Tarea 2 **Calculo Computacional**

Victor Tortolero CI:24.569.609

Respuesta 1

Al correr el programa, que calcula el resultado del método de Newton en para hallar raíces de la función:

$$f(t) = 1 - \frac{3}{2} * e^{(-1*(t*t-2*t+0.9775))} - e^{(-1*(t*t-8*t+15.96))}$$

con los siguientes puntos iniciales:

$$[0.80, 0.85, 0.90, 0.95, 1.00, 1.05, 1.10, 1.15, 1.20]$$

obtenemos la siguiente información:

Figura 1: Punto inicial: 0.80

i	x_i	$f(x_i)$	$f'(x_i)$
0	0.8000000	-0.4740155	-0.5898284
1	-0.0036499	0.4397364	-1.1246161
2	0.3873603	-0.0540499	-1.2915172
3	0.3455103	0.0003899	-1.3084770
4	0.3458083	0.0000000	-1.3083914

Figura 2: Punto inicial: 0.85

i	x_i	$f(x_i)$	$f'(x_i)$
0	0.8500000	-0.5000511	-0.4503210
1	-0.2604324	0.6867409	-0.7896827
2	0.6092092	-0.3168673	-1.0293012
3	0.3013622	0.0583564	-1.3157409
4	0.3457147	0.0001225	-1.3084183
5	0.3458083	0.0000000	-1.3083914

Figura 3: Punto inicial: 0.90

i	x_i	$f(x_i)$	$f'(x_i)$
0	0.9000000	-0.5189375	-0.3042058
1	-0.8058763	0.9411771	-0.2124534
2	3.6241634	0.0947282	-0.6710567
3	3.7653262	0.0142263	-0.4582679
4	3.7963698	0.0008478	-0.4032092
5	3.7984726	0.0000040	-0.3993906
6	3.7984826	0.0000000	-0.3993724

Figura 4: Punto inicial: 0.95

i	x_i	$f(x_i)$	$f'(x_i)$
0	0.9500000	-0.5303969	-0.1536090
1	-2.5029032	0.9999928	-0.0000504

Figura 5: Punto inicial: 1.00

i	x_i	$f(x_i)$	$f'(x_i)$
0	1.0000000	-0.5342610	-0.0007707

Figura 6: Punto inicial: 1.05

i	x_i	$f(x_i)$	$f'(x_i)$
0	1.0500000	-0.5304750	0.1520096
1	4.5397473	0.2222265	0.8396434
2	4.2750795	0.0350064	0.5311111
3	4.2091679	0.0036925	0.4171101
4	4.2003153	0.0000715	0.4009391
5	4.2001369	0.0000000	0.4006113
6	4.2001368	0.0000000	0.4006112

Figura 7: Punto inicial: 1.10

i	x_i	$f(x_i)$	$f'(x_i)$
0	1.1000000	-0.5190994	0.3024291
1	2.8164331	0.6869363	-0.4013668
2	4.5279259	0.2123474	0.8316886
3	4.2726052	0.0336973	0.5270527
4	4.2086698	0.0034850	0.4162053
5	4.2002966	0.0000640	0.4009047
6	4.2001369	0.0000000	0.4006113
7	4.2001368	0.0000000	0.4006112

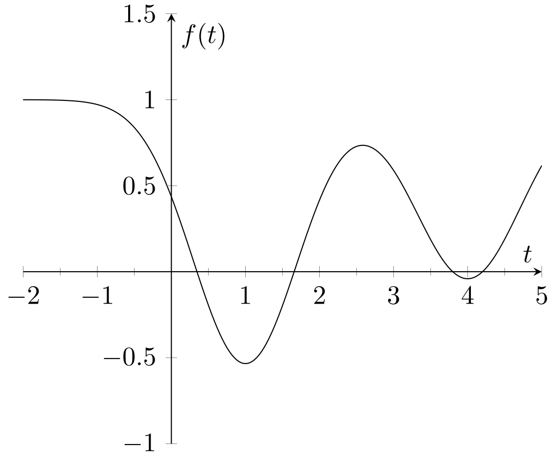
Figura 8: Punto inicial: 1.15

i	x_i	$f(x_i)$	$f'(x_i)$
0	1.1500000	-0.5003089	0.4482386
1	2.2661664	0.6397468	0.6032816
2	1.2057216	-0.4709837	0.6026869
3	1.9871949	0.4029704	1.0701177
4	1.6106285	-0.0600950	1.2739408
5	1.6578011	0.0004120	1.2891744
6	1.6574815	0.0000000	1.2891160

