Ostfalia
Hochschule für angewandte Wissenschaften

Gruppe 8

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Numerische Mathematik: Hausaufgabe 2

Aufgabe 1

Aufg. 1-1) $f(x) = (x-1)^8$ $\qquad f'(x) = 8\,(x-1)^7$

mit Startwert 1,1 $\qquad x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)}$

i	0	1	2	3	4
x_{i+1}	1,1	1,0875	1,0765625	1,066992	1,058618

$\Rightarrow$ Ergebnisse ändern sich noch, deshalb mit Iterationen notwendig.

Aufg. 1-2) $f(x) = (x-1)^{20}$ $\qquad f'(x) = \cancel{15}\,20\,(x-1)^{\cancel{20}\,19}$

mit Startwert 1,1 $\qquad x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)}$

i	0	1	2	3	4
x_{i+1}	1,1	1,095	1,090	1,085	1,081

$\Rightarrow$ Die quadratische Konvergenz wird nicht erreicht. Die Werte ändern sich mit jeder Iteration deutlich. Mehr Iterationsschritte sind erforderlich.

Aufg. 1-3) $f(x) = \frac{1}{2} + \frac{1}{4}x^2 - x\cdot\sin(x) - \frac{1}{2}\cos(2x)$

$f'(x) = \frac{1}{2}\cdot x - x\cdot\cos(x) - \sin(x) + \sin(2x)$

mit Startwert $\pi/2$ und $x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)}$

i	0	1	2	3	4	5	6	7	8	9	10
x_{i+1}	$\pi/2$	1,785	1,8446	1,8708	1,8833	1,8895	1,8925	1,8940	1,8942	1,8951	1,8953

$\Rightarrow$ Für eine Geuigkeit von 10^{-3} sind 9. Iterationen notwendig, was für das Newton-Verfahren ungewöhnlich ist.

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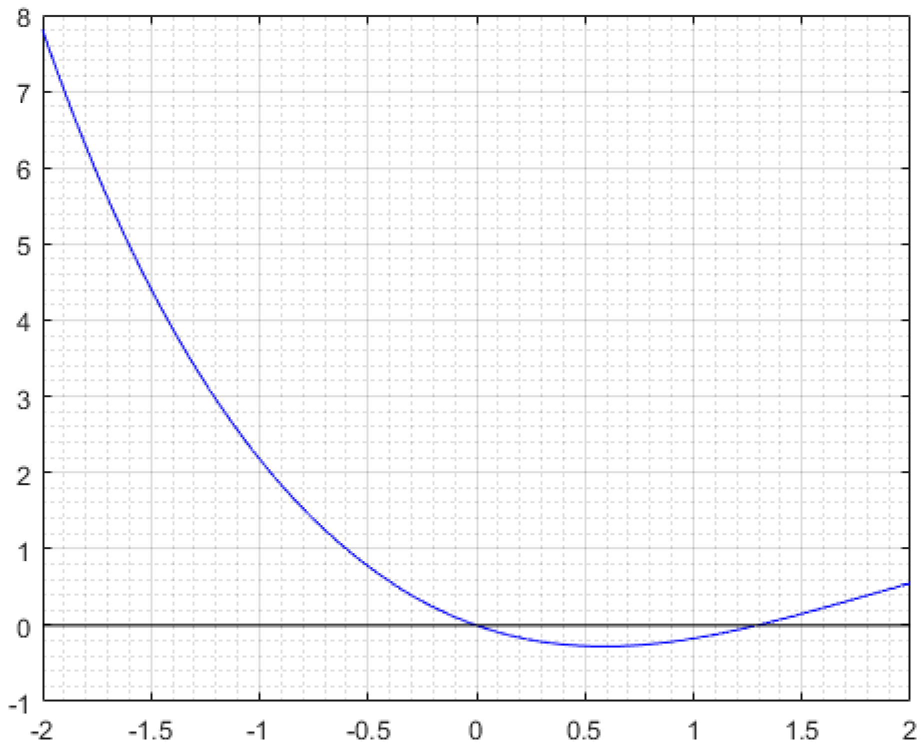
Aufgabe 2

Die Funktion wird in allen Skripten zunächst geplottet, um die Nullstellen zu erkennen:



a)

Quelltext siehe *G08_H2_Aufgabe_2a.pdf*

Variables - aTABELLE

BERECHNUNG | aTABELLE

5x4 string

	1	2	3	4
1	i	Xi	Xi+1	relativer Fehler
2	0	1.35000000000000010...	1.29384574638095180...	0.043401
3	1	1.29384574638095180...	1.29269624644439850...	0.00088923
4	2	1.29269624644439850...	1.29269571937350940...	4.0773e-07
5	3	1.29269571937350940...	1.29269571937339830...	8.5884e-14

Startwert wurde bei 1,35 gewählt, was dem mittleren Wert des Intervalls entspricht.

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b)

