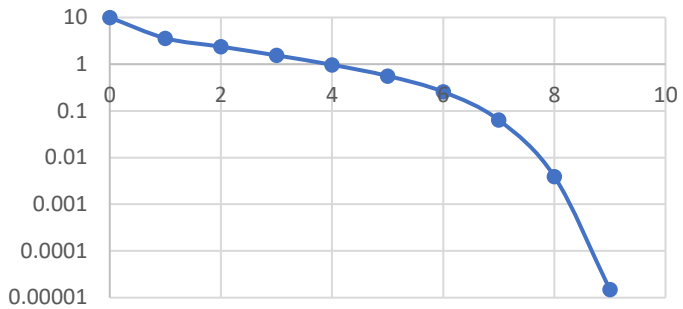
Newton Raphson Method

The Newton Raphson approx. error is similar to the bisection method, but its relative error is different. For example, the relative error when finding the first root in part A has a strange peak in the middle of the graph and only two of the graphs are similar but not within the same function.

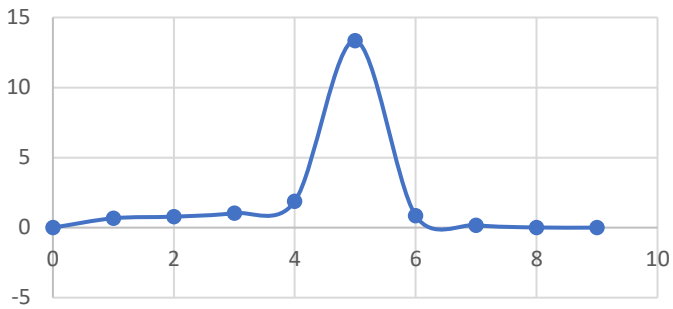
A_Root #1						
N	Xn	f(Xn)	f'(Xn)	Xn+1	Approx. Error	Relative Error
0	1	3	0.3	-9	10	0
1	-9	-2570	714.3	-5.40207	3.59793	0.666027
2	-5.40207	-757.341	319.203	-3.02947	2.3726	0.783174
3	-3.02947	-221.608	143.656	-1.48684	1.54263	1.03752
4	-1.48684	-63.7561	65.7562	-0.517257	0.969582	1.87447
5	-0.517257	-17.5626	31.4092	0.0418994	0.559157	13.3452
6	0.0418994	-4.27877	16.7301	0.297653	0.255753	0.859234
7	0.297653	-0.715392	11.2665	0.36115	0.0634972	0.17582
8	0.36115	-0.0394606	10.0317	0.365083	0.0039336	0.0107745
9	0.365083	-0.000147386	9.95676	0.365098	1.48026e-05	4.05441e-05
A_Root #2						
N	Xn	f(Xn)	f'(Xn)	Xn+1	Approx. Error	Relative Error
0	2	-0.4	-5.1	1.92157	0.0784314	0
1	1.92157	0.000880506	-5.11015	1.92174	0.000172305	8.96611e-05
A_Root #3						
N	Xn	f(Xn)	f'(Xn)	Xn+1	Approx. Error	Relative Error
0	3	-3.2	1.5	5.13333	2.13333	0
1	5.13333	48.0901	55.6867	4.26975	0.863583	0.202256
2	4.26975	12.9562	27.1724	3.79293	0.476816	0.125712
3	3.79293	2.9476	15.2634	3.59982	0.193115	0.0536458
4	3.59982	0.397973	11.2164	3.56434	0.0354813	0.00995451

B_Root						
N	Xn	f(Xn)	f'(Xn)	Xn+1	Approx. Error	Relative Error
0	120	-0.568246	0.0906097	126.271	6.27136	0
1	126.271	-0.0293397	0.0814971	126.631	0.360009	0.00284297

