

Projeto Computacional 1 - Cálculo Numérico  
Turma IC - 2º Semestre 2025

Integrantes:

Felipe Lopes Bueno — RA 178087  
Lucas Ribeiro Navarro — RA 178181  
Gianlucca Portelo Magnussen Vidotto — RA 176494

## **Explicações:**

**1) Implementações: bissecção, newton, secante implementados em metodos\_raizes.py.**

**Limita o tamanho do passo quando o método original produz passos grandes, evitando overflow.**

**2) Exercício I: para cada função foram produzidas tabelas e gráficos. Ver páginas com tabelas geradas.**

**3) Exercício II: provar a existência de raiz em [0,1] via avaliação em 0 e 1.**

**4) Casos de falha e mitigação: os runs originais de Newton para f3 x0=1.45 e ex2 x0=0.7 divergira**

**5) O que cada integrante fez:**

- Felipe: Códigos em python**
- Gianlucca: Realização dos resultados**
- Lucas: Organização do PDF**

## ex2\_bisection\_0\_1.csv

k	xk	f(xk)	step
1	0.5 0.25 0.125 0.1875	0.1909523064943483	0.5 0.25 0.125 0.0625
2	0.15625 0.171875	0.0614502536579895	0.03125 0.015625
3	0.1796875	-0.0446920620023974	0.0078125 0.00390625
4	0.17570125	0.0112111092372025	0.001953125
5	0.173828125	-0.0161208335851449	0.0009765625
6	0.1748046875	-0.0022877614885285	0.00048828125
7	0.17431640625	0.0045048764094097	0.000244140625
8	0.174560546875	0.0011191841220265	0.0001220703125
9	0.1744384765625	-0.00058165415755	6.103515625e-05
10	0.17449951171075	0.000269426390556	3.0517570125e-05
11	0.174468994140625	-0.000155948872443	1.52587890625e-05
12	0.1744842529296875	5.678005826617594e-05	7.62939453125e-06
13	0.1744918823242187	-4.957408871253399e-05	3.814697265625e-06
14	0.1744956970214843	3.605565049358273e-06	1.9073486328125e-06
15	0.1744937896728515	-2.298361684824335e-05	9.5367431640625e-07
16	0.1744947433471679	9.680064643031536e-06	4.76037150203125e-07
17	0.1744952201843261	-3.0416094813912053e-06	2.384185791015625e-07
18	0.1744954586029052	2.819878630044848e-07	1.1920928955078125e-07
19	0.1744953393936157	-1.3798082894589392e-06	5.960464477539064e-08
20	0.1744953989982605	-5.489095832589275e-07	2.9802322387695312e-08
21	0.1744953691959381	-1.3346070262820753e-07	
22		7.426361953166706e-08	
23		-2.9598531708918685e-08	
24		2.23325463954982e-08	
25		-3.632992018332004e-09	

## ex2\_f0\_f1.csv

x	f(x)
0.0	-0.166818569905618
1.0	0.1867348206876557

## ex2\_newton\_x0\_0.3.csv

k	xk	f(xk)	f'(xk)	step
1	0.3	0.0968033434580016	0.6610702414622878	-0.1464342779125445
2	0.1535657220874554	-0.0185291890905583	0.8988986061591835	0.0206132137302225
3	0.1741789358176779	-0.0002757683555618	0.8716969541847347	0.0003163580579672
4	0.1744952938756452	-6.92564725846001e-08	0.8712590185670689	7.94901069701453e-08
5	0.1744953733657522	-4.3853809472693675e-15	0.8712589084535288	5.033384341576894e-15

## ex2\_newton\_x0\_0.7\_error.csv

error
Newton step too large: -721334071.9305339

## ex2\_newton\_x0\_0.7\_safe\_error.csv

error
name 'newton_safe' is not defined

## ex2\_secant\_0.3\_0.6.csv

k	xk	f(xk)	step
1	0.3 0.6	0.0968033434580016	
2	0.0467732514685228	0.211487132614622	0.3
3	0.2472552150750116	-0.1201983911203722	-0.5532267485314771
4	0.1000633402191776	0.0593797707133972	0.2004819636064887
5	0.1740522657405911	0.0056060312002854	0.066291074055034
6	0.1744976824615919	-0.0003861973721281	-0.0069110744785864
7	0.1744953741783528	2.011816623459506e-06	0.0004454167210008
8		7.079812014421093e-10	-2.3082832391330133e-06