Quelltext siehe *G08_H2_Aufgabe_2b.pdf*

Variables - aTABELLE

aTABELLE

41x6 string

	1	2	3	4	5	6
1	i	Xu	Xo	Xm	f(Xm)	f(Xu)*f(Xm)
2	0	1.10000000000000010...	1.60000000000000010...	1.35000000000000010...	0.04023357355285001...	<0
3	1	1.10000000000000010...	1.35000000000000010...	1.22500000000000010...	-0.0451882732125844...	>0
4	2	1.22500000000000010...	1.35000000000000010...	1.28750000000000010...	-0.0035622732266422...	>0
5	3	1.28750000000000010...	1.35000000000000010...	1.31875000000000010...	0.01808327855461017...	<0
6	4	1.28750000000000010...	1.31875000000000010...	1.30312500000000010...	0.00719505246683549...	<0
7	5	1.28750000000000010...	1.30312500000000010...	1.29531250000000010...	0.00179973236771513...	<0
8	6	1.28750000000000010...	1.29531250000000010...	1.29140625000000010...	-0.0008854715813622...	>0
9	7	1.29140625000000010...	1.29531250000000010...	1.29335937500000010...	0.00045608471006125...	<0
10	8	1.29140625000000010...	1.29335937500000010...	1.29238281250000010...	-0.0002149554320369...	>0
11	9	1.29238281250000010...	1.29335937500000010...	1.29287109375000010...	0.00012049921186646...	<0
12	10	1.29238281250000010...	1.29287109375000010...	1.29262695312500010...	-0.0000472444758655...	>0
13	11	1.29262695312500010...	1.29287109375000010...	1.29274902343750010...	0.00003662327767967...	<0
14	12	1.29262695312500010...	1.29274902343750010...	1.29268798828125010...	-0.0000053116218136...	>0
15	13	1.29268798828125010...	1.29274902343750010...	1.29271850585937510...	0.00001565557227040...	<0
16	14	1.29268798828125010...	1.29271850585937510...	1.29270324707031260...	0.00000517191131049...	<0
17	15	1.29268798828125010...	1.29270324707031260...	1.29269561767578130...	-0.0000000698712313...	>0
18	16	1.29269561767578130...	1.29270324707031260...	1.29269943237304700...	0.00000255101604468...	<0
19	17	1.29269561767578130...	1.29269943237304700...	1.29269752502441420...	0.00000124057140793...	<0
20	18	1.29269561767578130...	1.29269752502441420...	1.29269657135009770...	0.00000058534983859...	<0
21	19	1.29269561767578130...	1.29269657135009770...	1.29269609451293950...	0.00000025773924122...	<0
22	20	1.29269561767578130...	1.29269609451293950...	1.29269585609436040...	0.00000009393398936...	<0
23	21	1.29269561767578130...	1.29269585609436040...	1.29269573688507090...	0.00000001203137511...	<0
24	22	1.29269561767578130...	1.29269573688507090...	1.29269567728042610...	-0.0000000289199290...	>0
25	23	1.29269567728042610...	1.29269573688507090...	1.29269570708274850...	-0.0000000084442772...	>0
26	24	1.29269570708274850...	1.29269573688507090...	1.29269572198390970...	0.00000000179354886...	<0
27	25	1.29269570708274850...	1.29269572198390970...	1.29269571453332910...	-0.0000000033253641...	>0
28	26	1.29269571453332910...	1.29269572198390970...	1.29269571825861940...	-0.0000000007659076...	>0
29	27	1.29269571825861940...	1.29269572198390970...	1.29269572012126450...	0.00000000051382059...	<0
30	28	1.29269571825861940...	1.29269572012126450...	1.29269571918994200...	-0.0000000001260435...	>0
31	29	1.29269571918994200...	1.29269572012126450...	1.29269571965560330...	0.00000000019388851...	<0
32	30	1.29269571918994200...	1.29269571965560330...	1.29269571942277260...	0.00000000003392253...	<0
33	31	1.29269571918994200...	1.29269571942277260...	1.29269571930635730...	-0.0000000000460604...	>0
34	32	1.29269571930635730...	1.29269571942277260...	1.29269571936456500...	-0.0000000000060689...	>0
35	33	1.29269571936456500...	1.29269571942277260...	1.29269571939366880...	0.00000000001392674...	<0
36	34	1.29269571936456500...	1.29269571939366880...	1.29269571937911690...	0.00000000000392885...	<0
37	35	1.29269571936456500...	1.29269571937911690...	1.29269571937184090...	-0.0000000000010700...	>0
38	36	1.29269571937184090...	1.29269571937911690...	1.29269571937547890...	0.00000000000142941...	<0
39	37	1.29269571937184090...	1.29269571937547890...	1.29269571937365990...	0.00000000000017968...	<0
40	38	1.29269571937184090...	1.29269571937365990...	1.29269571937275040...	-0.0000000000004451...	>0
41	39	1.29269571937275040...	1.29269571937365990...	1.29269571937320520...	-0.0000000000001327...	>0

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c)

Quelltext siehe *G08_H2_Aufgabe_2b.pdf*

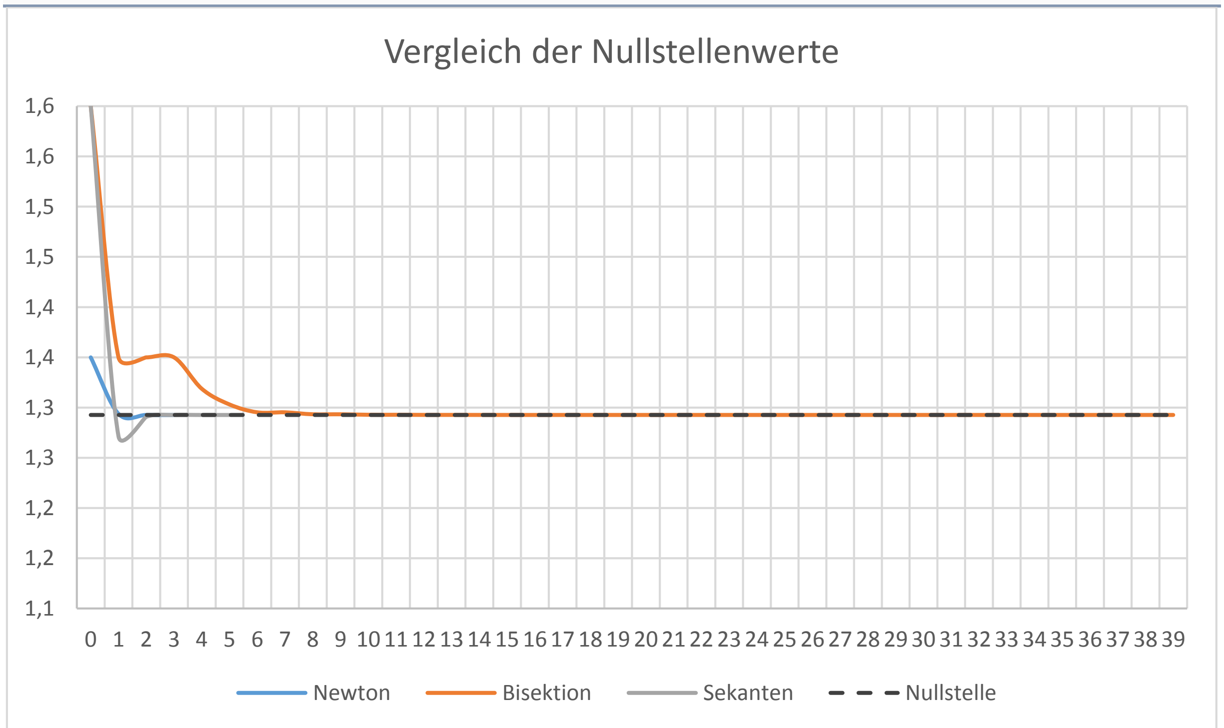
Variables - aTABELLE

aTABELLE

7x4 string

	1	2	3	4
1	i	Xi-1	Xi	Xi+1
2	0	1.10000000000000010...	1.60000000000000010...	1.27157163863765700...
3	1	1.60000000000000010...	1.27157163863765700...	1.29082211364092240...
4	2	1.27157163863765700...	1.29082211364092240...	1.29271195849806660...
5	3	1.29082211364092240...	1.29271195849806660...	1.29269570718994590...
6	4	1.29271195849806660...	1.29269570718994590...	1.29269571937331930...
7	5	1.29269570718994590...	1.29269571937331930...	1.29269571937339830...

d)



Der Plot zeigt auf der y-Achse den angenäherten Wert der Nullstelle über die Iterationsschritte auf der x-Achse.

Man erkennt, dass das Newton-Verfahren mit dem gewählten Startwert, dicht gefolgt vom Sekanten-Verfahren, am schnellsten konvergiert. Das Bisektions-Verfahren ist dagegen träge in der Konvergenz.