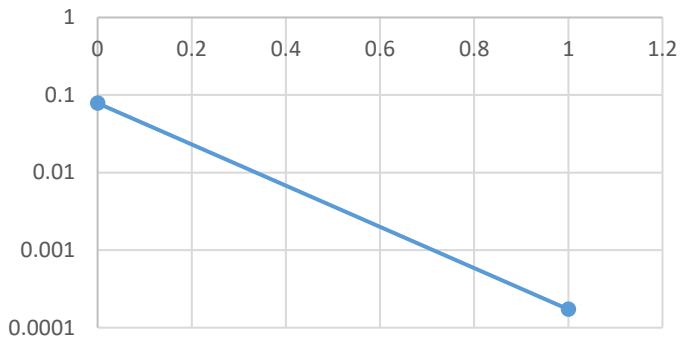
Newton Raphson A Root #1 Approx. Error



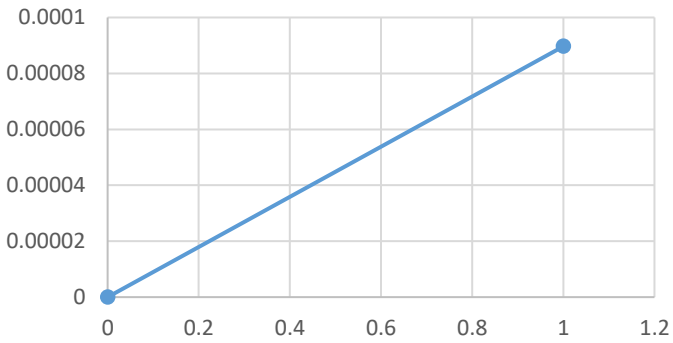
Newton Raphson A Root #1 Relative Error



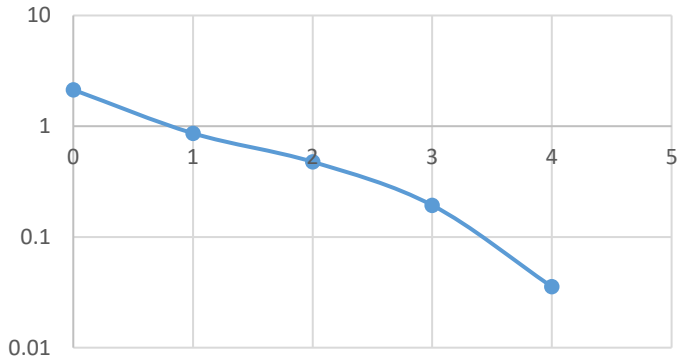
Newton Raphson A Root #2 Approx. Error



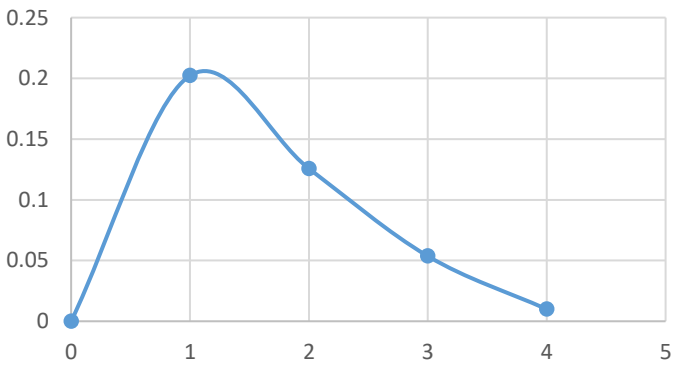
Newton Raphson A Root #2 Relative Error



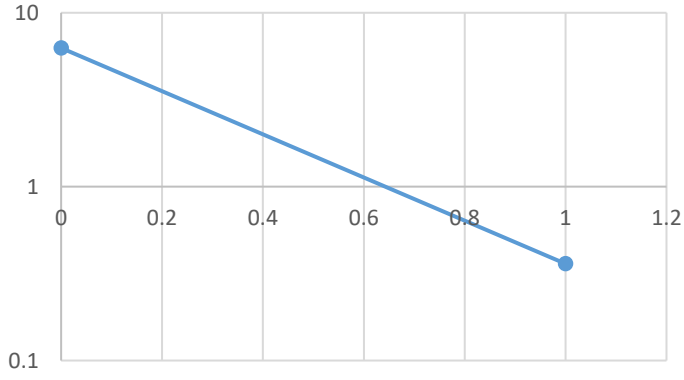
Newton Raphson A Root #3 Approx. Error



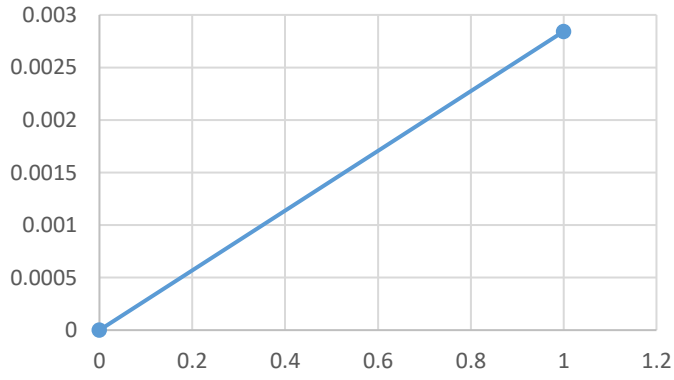
Newton Raphson A Root #3 Relative Error



Newton Raphson B Approx. Error



Newton Raphson B Relative Error

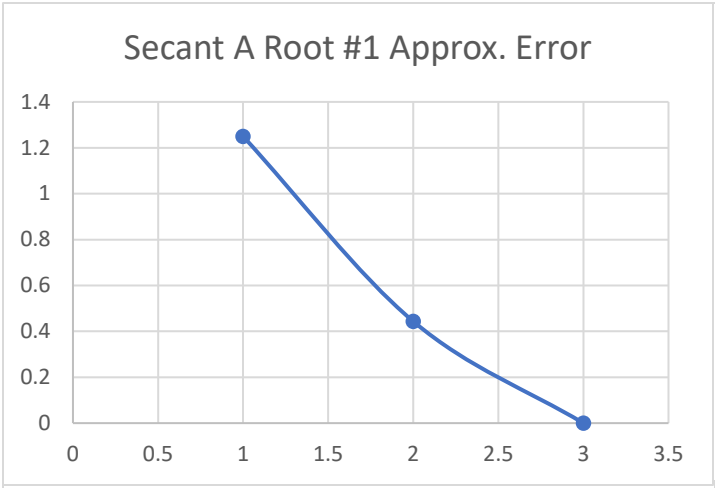


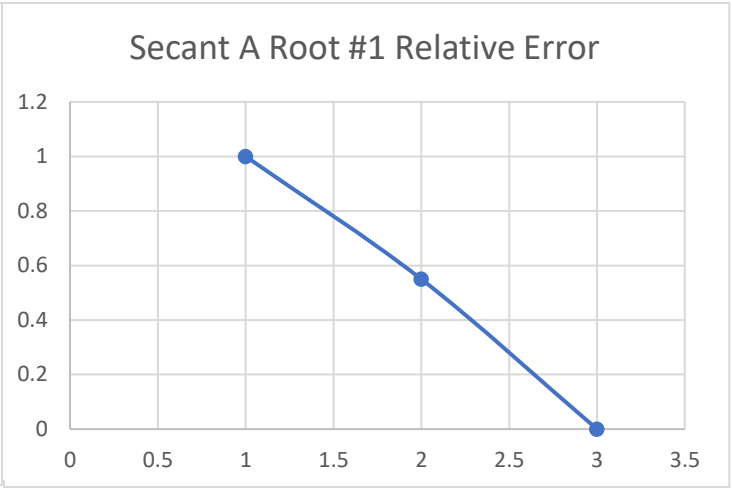
Secant Method

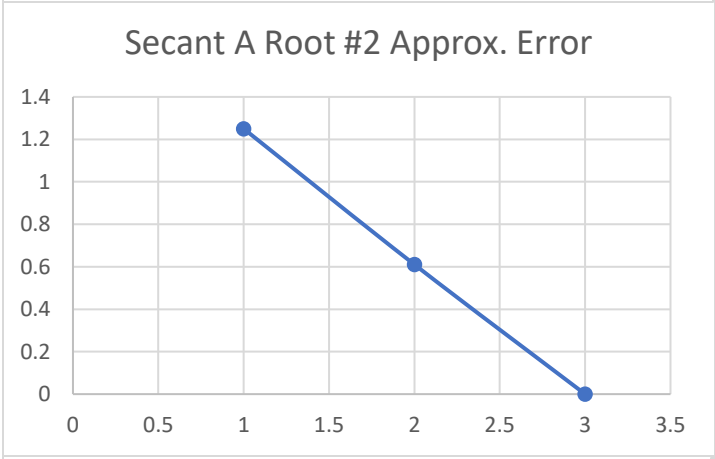