Figura 9: Punto inicial: 1.20

i	x_i	$f(x_i)$	$f'(x_i)$
0	1.2000000	−0.4743881	0.5872960
1	2.0077496	0.4246754	1.0415920
2	1.6000320	−0.0735670	1.2686661
3	1.6580197	0.0006939	1.2892140
4	1.6574815	0.0000000	1.2891160
5	1.6574815	−0.0000000	1.2891160

$$f(t) = 1 - \frac{3}{2} * e^{(-1*(t*t-2*t+0.9775))} - e^{(-1*(t*t-8*t+15.96))}$$



Entonces tenemos que todos los valores convergen excepto $t_0 = 0.95$, y $t_0 = 1$. Como podemos ver en , se pierde en estos valores por la pendiente de la curva ya que están cerca de un punto critico, entonces al trazar las rectas tangentes el método se aleja mucho. Los cambios en t_0, a pesar de ser pequeños, la pendiente en estos puntos cambia bastante y por lo tanto también la velocidad de convergencia.

Respuesta 2

Al correr el programa, que calcula el resultado del método de Newton para resolver la equacion

$$\frac{1}{4}x^2 - x\sin x - \frac{1}{2}\cos 2x + \frac{1}{2} = 0$$

con los siguientes puntos iniciales

$$[\frac{\pi}{2}, 5\pi, 10\pi]$$

obtenemos la siguiente información:

Figura 10: Punto inicial: π (Converge)

i	x_i	$f(x_i)$	$f'(x_i)$
0	1.7853982	0.0460539	-0.2146018
1	1.8445616	0.0071170	-0.1202935
2	1.8708344	0.0016385	-0.0623666
3	1.8833464	0.0003963	-0.0316759
4	1.8894638	0.0000976	-0.0159548
5	1.8924896	0.0000242	-0.0080059
6	1.8939946	0.0000060	-0.0040100
7	1.8947451	0.0000015	-0.0020068
8	1.8951198	0.0000004	-0.0010038
9	1.8953071	0.0000001	-0.0005020
10	1.8954007	0.0000000	-0.0002510
11	1.8954475	0.0000000	-0.0001255
12	1.8954709	0.0000000	-0.0000628
13	1.8954826	0.0000000	-0.0000314
14	1.8954884	0.0000000	-0.0000157
15	1.8954913	0.0000000	-0.0000078
16	1.8954928	0.0000000	-0.0000039
17	1.8954935	0.0000000	-0.0000020
18	1.8954939	0.0000000	-0.0000010
19	1.8954941	0.0000000	-0.0000005
20	1.8954942	0.0000000	-0.0000002
21	1.8954942	0.0000000	-0.0000001
22	1.8954942	0.0000000	-0.0000001

Figura 11: Punto inicial: 5π (Converge)

i	x_i	$f(x_i)$	$f'(x_i)$
0	13.0899694	61.6850275	23.5619449
1	21.3475720	36.5418400	-4.4252359
2	17.4729273	101.4799493	26.1907751
3	1.6486799	94.4331539	5.9676237
4	1.7980631	0.0298006	-0.1994913
5	1.8499401	0.0056632	-0.1091663
6	1.8733573	0.0013193	-0.0563373
7	1.8845720	0.0003203	-0.0285638
8	1.8900682	0.0000790	-0.0143762
9	1.8927898	0.0000196	-0.0072112
10	1.8941442	0.0000049	-0.0036113
11	1.8948197	0.0000012	-0.0018071
12	1.8951571	0.0000003	-0.0009039
13	1.8953257	0.0000001	-0.0004520
14	1.8954100	0.0000000	-0.0002260
15	1.8954521	0.0000000	-0.0001130
16	1.8954732	0.0000000	-0.0000565
17	1.8954837	0.0000000	-0.0000283
18	1.8954890	0.0000000	-0.0000141
19	1.8954916	0.0000000	-0.0000071
20	1.8954930	0.0000000	-0.0000035
21	1.8954936	0.0000000	-0.0000018
22	1.8954939	0.0000000	-0.0000009
23	1.8954941	0.0000000	-0.0000004
24	1.8954942	0.0000000	-0.0000002
25	1.8954942	0.0000000	-0.0000001
26	1.8954942	0.0000000	-0.0000001
27	1.8954943	0.0000000	-0.0000000