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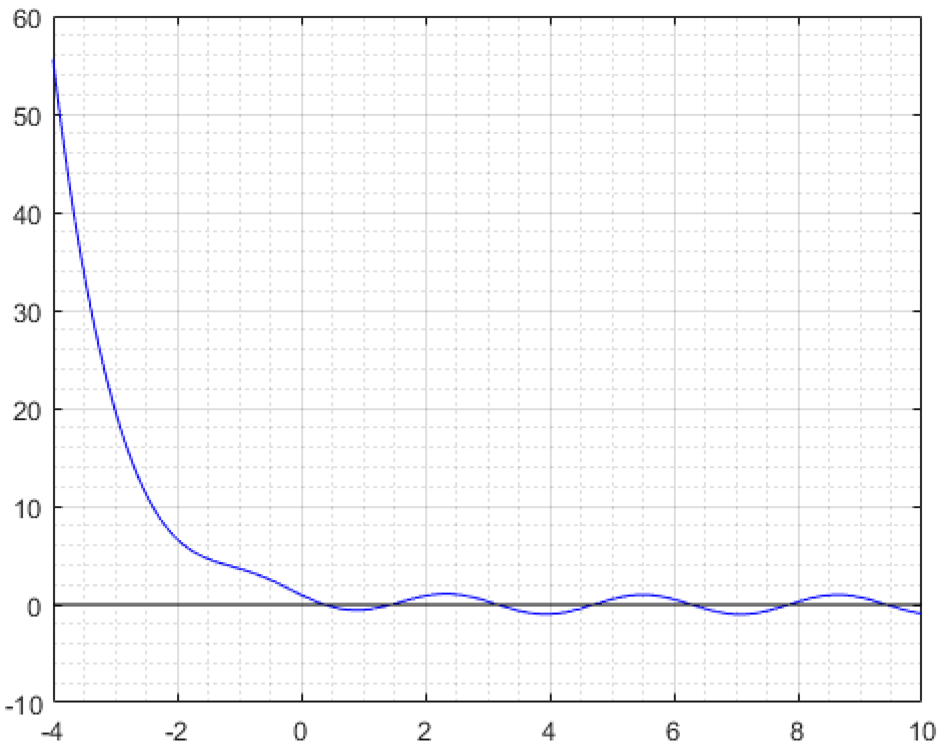
Aufgabe 3

a)

Quelltext siehe *G08_H2_Aufgabe_3a.pdf*



Da ein sinusförmiger Auslauf der Funktion zu erkennen ist, wird das Verfahren immer die Nullstelle finden, die sich am nächsten am Startwert befindet.

Startwert: 0,5

Variables - aTABELLE

aTABELLE

5x4 string

	1	2	3	4
1	i	Xi	Xi+1	Abweichung
2	0	0.50000000000000000...	0.36074600592429307...	0.13925
3	1	0.36074600592429307...	0.37741438801916721...	0.0083342
4	2	0.37741438801916721...	0.37763280390682930...	5.4604e-05
5	3	0.37763280390682930...	0.37763284207127579...	4.7706e-09

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Startwert: 1,5

Variables - aTABELLE

aTABELLE

5x4 string

	1	2	3	4
1	i	Xi	Xi+1	Abweichung
2	0	1.50000000000000000...	1.45331990410040120...	0.04668
3	1	1.45331990410040120...	1.45273805035070950...	0.00029093
4	2	1.45273805035070950...	1.45273793491169090...	2.886e-08
5	3	1.45273793491169090...	1.45273793491168650...	5.5511e-16

Startwert: 2,5

Variables - aTABELLE

aTABELLE

14x4 string

	1	2	3	4
1	i	Xi	Xi+1	Abweichung
2	0	2.50000000000000000...	4.10300932215965460...	1.603
3	1	4.10300932215965460...	5.47301627597271170...	0.685
4	2	5.47301627597271170...	-5.1019006820381518...	2.6437
5	3	-5.1019006820381518...	-4.0974773078995534...	0.12555
6	4	-4.0974773078995534...	-3.0704065243325056...	0.064192
7	5	-3.0704065243325056...	-2.1605730225181023...	0.028432
8	6	-2.1605730225181023...	-1.1810142598033995...	0.015306
9	7	-1.1810142598033995...	0.97709769591021223...	0.01686
10	8	0.97709769591021223...	2.45927574675950170...	0.0057898
11	9	2.45927574675950170...	4.60982123221871460...	0.0042003
12	10	4.60982123221871460...	4.70927449850607170...	9.7122e-05
13	11	4.70927449850607170...	4.70787697992781330...	6.8238e-07
14	12	4.70787697992781330...	4.70787696145673620...	4.5095e-12

Startwert: π

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Variables - aTABELLE

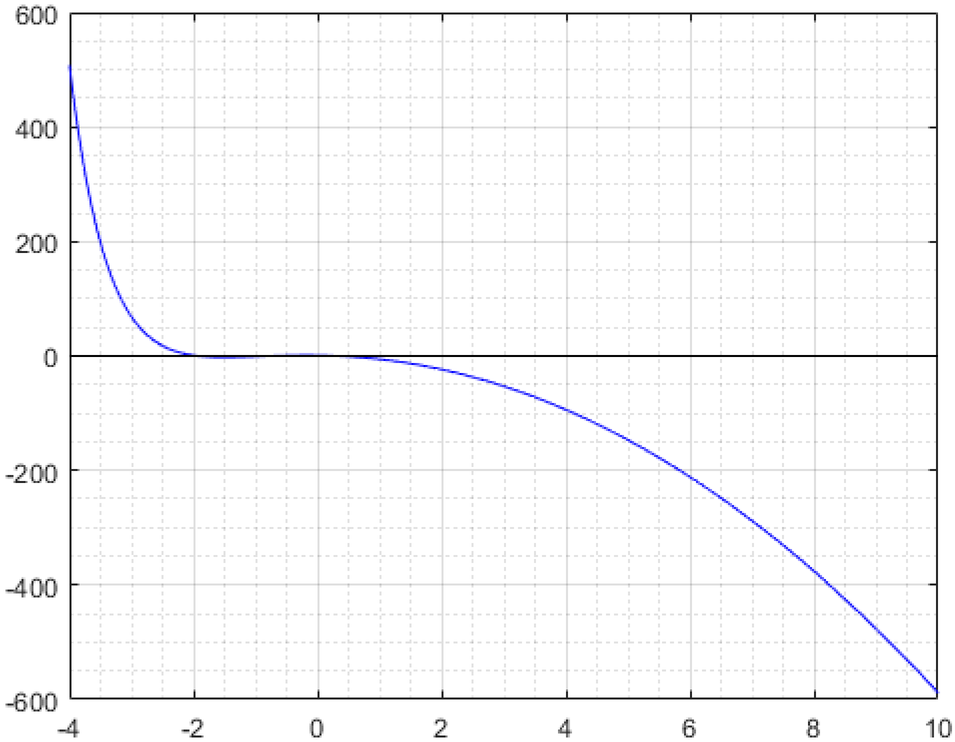
aTABELLE

4x4 string

	1	2	3	4
1	i	Xi	Xi+1	Abweichung
2	0	3.14159265358979310...	3.16274262612937610...	0.02115
3	1	3.16274262612937610...	3.16275351099395240...	5.4424e-06
4	2	3.16275351099395240...	3.16275351100009240...	1.535e-12

b)

Quelltext siehe *G08_H2_Aufgabe_3b.pdf*



Da die Startwerte rechtsseitig der dritten Nullstelle angesetzt sind, wird das Verfahren immer nur diese finden.