The secant method's graphs are very similar to each other in each of the roots and function.

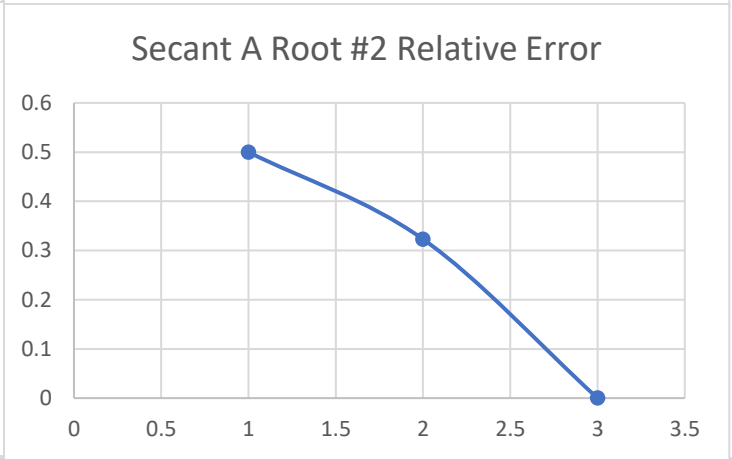
A_Root #1				
N	Xn	f(Xn)	Approx. Error	Relative Error
0	0	-5	N/A	N/A
1	1.25	2.75	1.25	1
2	0.806452	2.71391	0.443548	0.55
3	0.806452	2.71391	0	0
A_Root #2				
N	Xn	f(Xn)	Approx.	Error
0	1.25	2.75	N/A	N/A
1	2.5	-2.625	1.25	0.5
2	1.88953	0.164337	0.610465	0.323077
3	1.88953	0.164337	0	0
A_Root #3				
N	Xn	f(Xn)	Approx.	Error
0	2.5	-2.625	N/A	N/A
1	4	6.6	1.5	0.375
2	2.92683	-3.27681	1.07317	0.366667
3	2.92683	-3.27681	0	0

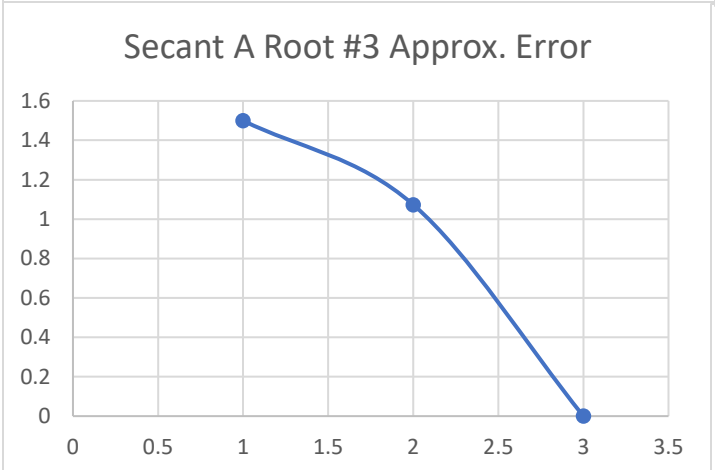
B_Root				
N	Xn	f(Xn)	Approx. Error	Relative Error
0	120	-0.568246	N/A	N/A
1	130	0.265497	10	0.0769231
2	126.816	0.0148171	3.1844	0.0251104
3	126.816	0.0148171	0	0