## ex2\_summary\_roots.csv

method	root	f(root)	niter
bisection	0.1744953691959381	-3.632992018332004e-09	25.0
newton_0.3	0.1744953733657522	-4.3853809472693675e-15	5.0
secant	0.1744953741783528	7.079812014421093e-10	8.0
newton_0.7_epsilon_4			

## newton\_f1\_x0\_0.5.csv

k	xk	f(xk)	f'(xk)	step
1	0.5	-0.5	0.3032653298563167	0.3032653298563167
2	-0.1666666666666666	-0.8243606353500641	2.4730819060501923	0.1428571428571428
3	-0.0238095238095238	-0.1968934021442743	1.3782538150099206	0.0232558139534884
4	-0.0005537098560354	-0.0243832198464995	1.0484784533994782	0.0005534034311012
5	-3.0642493416461764e-07	-0.000554016535538	1.0011078797171735	3.0642484026840615e-07
6	-9.389621148813321e-14	-3.064250280608724e-07	1.0000006128500092	9.38962114881244e-14
7		-9.389621148814204e-14	1.000000000001878	

# newton\_f1\_x0\_2.csv



## newton\_f2\_x0\_0.62.csv

k	xk	f(xk)	f'(xk)	step
1	0.62	-3.381672	0.1532	22.073577023498693
2	22.69357702349869	11661.463145467556	1543.9953143644036	-7.552784025298728
3	15.140792998199966	3452.7892917550816	686.7308378430233	-5.0278640520061
4	10.112928947999356	1021.1497840476172	305.8139957218501	-3.339120505708945
5	6.773808442290413	301.03887505787065	136.65344243853465	-2.202936638008772
6	4.570871804281642	87.92775425229144	61.67860715353073	-1.4255794401034574
7	3.145292364178184	24.970657411507105	28.67859216847277	-0.8707072252646381
8	2.274585138913546	6.4935214144321645	14.521212662499067	-0.4471748720547037
9	1.8274102668588423	1.275095263703686	9.018284850263315	-0.1413899965320407
10	1.6860202703268017	0.1067694488011241	7.527993055858584	-0.0141829898100174
11	1.6718372805167845	0.0010146123394019	7.38511967757727	-0.0001373860389131
12	1.6716998944778712	9.466481065700805e-08	7.383741611591976	-1.2820710100200512e-08
13	1.671699881657161	8.881784197001252e-16	7.383741482997699	-1.202883960313758e-16

## newton\_f3\_x0\_1.0.csv

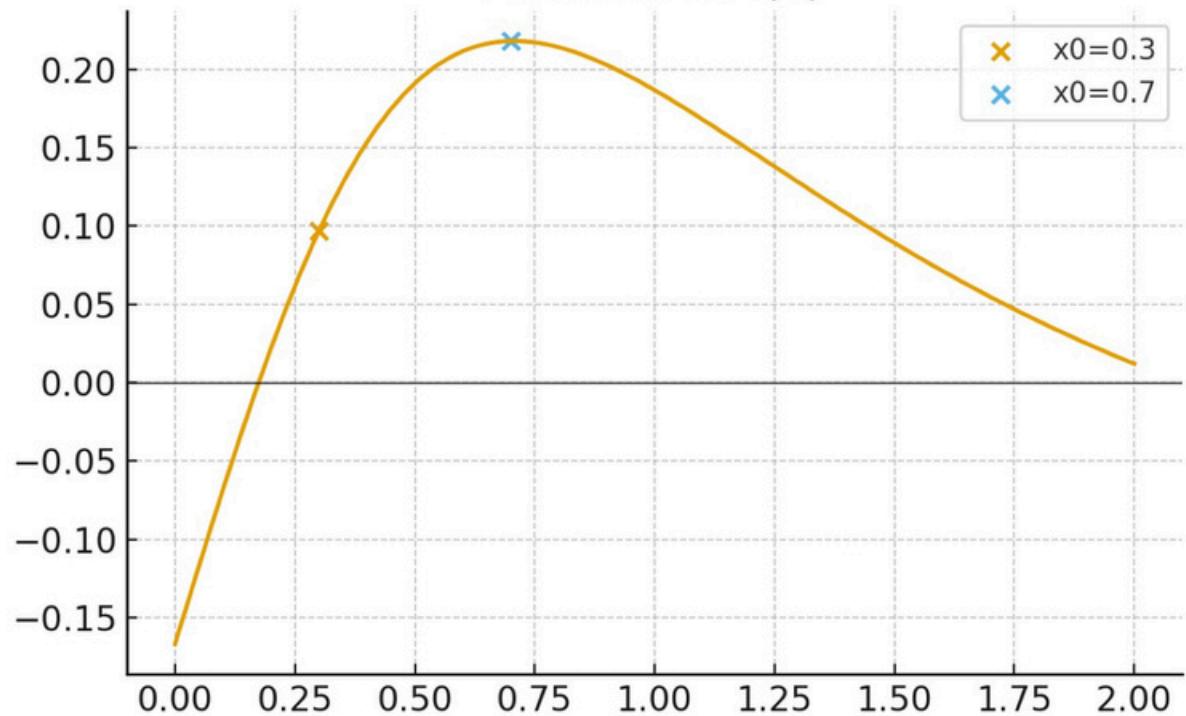
k	xk	f(xk)	f'(xk)	step
1	1.0	0.7853981633974483	0.5	-1.5707963267948966
2	-0.5707963267948966	-0.5186693692550166	0.7542567725392094	0.6876562307938097
3	0.1168599039989131	0.1163322651138959	0.9865277431717276	-0.1179209261159578
4	-0.0010610221170447	-0.00106102171889	0.9999988742333344	0.0010610229133543
5	7.963096044106415e-10	7.963096044106415e-10	1.0	-7.963096044106415e-10