Startwert: 0,5

Variables - aTABELLE

aTABELLE

6x4 string

	1	2	3	4
1	i	Xi	Xi+1	Abweichung
2	0	0.50000000000000000...	0.34532771198010442...	0.15467
3	1	0.34532771198010442...	0.32009570202478377...	0.012616
4	2	0.32009570202478377...	0.31940374033911878...	0.00017299
5	3	0.31940374033911878...	0.31940322124535570...	6.4887e-08
6	4	0.31940322124535570...	0.31940322124506360...	1.8256e-14

Startwert: 1,5

Variables - aTABELLE

aTABELLE

7x4 string

	1	2	3	4
1	i	Xi	Xi+1	Abweichung
2	0	1.50000000000000000...	0.76122169402796236...	0.73878
3	1	0.76122169402796236...	0.43111227099520272...	0.16505
4	2	0.43111227099520272...	0.33044828569452900...	0.025166
5	3	0.33044828569452900...	0.31953259400877182...	0.0013645
6	4	0.31953259400877182...	0.31940323938379633...	8.0847e-06
7	5	0.31940323938379633...	0.31940322124506393...	5.6684e-10

Startwert: 2,5

Variables - aTABELLE

aTABELLE

8x4 string

	1	2	3	4
1	i	Xi	Xi+1	Abweichung
2	0	2.50000000000000000...	1.25186708169373070...	1.2481
3	1	1.25186708169373070...	0.64401276774923744...	0.30393
4	2	0.64401276774923744...	0.38839586785996855...	0.063904
5	3	0.38839586785996855...	0.32393462737030249...	0.0080577
6	4	0.32393462737030249...	0.31942527925115244...	0.00028183
7	5	0.31942527925115244...	0.31940322177247232...	6.893e-07
8	6	0.31940322177247232...	0.31940322124506360...	8.2408e-12

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Startwert: 3,5

Variables - aTABELLE

aTABELLE

8x4 string

	1	2	3	4
1	i	Xi	Xi+1	Abweichung
2	0	3.50000000000000000...	1.75034134748572060...	1.7497
3	1	1.75034134748572060...	0.88222445480886402...	0.43406
4	2	0.88222445480886402...	0.47973801327660159...	0.10062
5	3	0.47973801327660159...	0.34046914600880701...	0.017409
6	4	0.34046914600880701...	0.31986474847786645...	0.0012878
7	5	0.31986474847786645...	0.31940345193382125...	1.4416e-05
8	6	0.31940345193382125...	0.31940322124512127...	3.6045e-09

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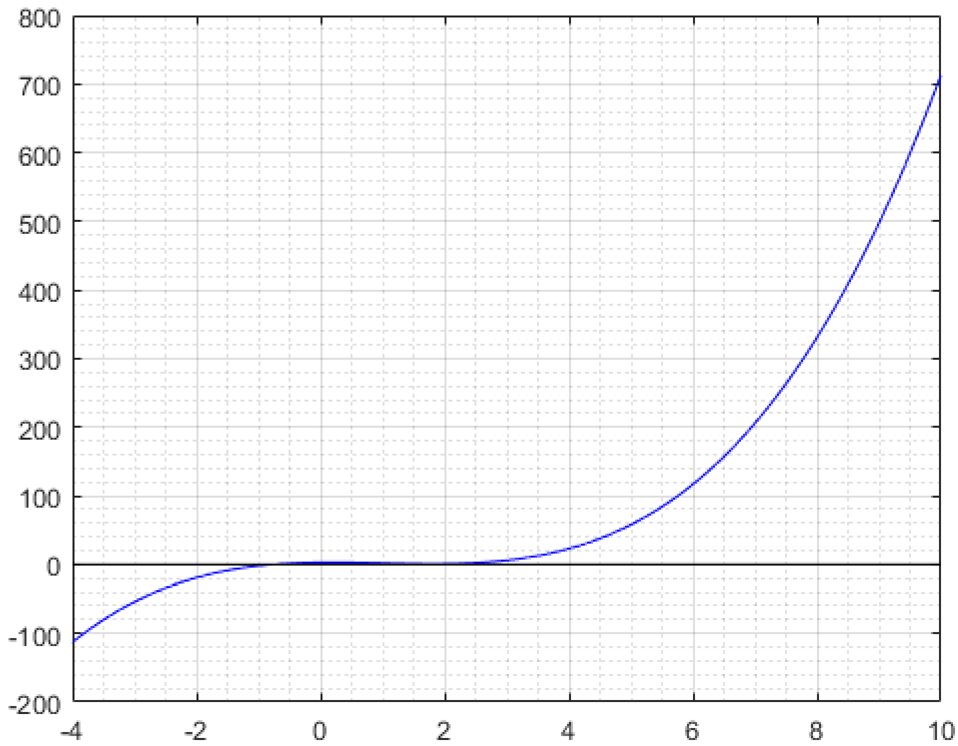
c)

Quelltext siehe *G08_H2_Aufgabe_3c.pdf*



Startwert: -1,0

Variables - aTABELLE

aTABELLE

6x4 string

	1	2	3	4
1	i	Xi	Xi+1	Abweichung
2	0	-1.0000000000000000...	-0.8000000000000000...	0.2
3	1	-0.8000000000000000...	-0.7699481865284973...	0.015026
4	2	-0.7699481865284973...	-0.7692926629059410...	0.00016388
5	3	-0.7692926629059410...	-0.7692923542386997...	3.8583e-08
6	4	-0.7692923542386997...	-0.7692923542386314...	4.2744e-15

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Startwert: 1,0

Variables - aTABELLE

aTABELLE

29x4 string

	1	2	3	4
1	i	Xi	Xi+1	Abweichung
2	0	1.000000000000000000...	2.000000000000000000...	1
3	1	2.000000000000000000...	1.000000000000000000...	0.5
4	2	1.000000000000000000...	2.000000000000000000...	0.25
5	3	2.000000000000000000...	1.000000000000000000...	0.125
6	4	1.000000000000000000...	2.000000000000000000...	0.0625
7	5	2.000000000000000000...	1.000000000000000000...	0.03125
8	6	1.000000000000000000...	2.000000000000000000...	0.015625
9	7	2.000000000000000000...	1.000000000000000000...	0.0078125
10	8	1.000000000000000000...	2.000000000000000000...	0.0039063
11	9	2.000000000000000000...	1.000000000000000000...	0.0019531
12	10	1.000000000000000000...	2.000000000000000000...	0.00097656
13	11	2.000000000000000000...	1.000000000000000000...	0.00048828
14	12	1.000000000000000000...	2.000000000000000000...	0.00024414
15	13	2.000000000000000000...	1.000000000000000000...	0.00012207
16	14	1.000000000000000000...	2.000000000000000000...	6.1035e-05
17	15	2.000000000000000000...	1.000000000000000000...	3.0518e-05
18	16	1.000000000000000000...	2.000000000000000000...	1.5259e-05
19	17	2.000000000000000000...	1.000000000000000000...	7.6294e-06
20	18	1.000000000000000000...	2.000000000000000000...	3.8147e-06
21	19	2.000000000000000000...	1.000000000000000000...	1.9073e-06
22	20	1.000000000000000000...	2.000000000000000000...	9.5367e-07
23	21	2.000000000000000000...	1.000000000000000000...	4.7684e-07
24	22	1.000000000000000000...	2.000000000000000000...	2.3842e-07
25	23	2.000000000000000000...	1.000000000000000000...	1.1921e-07
26	24	1.000000000000000000...	2.000000000000000000...	5.9605e-08
27	25	2.000000000000000000...	1.000000000000000000...	2.9802e-08
28	26	1.000000000000000000...	2.000000000000000000...	1.4901e-08
29	27	2.000000000000000000...	1.000000000000000000...	7.4506e-09