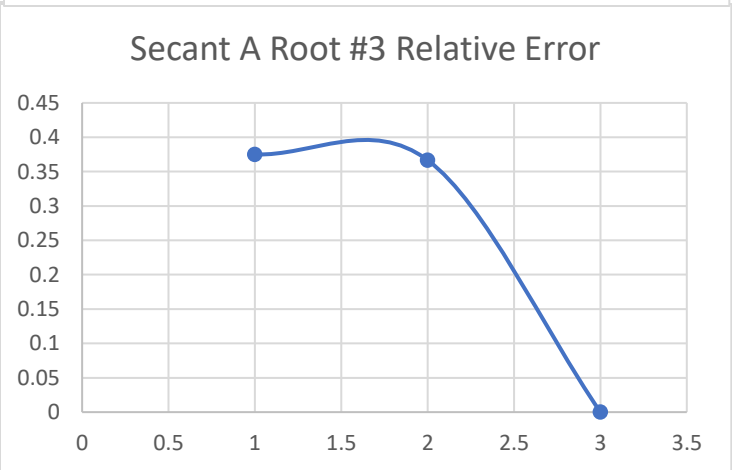

Secant A Root #1 Approx. Error
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0 0.5 1 1.5 2 2.5 3 3.5

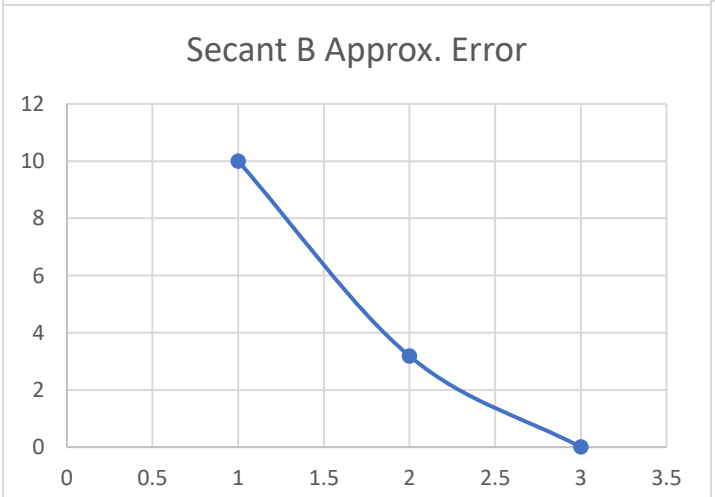

Secant A Root #1 Relative Error
1.2
1
0.8
0.6
0.4
0.2
0
0 0.5 1 1.5 2 2.5 3 3.5

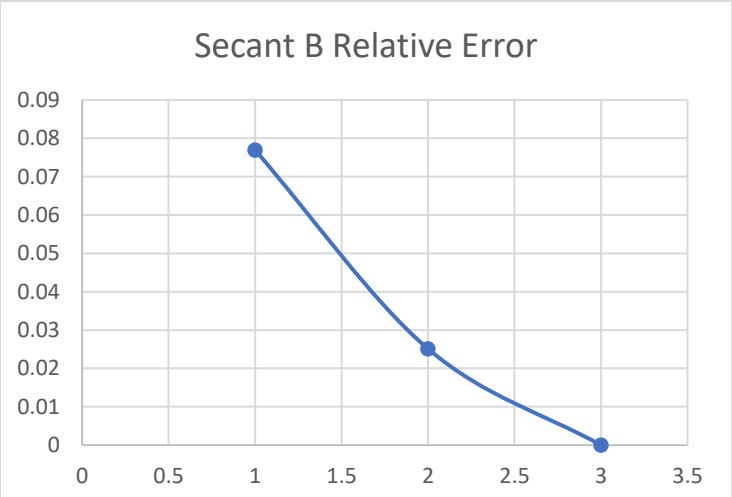

Secant A Root #2 Approx. Error
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0 0.5 1 1.5 2 2.5 3 3.5


Secant A Root #2 Relative Error
0.6
0.5
0.4
0.3
0.2
0.1
0
0 0.5 1 1.5 2 2.5 3 3.5


Secant A Root #3 Approx. Error
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0 0.5 1 1.5 2 2.5 3 3.5


Secant A Root #3 Relative Error
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0 0.5 1 1.5 2 2.5 3 3.5


Secant B Approx. Error
12
10
8
6
4
2
0
0 0.5 1 1.5 2 2.5 3 3.5

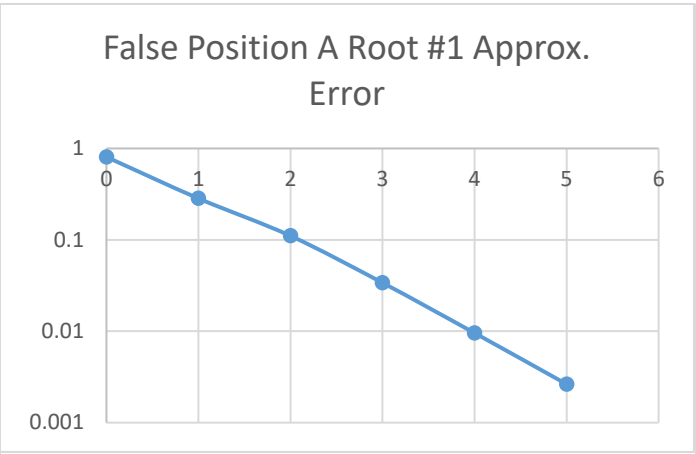

Secant B Relative Error
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0 0.5 1 1.5 2 2.5 3 3.5