Figura 12: Punto inicial: 10π (Converge)

i	x_i	$f(x_i)$	$f'(x_i)$
0	47.1238898	246.7401100	-15.7079633
1	39.2699082	555.1652476	70.6858347
2	20.6349541	347.2615137	18.6349541
3	14.0844908	87.2433669	13.3186561
4	7.3295384	36.5254936	5.4072170
5	1921.5404903	7.8353322	-0.0040932
6	-6212.1139178	924804.9759238	113.7010413
7	-4438.8695742	9653346.7729376	-5443.8897877
8	-3689.0763974	4925005.2698354	-6568.4850462
9	-9361.6753668	3399558.4368288	599.2946893
10	-14410.6158688	21912745.2270146	4340.0680238
11	-11995.1385095	51918335.7955691	-21494.0270898

12	−20350.8637606	35964693.1763045	4304.1976723
13	−32153.6935851	103546838.6734365	8773.0519048
14	−26303.8986398	258449384.2733945	−44180.9305611
15	−21214.5387407	172957713.6523489	−33984.1781835
16	−17148.2210877	112501555.1255755	−27666.6912741
17	−4477.3764256	73498450.0392219	−5800.5959349
18	−3630.0860097	5014278.7724454	−5918.0166310
19	−1898.2094594	3298011.1230452	−1904.2991964
20	−3636.3713853	899595.5784556	517.5556805
21	−1894.2216866	3309435.6950319	−1899.6276252
22	−1575.9045549	896719.6524757	−2817.0637499
23	1871.4510788	622323.6879867	−180.5220447
24	7001.0593921	877092.1883610	−170.9861913
25	3637.1758662	12246709.5161439	3640.6461228
26	8075.3076376	3309842.2222794	−745.7737608
27	2214.1410621	16294672.4394335	2780.1073779
28	1780.7410806	1224210.2955517	2824.6662390
29	1452.7934396	791841.4393738	2414.5361647
30	275.3098815	526227.3832642	446.9084767
31	−479.7389156	19201.0395684	25.4301969
32	−371.2700565	57154.9340550	−526.9248201
33	−638.6617194	34262.7667743	128.1370047
34	−494.0812020	102480.3341694	−708.8115050
35	−387.1924527	61401.1941242	−574.4401962
36	−307.1248467	37751.3449524	−471.4933647
37	−641.2088390	23791.5089290	71.2141541
38	−998.6794801	102583.1971350	286.9695727
39	−1565.9782382	249679.9054533	440.1206628
40	−574.8496464	611515.7109923	−616.9892747
41	−478.9398636	82577.5244163	−860.9916736
42	−135.8801421	56873.4811346	−165.7830330
43	−107.3387362	4713.0408533	−165.1299474
44	−180.0664384	2826.8908166	38.8695192
45	−136.5431877	8257.7814073	−189.7326436
46	−80.3063845	4797.6211971	−85.3110584
47	−12.9785910	1692.0133666	−25.1309790
48	−20.2925756	37.0716685	5.0686009
49	−8.0070693	83.8037739	−6.8213529
50	−5.6965144	9.0916100	−3.9348167
51	−10.8076459	11.5725758	2.2641905

52	−6.1585544	40.7837593	−8.7724148
53	−9.4126197	10.2629614	3.1538892
54	−7.8478253	22.0350615	−14.0817616
55	−4.8874436	8.5493760	−2.8879303
56	0.3735117	11.7541929	−2.2342316
57	0.1668875	0.0317308	0.1535677
58	0.0818546	0.0068344	0.0803730
59	0.0407434	0.0016676	0.0405625
60	0.0203491	0.0004145	0.0203266
61	0.0101717	0.0001035	0.0101689
62	0.0050855	0.0000259	0.0050852
63	0.0025427	0.0000065	0.0025427
64	0.0012714	0.0000016	0.0012713
65	0.0006357	0.0000004	0.0006357
66	0.0003178	0.0000001	0.0003178
67	0.0001589	0.0000000	0.0001589
68	0.0000795	0.0000000	0.0000795
69	0.0000397	0.0000000	0.0000397
70	0.0000199	0.0000000	0.0000199
71	0.0000099	0.0000000	0.0000099
72	0.0000050	0.0000000	0.0000050
73	0.0000025	0.0000000	0.0000025
74	0.0000012	0.0000000	0.0000012
75	0.0000006	0.0000000	0.0000006
76	0.0000003	0.0000000	0.0000003
77	0.0000002	0.0000000	0.0000002
78	0.0000001	0.0000000	0.0000001
79	0.0000000	0.0000000	0.0000000
80	0.0000000	0.0000000	0.0000000