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Startwert: 2,0

Variables - aTABELLE

aTABELLE

29x4 string

	1	2	3	4
1	i	Xi	Xi+1	Abweichung
2	0	2.00000000000000000...	1.00000000000000000...	1
3	1	1.00000000000000000...	2.00000000000000000...	0.5
4	2	2.00000000000000000...	1.00000000000000000...	0.25
5	3	1.00000000000000000...	2.00000000000000000...	0.125
6	4	2.00000000000000000...	1.00000000000000000...	0.0625
7	5	1.00000000000000000...	2.00000000000000000...	0.03125
8	6	2.00000000000000000...	1.00000000000000000...	0.015625
9	7	1.00000000000000000...	2.00000000000000000...	0.0078125
10	8	2.00000000000000000...	1.00000000000000000...	0.0039063
11	9	1.00000000000000000...	2.00000000000000000...	0.0019531
12	10	2.00000000000000000...	1.00000000000000000...	0.00097656
13	11	1.00000000000000000...	2.00000000000000000...	0.00048828
14	12	2.00000000000000000...	1.00000000000000000...	0.00024414
15	13	1.00000000000000000...	2.00000000000000000...	0.00012207
16	14	2.00000000000000000...	1.00000000000000000...	6.1035e-05
17	15	1.00000000000000000...	2.00000000000000000...	3.0518e-05
18	16	2.00000000000000000...	1.00000000000000000...	1.5259e-05
19	17	1.00000000000000000...	2.00000000000000000...	7.6294e-06
20	18	2.00000000000000000...	1.00000000000000000...	3.8147e-06
21	19	1.00000000000000000...	2.00000000000000000...	1.9073e-06
22	20	2.00000000000000000...	1.00000000000000000...	9.5367e-07
23	21	1.00000000000000000...	2.00000000000000000...	4.7684e-07
24	22	2.00000000000000000...	1.00000000000000000...	2.3842e-07
25	23	1.00000000000000000...	2.00000000000000000...	1.1921e-07
26	24	2.00000000000000000...	1.00000000000000000...	5.9605e-08
27	25	1.00000000000000000...	2.00000000000000000...	2.9802e-08
28	26	2.00000000000000000...	1.00000000000000000...	1.4901e-08
29	27	1.00000000000000000...	2.00000000000000000...	7.4506e-09

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Gruppe 8
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Daniel Kuschel 70451470
Mohammed Almassri 70452593
Alexander König 70012769

Startwert: 3,0

Variables - aTABELLE

aTABELLE

10x4 string

	1	2	3	4
1	i	Xi	Xi+1	Abweichung
2	0	3.00000000000000000...	2.39999999999999990...	0.6
3	1	2.39999999999999990...	1.89896907216494950...	0.25052
4	2	1.89896907216494950...	-0.2887793276654215...	0.54694
5	3	-0.2887793276654215...	-1.1057672990136456...	0.10212
6	4	-1.1057672990136456...	-0.8291999504602743...	0.017285
7	5	-0.8291999504602743...	-0.7717158120621090...	0.0017964
8	6	-0.7717158120621090...	-0.7692965611557901...	3.7801e-05
9	7	-0.7692965611557901...	-0.7692923542513410...	3.2866e-08
10	8	-0.7692923542513410...	-0.7692923542386314...	4.9647e-14

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Gruppe 8
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Startwert: -1,0

i	Xi	Xi+1	Abweichung
0	-1	-0,8	0,2
1	-0,8	-0,769948187	0,015026
2	-0,769948187	-0,769292663	0,00016388
3	-0,769292663	-0,769292354	3,86E-08
4	-0,769292354	-0,769292354	4,27E-15

Startwert: 1,0

i	Xi	Xi+1	Abweichung
0	1,00000000000000000000	2,00000000000000000000	1
1	2,00000000000000000000	1,00000000000000000000	0,5
2	1,00000000000000000000	2,00000000000000000000	0,25
3	2,00000000000000000000	1,00000000000000000000	0,125
4	1,00000000000000000000	2,00000000000000000000	0,0625
5	2,00000000000000000000	1,00000000000000000000	0,03125
6	[illegible]	2,00000000000000000000	0,015625
7	[illegible]	1,00000000000000000000	0,0078125
8	[illegible]	2,00000000000000000000	0,0039063
9	[illegible]	[illegible]	0,0019531
[illegible]	[illegible]	[illegible]	0,00097656
[illegible]	[illegible]	[illegible]	0,00048828
12	[illegible]	[illegible]	0,00024414
13	[illegible]	[illegible]	0,00012207
14	1,00000000000000000000	[illegible]	6,10E-05
15	2,00000000000000000000	[illegible]	3,05E-05
16	1,00000000000000000000	2,00000000000000000000	1,53E-05
17	2,00000000000000000000	1,00000000000000000000	7,63E-06
18	1,00000000000000000000	2,00000000000000000000	3,81E-06
19	2,00000000000000000000	1,00000000000000000000	1,91E-06
20	1,00000000000000000000	2,00000000000000000000	9,54E-07
21	2,00000000000000000000	1,00000000000000000000	4,77E-07
22	1,00000000000000000000	2,00000000000000000000	2,38E-07
23	2,00000000000000000000	1,00000000000000000000	1,19E-07
24	1,00000000000000000000	2,00000000000000000000	5,96E-08
25	2,00000000000000000000	1,00000000000000000000	2,98E-08
26	1,00000000000000000000	2,00000000000000000000	1,49E-08
27	2,00000000000000000000	1,00000000000000000000	7,45E-09

Die Werte springen die ganze Zeit zwischen 1,00000000 ... und 2,0000000 ...

Keine Nullstelle gefunden!!!