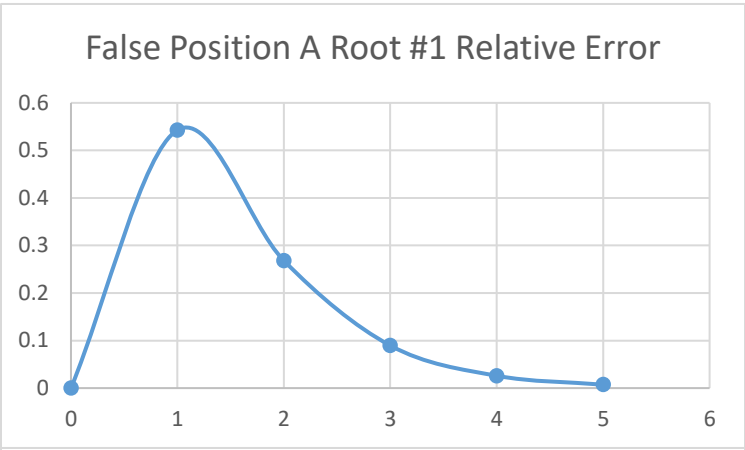
False Position

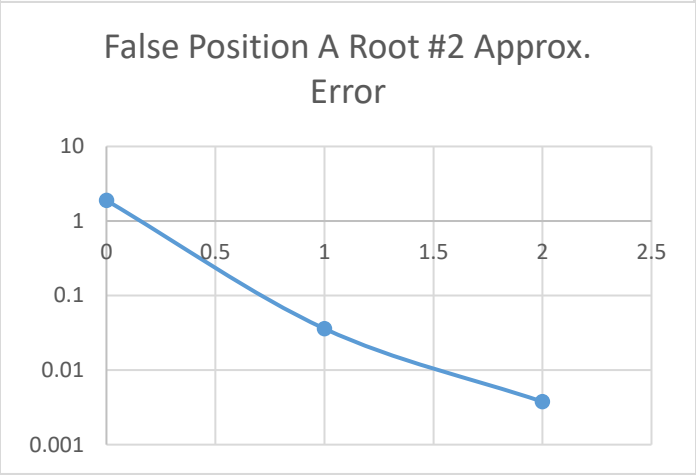
The false position method approaches the root quicker than the newton raphson method but does not have the same anomalies with the relative error graphs.

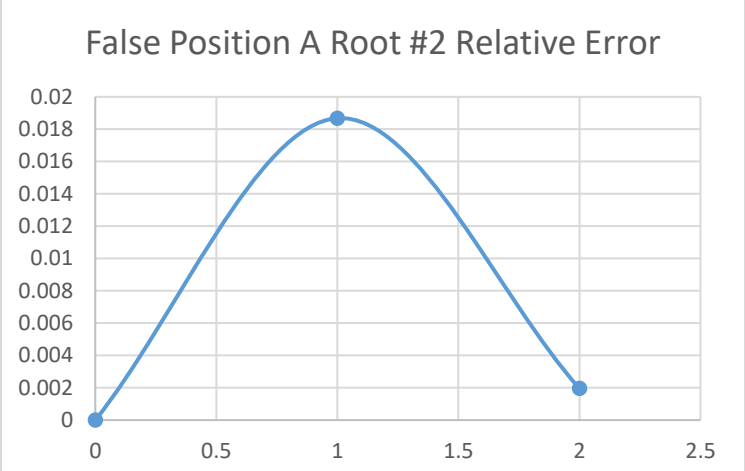
A_Root #1								
N	An	Bn	Cn	f(An)	f(Bn)	f(Cn)	Approx. Error	Relative Error
0	0	1.25	0.806452	-5	2.75	2.71391	0.806452	0
1	0	0.806452	0.522726	-5	2.71391	1.34097	0.283726	0.542781
2	0	0.522726	0.412181	-5	1.34097	0.447907	0.110545	0.268195
3	0	0.412181	0.378293	-5	0.447907	0.129722	0.033888	0.0895814
4	0	0.378293	0.368727	-5	0.129722	0.0360004	0.00956641	0.0259444
5	0	0.368727	0.366091	-5	0.0360004	0.00987201	0.00263588	0.00720008
A_Root #2								
N	An	Bn	Cn	f(An)	f(Bn)	f(Cn)	Approx. Error	Relative Error
0	1.25	2.5	1.88953	2.75	-2.625	0.164337	1.88953	0
1	1.88953	2.5	1.9255	0.164337	-2.625	-0.0192177	0.0359662	0.0186789
2	1.88953	1.9255	1.92174	0.164337	-0.0192177	2.74588e-05	0.00376557	0.00195946
A_Root#3								
N	An	Bn	Cn	f(An)	f(Bn)	f(Cn)	Approx. Error	Relative Error
0	2.5	4	2.92683	-2.625	6.6	-3.27681	2.92683	0
1	2.92683	4	3.28287	-3.27681	6.6	-2.22631	0.356044	0.108455
2	3.28287	4	3.46376	-2.22631	6.6	-0.949929	0.180885	0.0522222
3	3.46376	4	3.53123	-0.949929	6.6	-0.32545	0.0674697	0.0191066
4	3.53123	4	3.55326	-0.32545	6.6	-0.103029	0.0220292	0.00619972