Figura 13: Desde -30 a 30
$f(x) = \frac{1}{4}x^2 - x\sin x - \frac{1}{2}\cos 2x + \frac{1}{2}$

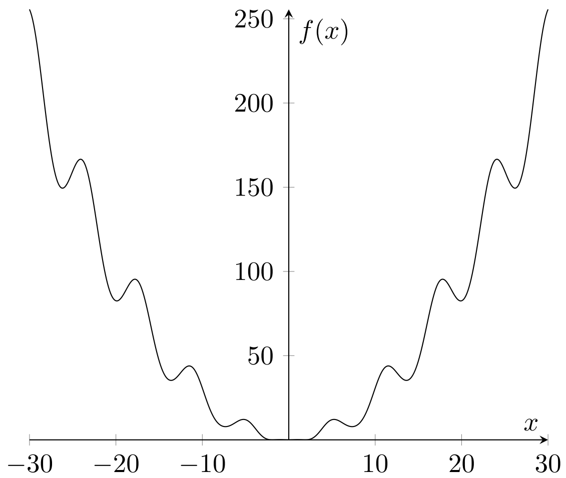
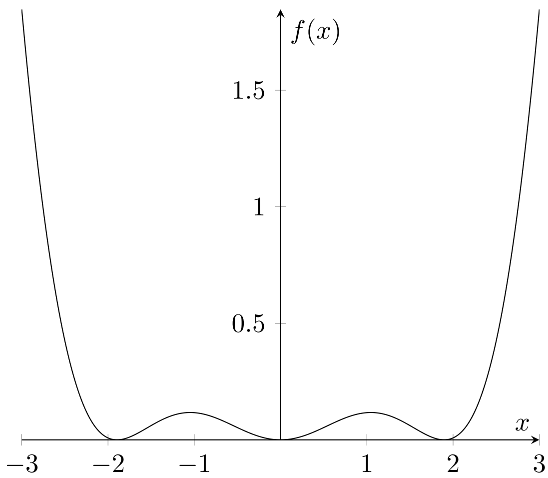


Figura 14: Desde -3 a 3
$f(x) = \frac{1}{4}x^2 - x\sin x - \frac{1}{2}\cos 2x + \frac{1}{2}$



El método converge en los 3 casos aunque no con la velocidad que esperaríamos de este método. En el primer ($x_0 = \pi/2$) caso se debe a la cercanía que tiene la curva con el eje x, por lo que al trazar las rectas tangentes, no hay mucho avance.
En los otros dos casos de ($x_0 = 5\pi$ y $x_0 = 10\pi$) se debe a las irregularidades de la curva, en $x_0 = 5\pi$ se pierde pero no tarda tanto en converger, y luego tarda por las mismas, ya que en este punto no existen tantas regularidades entre la solución y el punto inicial. Con $x_0 = 10\pi$, tarde en coverger por la pendiente al trazar las rectas tangentes toma un punto pero como la pendiente cambia su sentido de manera irregular entonces el método se pierde y por eso tarda en encontrar la solución.

Respuesta 3

Al correr el programa, para encontrar las primeras 10 raíces positivas de la ecuación:

$$x - \tan x = 0$$

obtenemos la siguiente información:

Figura 15: Punto inicial: 4.66

i	x_i	$f(x_i)$	$f'(x_i)$
0	4.6623890	−15.3209416	−399.3335001
1	4.6240227	−6.6630402	−127.3977882
2	4.5717216	−2.4902976	−49.8721154
3	4.5217880	−0.6610857	−26.8621799
4	4.4971777	−0.0774590	−20.9273010
5	4.4934763	−0.0013510	−20.2034728
6	4.4934095	−0.0000004	−20.1907326
7	4.4934095	−0.0000000	−20.1907286