## newton\_f3\_x0\_1.45\_error.csv

error
Newton step too large: -416375105.2821845

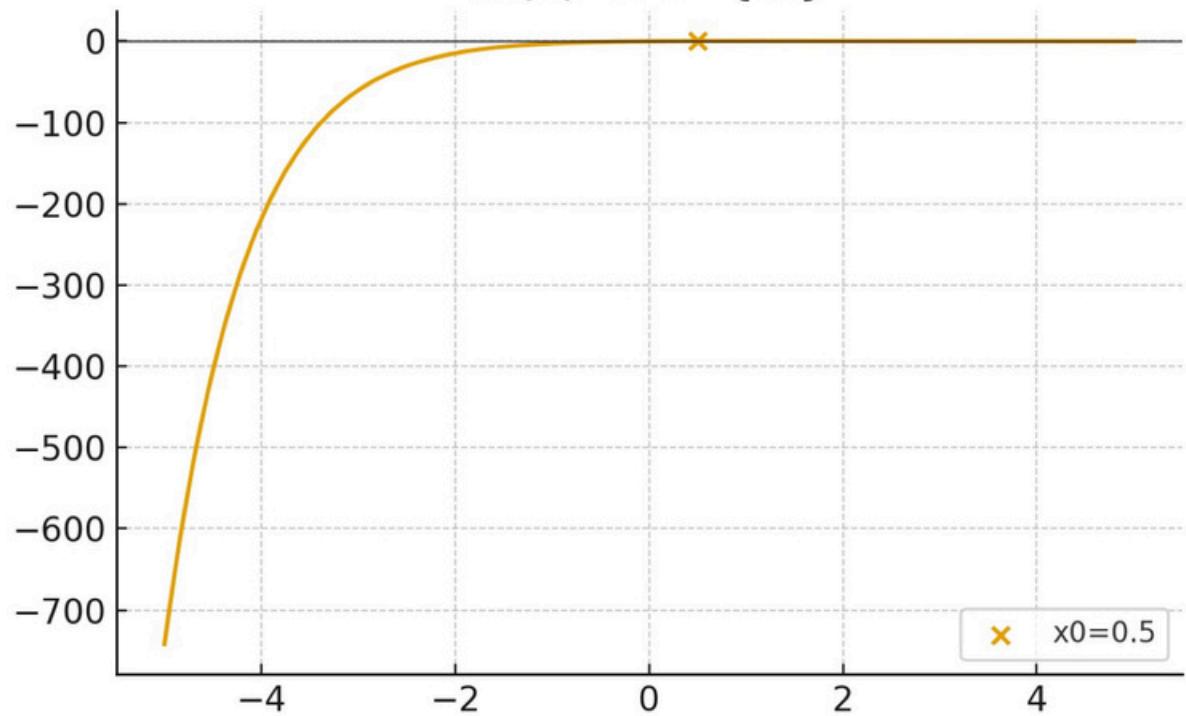
ex2\_function.png