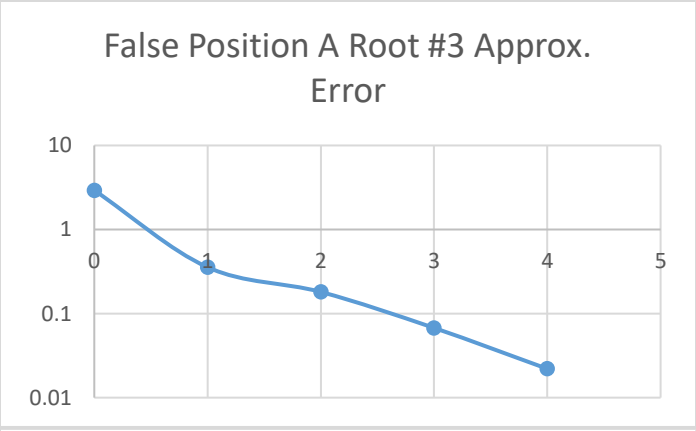
B_Root								
N	An	Bn	Cn	f(An)	f(Bn)	f(Cn)	Approx. Error	Relative Error
0	120	130	126.816	-0.568246	0.265497	0.0148171	126.816	0
1	120	126.816	126.642	-0.568246	0.0148171	0.000807297	0.173202	0.00136765

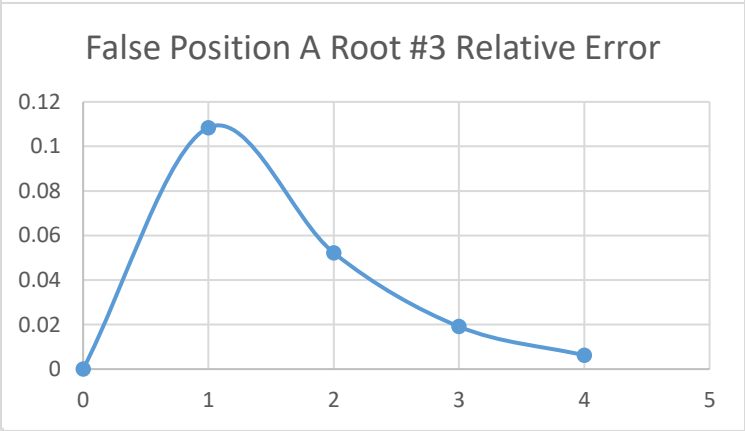

False Position A Root #1 Approx. Error
1
0.1
0.01
0.001
0
1
2
3
4
5
6

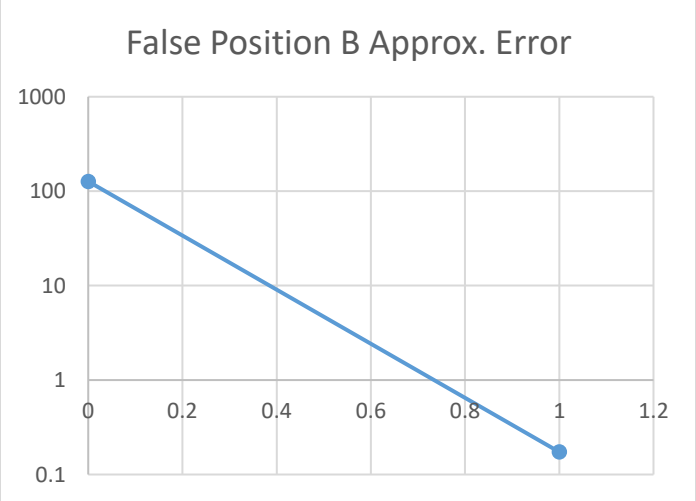

False Position A Root #1 Relative Error
0.6
0.5
0.4
0.3
0.2
0.1
0
0
1
2
3
4
5
6

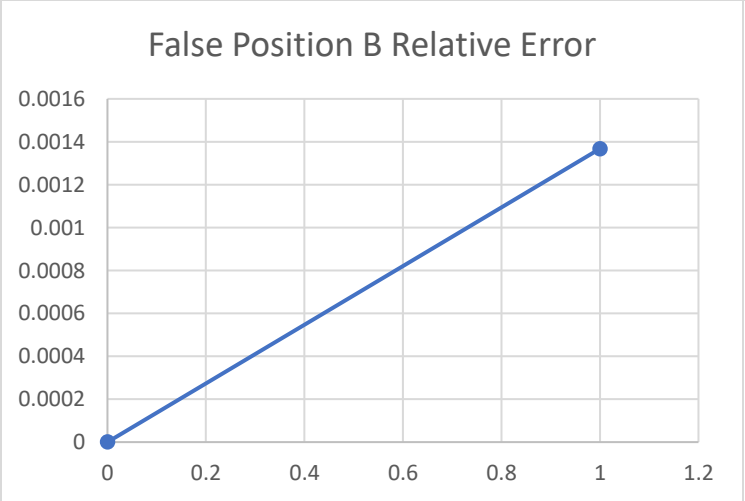

False Position A Root #2 Approx. Error
10
1
0.1
0.01
0.001
0
0.5
1
1.5
2
2.5


False Position A Root #2 Relative Error
0.02
0.018
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
0
0.5
1
1.5
2
2.5


False Position A Root #3 Approx. Error
10
1
0.1
0.01
0
1
2
3
4
5


False Position A Root #3 Relative Error
0.12
0.1
0.08
0.06
0.04
0.02
0
0
1
2
3
4
5