Startwert: 2.0

i	Xi	Xi+1	Abweichung
0	2,00000000000000000000	1,00000000000000000000	1
1	1,00000000000000000000	2,00000000000000000000	0,5
2	2,00000000000000000000	1,00000000000000000000	0,25
3	1,00000000000000000000	2,00000000000000000000	0,125
4	2,00000000000000000000	1,00000000000000000000	0,0625
5	1,00000000000000000000	2,00000000000000000000	0,03125
6	[illegible]	[illegible]	0,015625
7	[illegible]	2,00000000000000000000	0,0078125
8	[illegible]	[illegible]	0,0039063
9	[illegible]	[illegible]	0,0019531
10	[illegible]	[illegible]	0,00097656
11	[illegible]	[illegible]	0,00048828
12	[illegible]	[illegible]	0,00024414
13	[illegible]	[illegible]	0,00012207
14	2,00000000000000000000	[illegible]	6,10E-05
15	1,00000000000000000000	[illegible]	3,05E-05
16	2,00000000000000000000	1,00000000000000000000	1,53E-05
17	1,00000000000000000000	2,00000000000000000000	7,63E-06
18	2,00000000000000000000	1,00000000000000000000	3,81E-06
19	1,00000000000000000000	2,00000000000000000000	1,91E-06
20	2,00000000000000000000	1,00000000000000000000	9,54E-07
21	1,00000000000000000000	2,00000000000000000000	4,77E-07
22	2,00000000000000000000	1,00000000000000000000	2,38E-07
23	1,00000000000000000000	2,00000000000000000000	1,19E-07
24	2,00000000000000000000	1,00000000000000000000	5,96E-08
25	1,00000000000000000000	2,00000000000000000000	2,98E-08
26	2,00000000000000000000	1,00000000000000000000	1,49E-08
27	1,00000000000000000000	2,00000000000000000000	7,45E-09

Die Werte springen die ganze Zeit zwischen 1,00000000 ... und 2,0000000 ...

Keine Nullstelle gefunden!!!

Startwert: 3.0

i	Xi	Xi+1	Abweichung
0	3	2,4	0,6
1	2,4	1,898969072	0,25052
2	1,898969072	-0,288779328	0,54694
3	-0,288779328	-1,105767299	0,10212
4	-1,105767299	-0,82919995	0,017285
5	-0,82919995	-0,771715812	0,0017964
6	-0,771715812	-0,769296561	3,78E-05
7	-0,769296561	-0,769292354	3,29E-08
8	-0,769292354	-0,769292354	4,96E-14

Die gefundenenen Nullstellen sind gleich

Der Startwert -1.0 liegt näher an der Nullstelle als der Startwert 3.0. Deswegen sind weniger Iterationsschritte nötig

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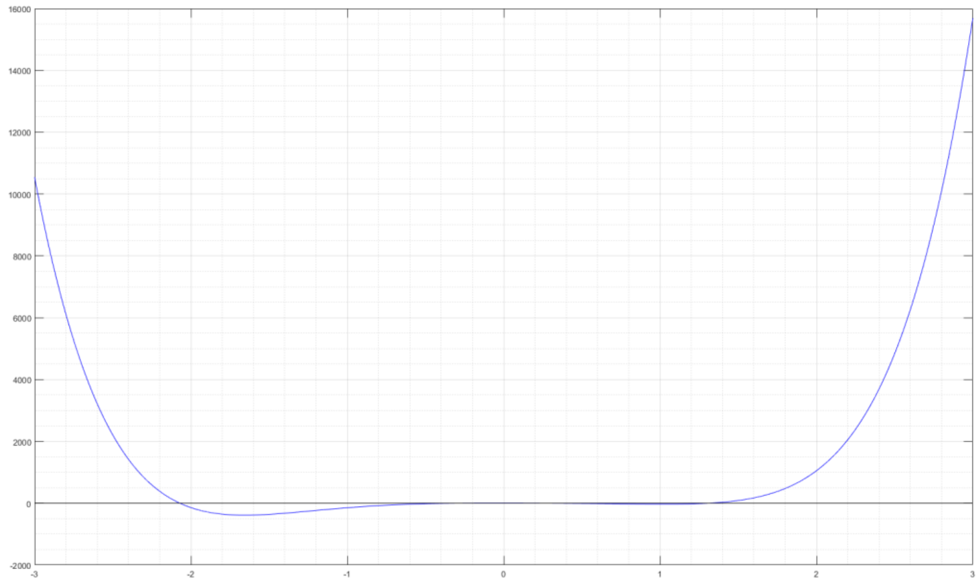
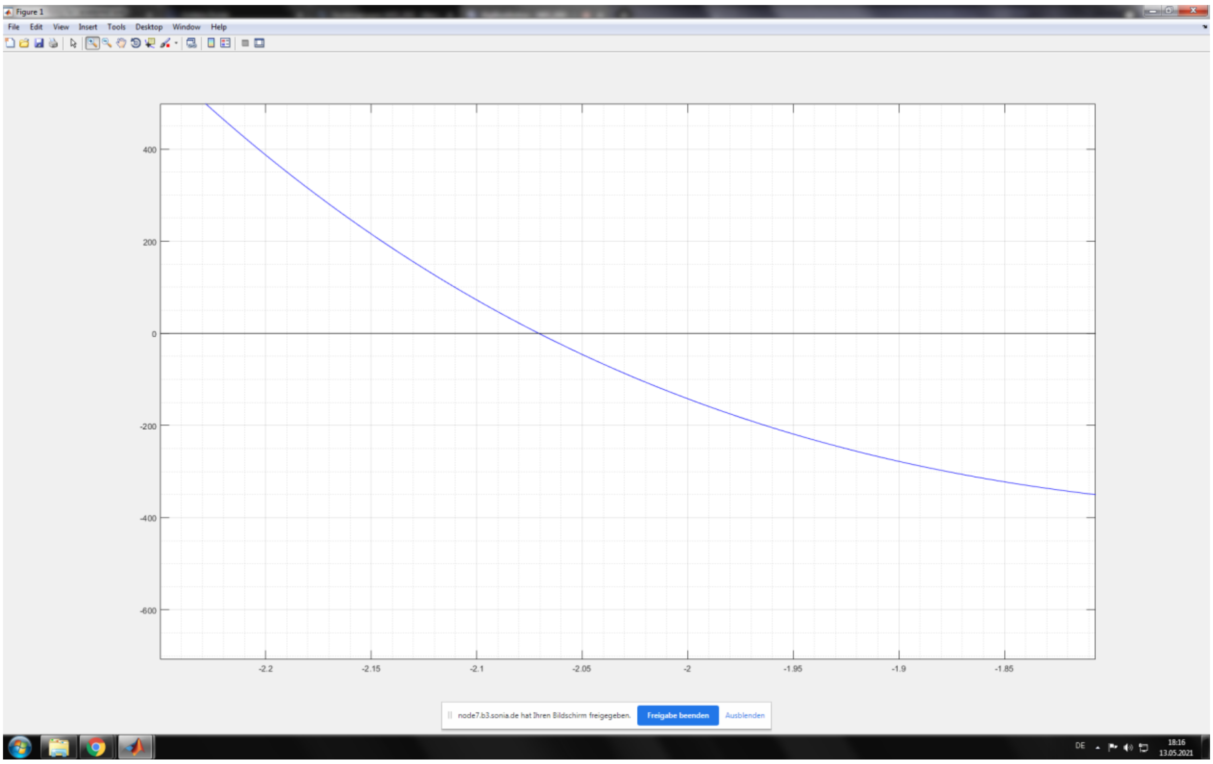
Aufgabe 4

Quelltext siehe *G08_H2_Aufgabe_4.pdf*

Indem Funktionsplot sind 4 Nullstellen zu erkennen:





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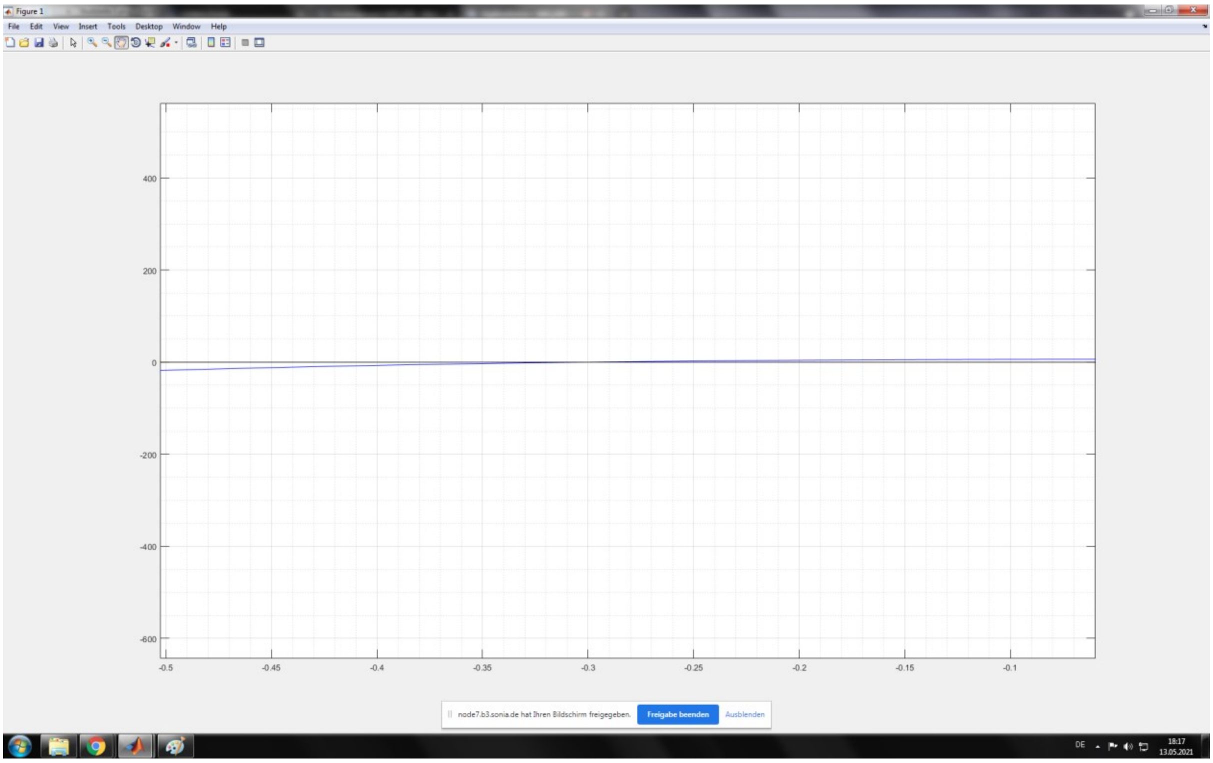