### Exercise II: $f(x)$

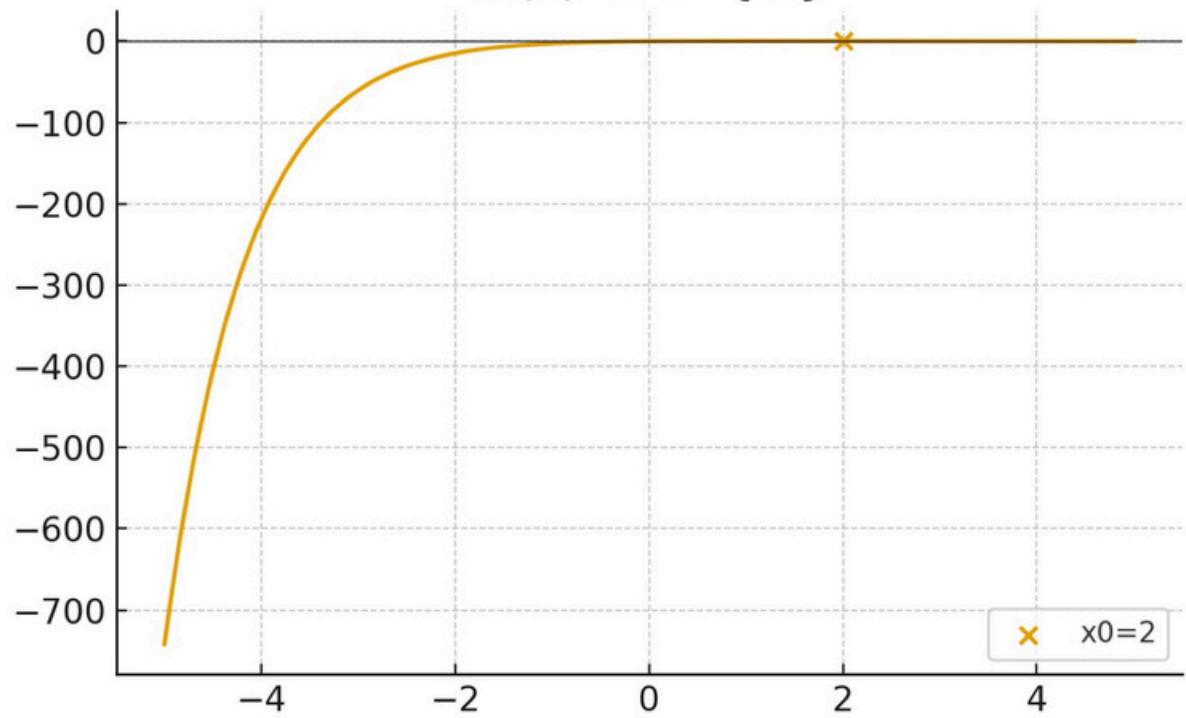


f1\_x0\_0.5.png

$$f1(x) = x e^{\{-x\}}$$

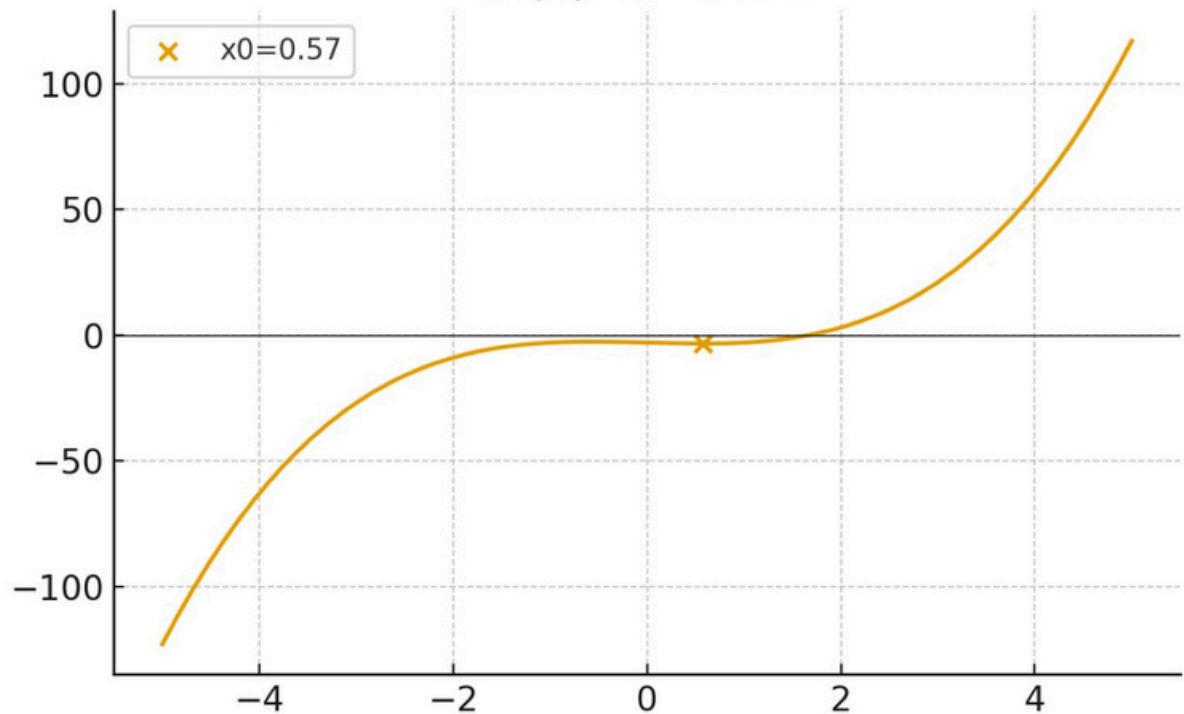


f1\_x0\_2.png  
 $f1(x)=x e^{\{-x\}}$