False Position B Approx. Error
1000
100
10
1
0.1
0
0.2
0.4
0.6
0.8
1
1.2

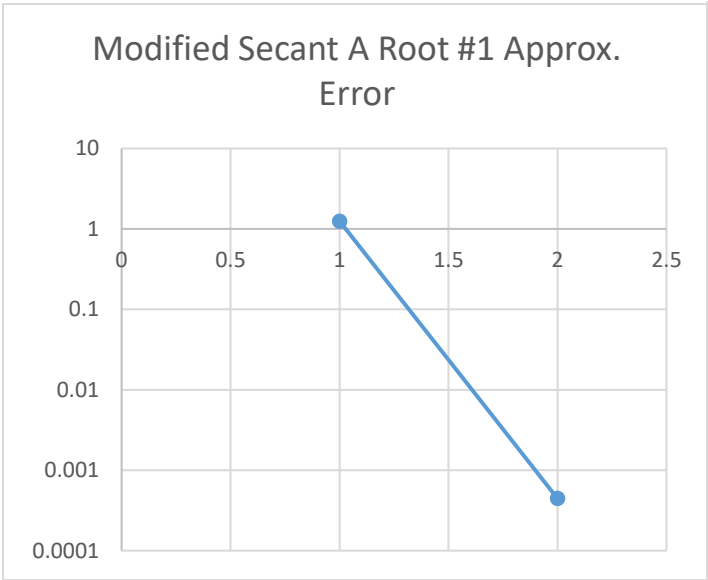

False Position B Relative Error
0.0016
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
0
0.2
0.4
0.6
0.8
1
1.2

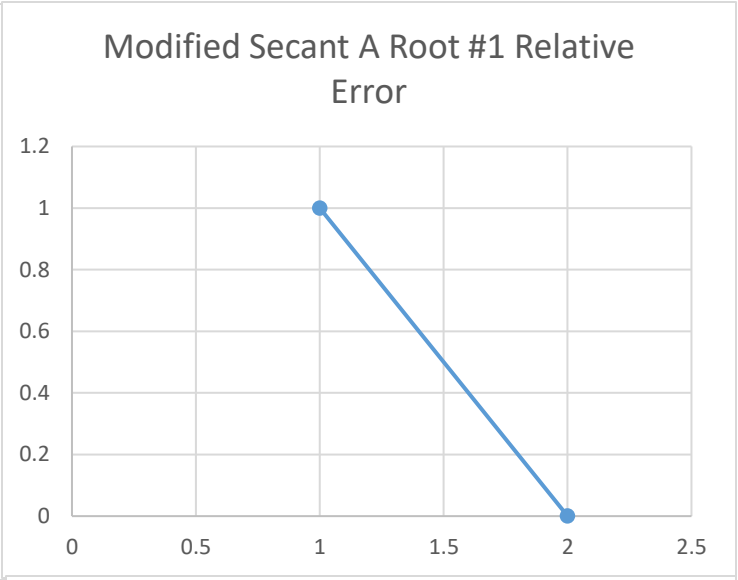
Modified Secant

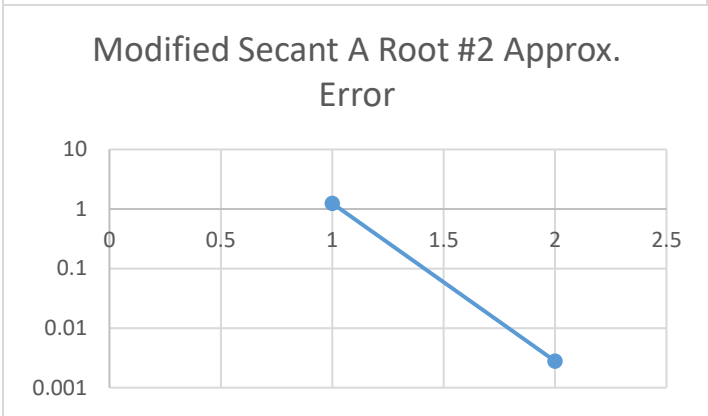
I performed the calculations correctly according to how it was taught during the lecture but I feel that it is still wrong, especially when viewing the graphs.

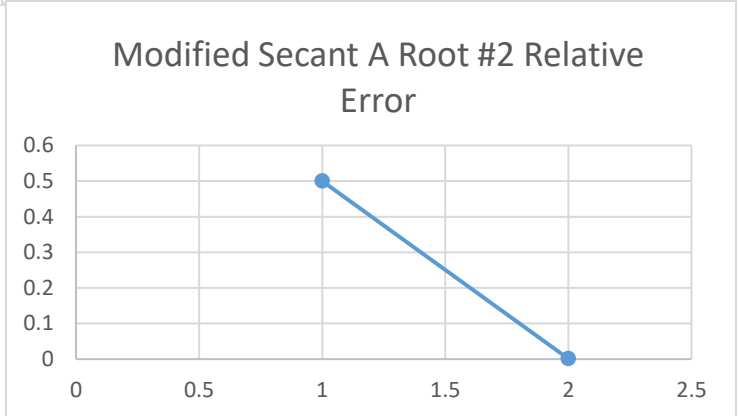
A_Root #1				
N	Xn	f(Xn)	Approx. Error	Relative Error
0	0	-5	N/A	N/A
1	1.25	2.75	1.25	1
2	1.25044	2.74903	0.000444875	0.000355647
A_Root #2				
N	Xn	f(Xn)	Approx. Error	Relative Error
0	1.25	2.75	N/A	N/A
1	2.5	-2.625	1.25	0.5
2	2.49718	-2.61568	0.00279116	0.00111897
A_Root #3				
N	Xn	f(Xn)	Approx. Error	Relative Error
0	2.5	-2.625	N/A	N/A
1	4	6.6	1.5	0.375
2	4.00229	6.64609	0.00229793	0.000573825