Figura 16: Punto inicial: 7.80

i	x_i	$f(x_i)$	$f'(x_i)$
0	7.8039816	−12.1793489	−399.3335001
1	7.7734824	−4.6221579	−153.6518994
2	7.7434004	−1.2628375	−81.1123214
3	7.7278314	−0.1571323	−62.1726535
4	7.7253041	−0.0031192	−59.7285267
5	7.7252519	−0.0000013	−59.6795360
6	7.7252518	−0.0000000	−59.6795159

Figura 17: Punto inicial: 10.95

i	x_i	$f(x_i)$	$f'(x_i)$
0	10.9455743	−9.0377563	−399.3335001
1	10.9229422	−2.8208555	−188.8919748
2	10.9080085	−0.4827718	−129.7498756
3	10.9042877	−0.0197784	−119.3352211
4	10.9041220	−0.0000360	−118.9006618
5	10.9041217	−0.0000000	−118.8998692

Figura 18: Punto inicial: 14.09

i	x_i	$f(x_i)$	$f'(x_i)$
0	14.0871669	−5.8961636	−399.3335001
1	14.0724019	−1.3464395	−237.7406718
2	14.0667384	−0.1085768	−200.9395614
3	14.0661981	−0.0008294	−197.8812635
4	14.0661939	−0.0000000	−197.8578126

Figura 19: Punto inicial: 17.23

i	x_i	$f(x_i)$	$f'(x_i)$
0	17.2287596	−2.7545710	−399.3335001
1	17.2218617	−0.3345028	−308.2259352
2	17.2207764	−0.0062743	−296.7712770
3	17.2207553	−0.0000023	−296.5544913

Figura 20: Punto inicial: 20.37

i	x_i	$f(x_i)$	$f'(x_i)$
0	20.3703522	0.3870217	−399.3335001
1	20.3713214	−0.0076628	−415.3029993
2	20.3713030	−0.0000029	−414.9901022

Figura 21: Punto inicial: 23.51

i	x_i	$f(x_i)$	$f'(x_i)$
0	23.5119449	3.5286143	−399.3335001
1	23.5207812	−0.7587207	−589.4942094
2	23.5194941	−0.0230297	−554.2504282
3	23.5194525	−0.0000225	−553.1657083
4	23.5194525	−0.0000000	−553.1646458

Figura 22: Punto inicial: 26.65

i	x_i	$f(x_i)$	$f'(x_i)$
0	26.6535376	6.6702070	−399.3335001
1	26.6702409	−3.3517103	−901.3175525
2	26.6665222	−0.3369726	−729.1887304
3	26.6660601	−0.0041589	−711.3005805
4	26.6660543	−0.0000006	−711.0784844

Figura 23: Punto inicial: 29.80

i	x_i	$f(x_i)$	$f'(x_i)$
0	29.7951302	9.8117997	−399.3335001
1	29.8197006	−9.4961358	−1545.7349954
2	29.8135572	−1.8485454	−1002.4887435
3	29.8117132	−0.1020710	−894.8344894
4	29.8115992	−0.0003475	−888.7521642
5	29.8115988	−0.0000000	−888.7314227

Figura 24: Punto inicial: 32.94

i	x_i	$f(x_i)$	$f'(x_i)$
0	32.9367229	12.9533923	−399.3335001
1	32.9691604	−23.9645837	−3241.4512185
2	32.9617672	−7.1010237	−1605.0272201
3	32.9573430	−1.0697688	−1157.8443361
4	32.9564191	−0.0326349	−1088.2776818
5	32.9563891	−0.0000323	−1086.1257083
6	32.9563890	−0.0000000	−1086.1235785

Estas serian las 10 primeras raíces positivas para la ecuación:

1. 4.4934095
2. 7.7252518
3. 10.9041217
4. 14.0661939
5. 17.2207553
6. 20.3713030
7. 23.5194525
8. 26.6660543
9. 29.8115988
10. 32.9563890

Respuesta 4

Nos piden calcular la raíz de la función:

$$f(x) = 2x^3 - \frac{34}{7}x^2 + \frac{209}{49}x - \frac{173}{343}$$

En el intervalo de $[-1, 1]$. Con el método de la secante tenemos:

Figura 25: Punto inicial: 0.50

i	x_{i-1}	x_i	x_{i+1}	$f(x_{i-1})$	$f(x_i)$	$f(x_{i+1})$
0	0.5000000	1.0000000	−0.8844985	0.6639942	0.9037901	−9.4609080
1	1.0000000	−0.8844985	0.8356738	0.9037901	−9.4609080	0.8352291
2	−0.8844985	0.8356738	0.6961324	−9.4609080	0.8352291	0.7857636
3	0.8356738	0.6961324	−1.5204967	0.8352291	0.7857636	−25.2495379
4	0.6961324	−1.5204967	0.6292330	0.7857636	−25.2495379	0.7546590
5	−1.5204967	0.6292330	0.5668464	−25.2495379	0.7546590	0.7170005
6	0.6292330	0.5668464	−0.6209630	0.7546590	0.7170005	−5.5047415
7	0.5668464	−0.6209630	0.4299619	0.7170005	−5.5047415	0.5905911
8	−0.6209630	0.4299619	0.3281353	−5.5047415	0.5905911	0.4429048
9	0.4299619	0.3281353	0.0227619	0.5905911	0.4429048	−0.4097797
10	0.3281353	0.0227619	0.1695170	0.4429048	−0.4097797	0.0888364
11	0.0227619	0.1695170	0.1433703	−0.4097797	0.0888364	0.0132001
12	0.1695170	0.1433703	0.1388071	0.0888364	0.0132001	−0.0005541
13	0.1433703	0.1388071	0.1389909	0.0132001	−0.0005541	0.0000032
14	0.1388071	0.1389909	0.1389899	−0.0005541	0.0000032	0.0000000
15	0.1389909	0.1389899	0.1389899	0.0000032	0.0000000	−0.0000000

Y con el método de falsa posición(regula falsi):

Figura 26: Punto inicial: -1.00

i	x_{i-1}	x_i	x_{i+1}	$f(x_{i-1})$	$f(x_i)$	$f(x_{i+1})$
0	−1.0000000	1.0000000	0.8557469	−11.6268222	0.9037901	0.8420818
1	−1.0000000	0.8557469	0.7304198	−11.6268222	0.8420818	0.7991187
2	−1.0000000	0.7304198	0.6191356	−11.6268222	0.7991187	0.7492116
3	−1.0000000	0.6191356	0.5211175	−11.6268222	0.7492116	0.6823630
4	−1.0000000	0.5211175	0.4367940	−11.6268222	0.6823630	0.5986685
5	−1.0000000	0.4367940	0.3664358	−11.6268222	0.5986685	0.5048004
6	−1.0000000	0.3664358	0.3095780	−11.6268222	0.5048004	0.4099093
7	−1.0000000	0.3095780	0.2649805	−11.6268222	0.4099093	0.3220181