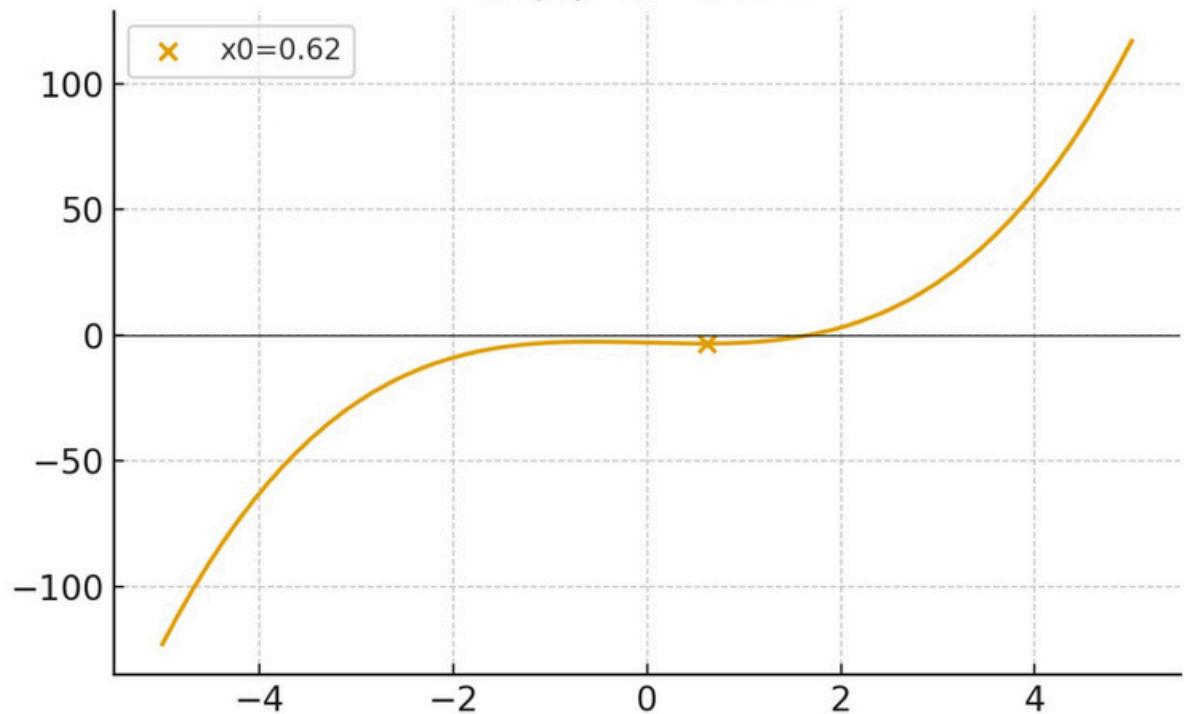
f2\_x0\_0.57.png

$$f2(x) = x^3 - x - 3$$



f2\_x0\_0.62.png

$$f2(x) = x^3 - x - 3$$



f3\_x0\_1.0.png

$$f3(x) = \arctg(x)$$