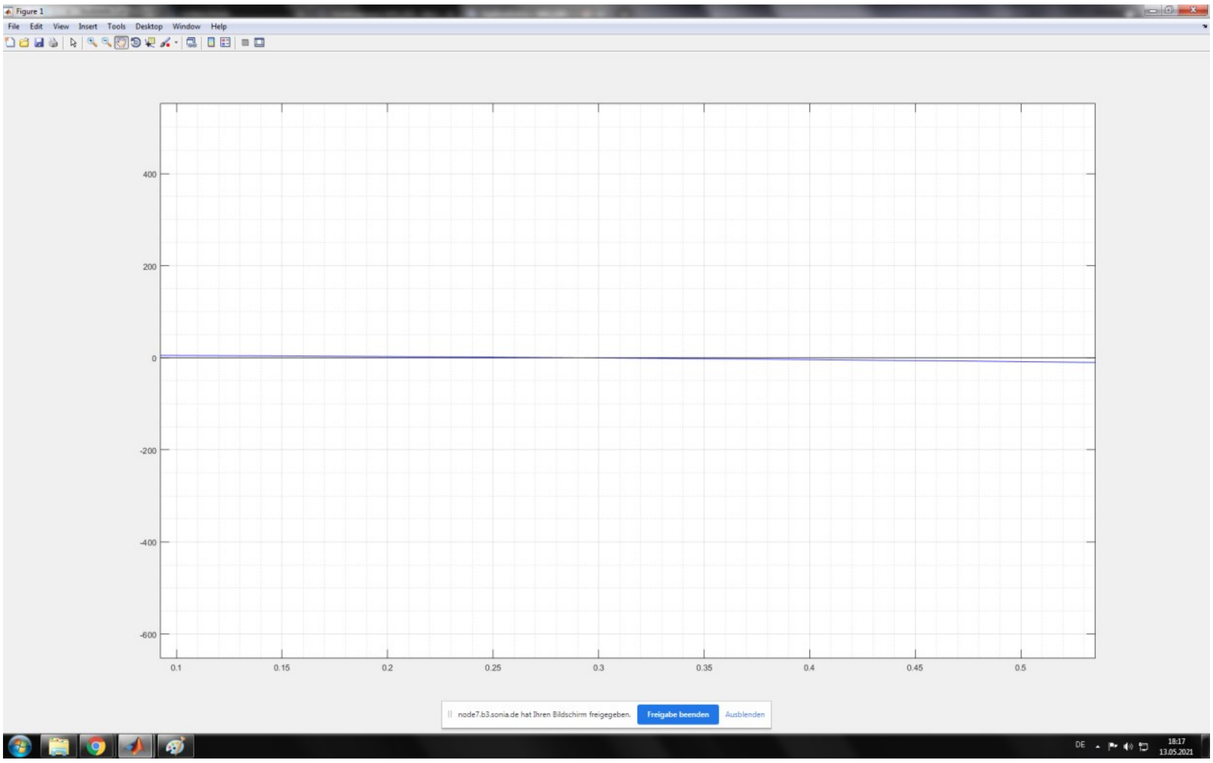

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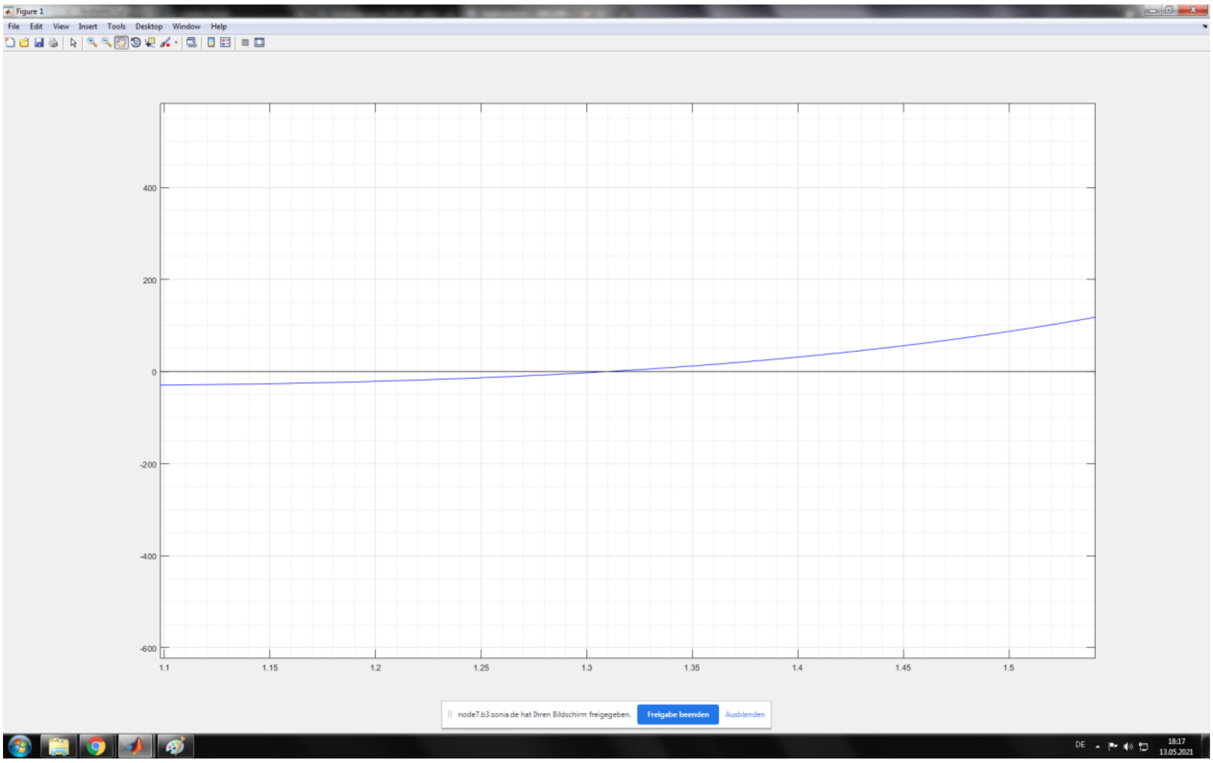

Variables - aTABELLE

aTABELLE

13x7 string

	1	2	3	4	5	6	7
1	i	Xu	Xo	Xm	f(Xu)	f(Xm)	f(Xu)*f(Xm)
2	0	-3.0000000000000000...	3.0000000000000000...	0.0000000000000000...	10545.000000000000...	6.0000000000000000...	>0
3	1	0.0000000000000000...	3.0000000000000000...	1.5000000000000000...	6.0000000000000000...	87.140625000000000...	>0
4	2	1.5000000000000000...	3.0000000000000000...	2.2500000000000000...	87.140625000000000...	2391.03735351562500...	>0
5	3	2.2500000000000000...	3.0000000000000000...	2.6250000000000000...	2391.03735351562500...	6653.44568252563480...	>0
6	4	2.6250000000000000...	3.0000000000000000...	2.8125000000000000...	6653.44568252563480...	10391.2557840943340...	>0
7	5	2.8125000000000000...	3.0000000000000000...	2.9062500000000000...	10391.2557840943340...	12819.0321628907700...	>0
8	6	2.9062500000000000...	3.0000000000000000...	2.9531250000000000...	12819.0321628907700...	14196.4805667202600...	>0
9	7	2.9531250000000000...	3.0000000000000000...	2.9765625000000000...	14196.4805667202600...	14929.3657930129080...	>0
10	8	2.9765625000000000...	3.0000000000000000...	2.9882812500000000...	14929.3657930129080...	15307.2766406210900...	>0
11	9	2.9882812500000000...	3.0000000000000000...	2.9941406250000000...	15307.2766406210900...	15499.1538445215480...	>0
12	10	2.9941406250000000...	3.0000000000000000...	2.9970703125000000...	15499.1538445215480...	15595.8298091396500...	>0
13	11	2.9970703125000000...	3.0000000000000000...	2.9985351562500000...	15595.8298091396500...	15644.3530016920520...	>0

Bei Grenzen -3 bis 3 liegen zu viele Nullstellen beieinander, sodass durch die Mittelwertbildung (xm) Nullstellen "übersprungen" werden

- ➔ der Algorhitmus hängt sich an der rechtsseitigen Grenze +3 auf, wo allerdings keine Nullstelle liegt
- ➔ Da f(xu)*f(xm) immer >0 denkt der Algorhitmus die Nullstelle liegt rechtsseitig von xm

Es gibt 4 Nullstellen im Bereich +3 bis -3 (siehe Abbildungen)

LÖSUNG DES PROBLEMS:

Variante 1:

- Graphen plotten
- Intervalle zur genauen Prüfung festlegen

Variante 2:

- Programm schreiben, dass in einer Schleife das große Intervall in viele kleine Intervalle zerlegt und das Bisektionsverfahren ausführt

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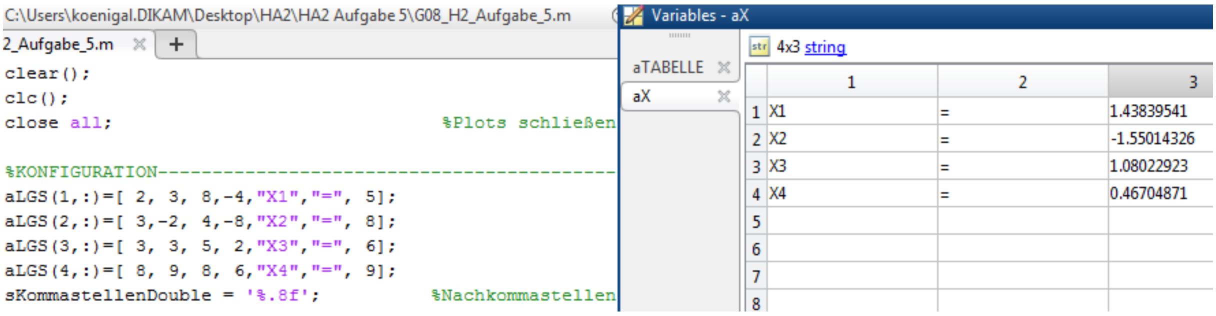
Aufgabe 5

Quelltext siehe *G08_H2_Aufgabe_5.pdf*



C:\Users\koenigal.DIKAM\Desktop\HA2\HA2 Aufgabe 5\G08_H2_Aufgabe_5.m

2_Aufgabe_5.m

```
clear();
clc();
close all;                                   %Plots schließen

%KONFIGURATION------------------------------------------
aLGS(1,:)=[ 2, 3, 8,-4,"X1","=", 5];
aLGS(2,:)=[ 3,-2, 4,-8,"X2","=", 8];
aLGS(3,:)=[ 3, 3, 5, 2,"X3","=", 6];
aLGS(4,:)=[ 8, 9, 8, 6,"X4","=", 9];
sKommastellenDouble = '%.8f';              %Nachkommastellen
```

Variables - aX

aTABELLE
aX

4x3 string

	1	2	3
1	X1	=	1.43839541
2	X2	=	-1.55014326
3	X3	=	1.08022923
4	X4	=	0.46704871
5			
6			
7			
8			