8	-1.0000000	0.2649805	0.2308896	-11.6268222	0.3220181	0.2461248
9	-1.0000000	0.2308896	0.2053734	-11.6268222	0.2461248	0.1840661
10	-1.0000000	0.2053734	0.1865883	-11.6268222	0.1840661	0.1353730
11	-1.0000000	0.1865883	0.1729317	-11.6268222	0.1353730	0.0983220
12	-1.0000000	0.1729317	0.1630960	-11.6268222	0.0983220	0.0707565
13	-1.0000000	0.1630960	0.1560606	-11.6268222	0.0707565	0.0505796
14	-1.0000000	0.1560606	0.1510533	-11.6268222	0.0505796	0.0359826
15	-1.0000000	0.1510533	0.1475020	-11.6268222	0.0359826	0.0255103
16	-1.0000000	0.1475020	0.1449898	-11.6268222	0.0255103	0.0180416
17	-1.0000000	0.1449898	0.1432158	-11.6268222	0.0180416	0.0127374
18	-1.0000000	0.1432158	0.1419648	-11.6268222	0.0127374	0.0089816
19	-1.0000000	0.1419648	0.1410833	-11.6268222	0.0089816	0.0063278
20	-1.0000000	0.1410833	0.1404626	-11.6268222	0.0063278	0.0044553
21	-1.0000000	0.1404626	0.1400258	-11.6268222	0.0044553	0.0031356
22	-1.0000000	0.1400258	0.1397184	-11.6268222	0.0031356	0.0022062
23	-1.0000000	0.1397184	0.1395022	-11.6268222	0.0022062	0.0015519
24	-1.0000000	0.1395022	0.1393501	-11.6268222	0.0015519	0.0010915
25	-1.0000000	0.1393501	0.1392432	-11.6268222	0.0010915	0.0007676
26	-1.0000000	0.1392432	0.1391680	-11.6268222	0.0007676	0.0005398
27	-1.0000000	0.1391680	0.1391151	-11.6268222	0.0005398	0.0003795
28	-1.0000000	0.1391151	0.1390779	-11.6268222	0.0003795	0.0002669
29	-1.0000000	0.1390779	0.1390518	-11.6268222	0.0002669	0.0001876
30	-1.0000000	0.1390518	0.1390334	-11.6268222	0.0001876	0.0001319
31	-1.0000000	0.1390334	0.1390205	-11.6268222	0.0001319	0.0000928
32	-1.0000000	0.1390205	0.1390114	-11.6268222	0.0000928	0.0000652
33	-1.0000000	0.1390114	0.1390050	-11.6268222	0.0000652	0.0000459
34	-1.0000000	0.1390050	0.1390005	-11.6268222	0.0000459	0.0000322
35	-1.0000000	0.1390005	0.1389973	-11.6268222	0.0000322	0.0000227
36	-1.0000000	0.1389973	0.1389951	-11.6268222	0.0000227	0.0000159
37	-1.0000000	0.1389951	0.1389936	-11.6268222	0.0000159	0.0000112
38	-1.0000000	0.1389936	0.1389925	-11.6268222	0.0000112	0.0000079
39	-1.0000000	0.1389925	0.1389917	-11.6268222	0.0000079	0.0000055
40	-1.0000000	0.1389917	0.1389911	-11.6268222	0.0000055	0.0000039
41	-1.0000000	0.1389911	0.1389908	-11.6268222	0.0000039	0.0000027
42	-1.0000000	0.1389908	0.1389905	-11.6268222	0.0000027	0.0000019
43	-1.0000000	0.1389905	0.1389903	-11.6268222	0.0000019	0.0000014
44	-1.0000000	0.1389903	0.1389902	-11.6268222	0.0000014	0.0000010
45	-1.0000000	0.1389902	0.1389901	-11.6268222	0.0000010	0.0000007
46	-1.0000000	0.1389901	0.1389900	-11.6268222	0.0000007	0.0000005
47	-1.0000000	0.1389900	0.1389900	-11.6268222	0.0000005	0.0000003

48	-1.0000000	0.1389900	0.1389899	-11.6268222	0.0000003	0.0000002
49	-1.0000000	0.1389899	0.1389899	-11.6268222	0.0000002	0.0000002
50	-1.0000000	0.1389899	0.1389899	-11.6268222	0.0000002	0.0000001
51	-1.0000000	0.1389899	0.1389899	-11.6268222	0.0000001	0.0000001
52	-1.0000000	0.1389899	0.1389899	-11.6268222	0.0000001	0.0000001
53	-1.0000000	0.1389899	0.1389899	-11.6268222	0.0000001	0.0000000
54	-1.0000000	0.1389899	0.1389899	-11.6268222	0.0000000	0.0000000
55	-1.0000000	0.1389899	0.1389899	-11.6268222	0.0000000	0.0000000
56	-1.0000000	0.1389899	0.1389899	-11.6268222	0.0000000	0.0000000
57	-1.0000000	0.1389899	0.1389899	-11.6268222	0.0000000	0.0000000

Por ambos métodos converge, aunque notablemente mas rapido con el método de la secante. Y vemos que ambos métodos convergen al mismo valor, a 0.1389899.

Respuesta 5

Normalmente el método de falsa posición calculamos el próximo punto (x_{i+1}) usando la siguiente formula:

$$x_{i+1} = x_{i-1} - \frac{f(x_{i-1})}{\left(\frac{f(x_i)-f(x_{i-1})}{x_i - x_{i-1}}\right)}$$

Si cambiamos la formula usada en el método por la siguiente:

$$x_{i+1} = \frac{f(x_i)\,x_{i-1} - \frac{1}{2}f(x_{i-1})\,x_i}{f(x_i) - \frac{1}{2}f(x_{i-1})}$$

Obtenemos los siguientes resultados:

Figura 27: Punto inicial: -1.00

i	x_{i-1}	x_i	x_{i+1}	$f(x_{i-1})$	$f(x_i)$	$f(x_{i+1})$
0	-1.0000000	1.0000000	0.7309028	-11.6268222	0.9037901	0.7992977
1	-1.0000000	0.7309028	0.5216834	-11.6268222	0.7992977	0.6828335
2	-1.0000000	0.5216834	0.3617362	-11.6268222	0.6828335	0.4976389
3	-1.0000000	0.3617362	0.2543606	-11.6268222	0.4976389	0.2992127
4	-1.0000000	0.2543606	0.1929597	-11.6268222	0.2992127	0.1521799
5	-1.0000000	0.1929597	0.1625277	-11.6268222	0.1521799	0.0691411
6	-1.0000000	0.1625277	0.1488639	-11.6268222	0.0691411	0.0295381
7	-1.0000000	0.1488639	0.1430560	-11.6268222	0.0295381	0.0122581
8	-1.0000000	0.1430560	0.1406508	-11.6268222	0.0122581	0.0050233
9	-1.0000000	0.1406508	0.1396660	-11.6268222	0.0050233	0.0020477
10	-1.0000000	0.1396660	0.1392647	-11.6268222	0.0020477	0.0008329
11	-1.0000000	0.1392647	0.1391015	-11.6268222	0.0008329	0.0003385
12	-1.0000000	0.1391015	0.1390352	-11.6268222	0.0003385	0.0001375
13	-1.0000000	0.1390352	0.1390083	-11.6268222	0.0001375	0.0000559
14	-1.0000000	0.1390083	0.1389973	-11.6268222	0.0000559	0.0000227
15	-1.0000000	0.1389973	0.1389929	-11.6268222	0.0000227	0.0000092
16	-1.0000000	0.1389929	0.1389911	-11.6268222	0.0000092	0.0000037
17	-1.0000000	0.1389911	0.1389904	-11.6268222	0.0000037	0.0000015
18	-1.0000000	0.1389904	0.1389901	-11.6268222	0.0000015	0.0000006
19	-1.0000000	0.1389901	0.1389899	-11.6268222	0.0000006	0.0000003
20	-1.0000000	0.1389899	0.1389899	-11.6268222	0.0000003	0.0000001
21	-1.0000000	0.1389899	0.1389899	-11.6268222	0.0000001	0.0000000
22	-1.0000000	0.1389899	0.1389899	-11.6268222	0.0000000	0.0000000
23	-1.0000000	0.1389899	0.1389899	-11.6268222	0.0000000	0.0000000

Esta nueva formula es equivalente a:

$$x_{i+1} = x_{i-1} - \frac{f\left(x_{i-1}\right)}{\left(\frac{2f(x_i)-f(x_{i-1})}{x_i-x_{i-1}}\right)}$$

Tenemos que esta formula es muy parecida a la formula original. Lo que cambia es el $2f\left(x_i\right)$. Esto hace que la recta se incline mas hacia arriba, y por lo tanto este mas cerca del resultado, por lo que logramos converger de manera mas rápida en este caso usando esta formula.

Respuesta 6

Tenemos que

$$c(t) = Ate^{-t/3}$$

y queremos saber la cantidad A que debe inyectarse para lograr la concentración máxima de $c(t) = 1mg/mL$, entonces calculamos la derivada de c para saber en que punto alcanza el máximo.

$$\left(te^{-t/3}\right)' = \frac{e^{-t/3}}{3}(3-t)$$

Si igualamos la derivada a 0, obtendremos el punto máximo de la función, entonces para encontrar la solución de:

$$\frac{e^{-t/3}}{3}(3-t) = 0$$

Aqui tenemos que la solucion es $t = 3$. Entonces teniendo esto, y que el punto máximo de $c(t)$ debe ser 1, y remplazando t por 3 tendríamos:

$$A = \frac{e}{3}$$

Entonces quedamos con:

$$c(t) = \frac{e}{3}te^{-t/3}$$

Tenemos que se debe administrar $\frac{e}{3}$ unidades al paciente, y que toma 3 horas alcanzar la concentración máxima ($1mg/mL$). Para saber cuando debe colocarse la segunda inyección debemos saber cuando la función desciende a $0.25mg/mL$ luego de que alcanza su máximo. Entonces tendríamos:

$$\frac{e^{-t/3}}{3}(3-t) = 0.25$$
$$\frac{4e^{-t/3}}{3}(3-t) - 1 = 0$$

Y ahora teniendo esto, si lo derivamos y le aplicamos newton y tomamos un valor inicial de 6, tenemos que converge a 11.0779036.

Entonces tarda 11.0779036 horas, o lo que es lo mismo, 11 horas con 4.20 minutos.