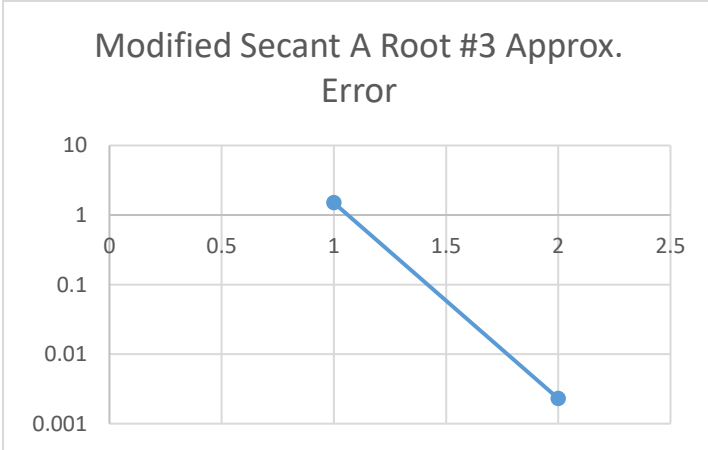
B_Root				
N	Xn	f(Xn)	Approx. Error	Relative Error
0	120	-0.568246	N/A	N/A
1	130	0.265497	10	0.0769231
2	130	0.265497	0	0

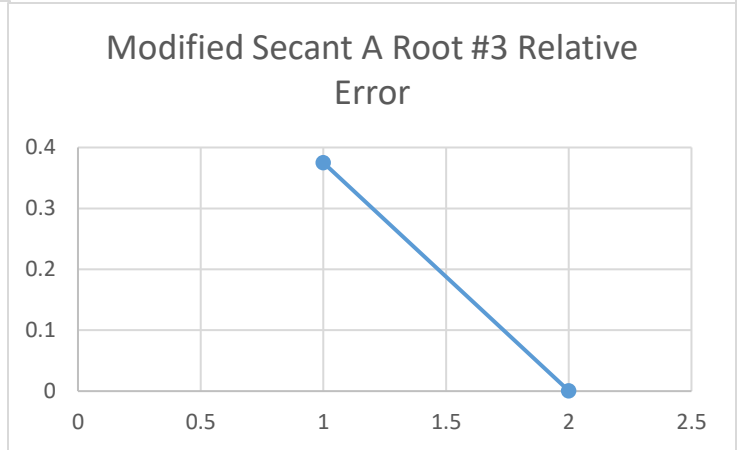

Modified Secant A Root #1 Approx. Error
10
1
0.1
0.01
0.001
0.0001
0
0.5
1
1.5
2
2.5

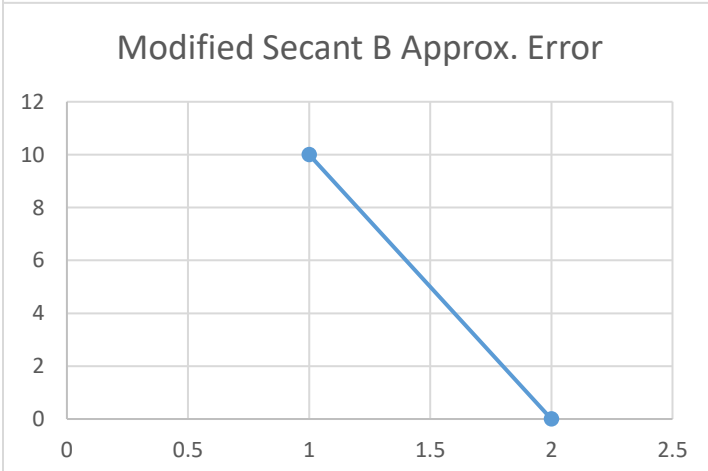

Modified Secant A Root #1 Relative Error
1.2
1
0.8
0.6
0.4
0.2
0
0
0.5
1
1.5
2
2.5

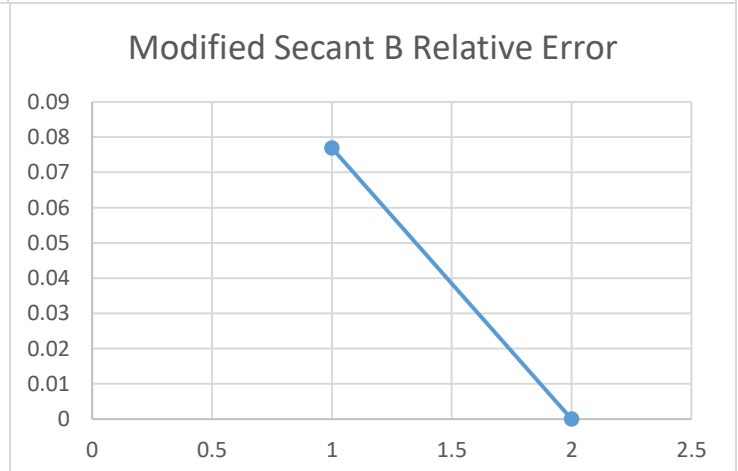

Modified Secant A Root #2 Approx. Error
10
1
0.1
0.01
0.001
0
0.5
1
1.5
2
2.5


Modified Secant A Root #2 Relative Error
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.5
1
1.5
2
2.5


Modified Secant A Root #3 Approx. Error
10
1
0.1
0.01
0.001
0
0.5
1
1.5
2
2.5


Modified Secant A Root #3 Relative Error
0.4
0.3
0.2
0.1
0
0
0.5
1
1.5
2
2.5


Modified Secant B Approx. Error
12
10
8
6
4
2
0
0
0.5
1
1.5
2
2.5


Modified Secant B Relative Error
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
0.5
1
1.5
2
2.5