TALLER 1

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Taller 1

1. Aproxime con 10^{-4} de precisión las raíces de las siguientes ecuaciones en los intervalos dados usando el método de la secante:

(a) $x^3 - 2\,x^2 - 5 = 0$ $[4,1]$

(b) $x - \cos x = 0$ $[0, \pi/2]$

(c) $x^3 + 3\,x^2 - 1 = 0$ $[-4, 0]$

(d) $x - 0.8 - 0.2 \sin x = 0$ $[0, \pi/2]$

a) $f(x) = x^3 - 2x^2 - 5 = 0.$

$f(4) = 4^3 - 2(4^2) - 5 =$64−32−5= **27**

$f(1) = 1^3 - 2(1^2) - 5 =$1−2−5= **−6**

Método Secante:

$$x_2 = x_1 - \frac{f(x1)(x1 - x0)}{f(x1) - f(x0)}$$

$X_0 = 4$

$X_1 = 1$

$$x_2 = 1 - \frac{(-6)(1-4)}{-6-27} \qquad x_2 = 1 - \frac{-6 \cdot (-3)}{-33} = 1 - \frac{18}{-33} = 1 + \frac{18}{33} \qquad x_2 \approx 1 + 0.5455 = 1.5455$$

ITERACION #2

$X_1 = 1$

$X_2 = 1.5455$

$f(x2) = 1.5455^3 - 2(1.5455)^2 - 5$

$= 3.69154 - 4.77714 - 5 = \mathbf{-6.0856}$

$$x_3 = x_2 - \frac{f(x2)(x2 - x1)}{f(x2) - f(x1)}$$

$$x_3 = 1.5455 - \frac{(-6.0856)(1.5455 - 1)}{(-6.0856) - (-6)}$$

$$x_3 = 1.5455 - \frac{-3.3196948}{-0.0856} = 1.5455 - 38.78148 = \mathbf{-37.23598}$$

ITERACION #3

$X_2 = 1.5455$

$X_3 = -37.2$

$f(x3) = -37.23598^3 - 2(37.23598)^2 - 5$

$= 51628.36421 - 2773.03641 - 5 = \mathbf{-54406.40062}$

Método secante

$$x_4 = -37.23598 - \frac{(-54406.40062)(-37.23598 - 1.5455)}{(-54406.40062) - (-6.0856)}$$

$$x_4 = -37.23598 - \frac{2109960.7375165176}{-54400.31502} = -37.23598 + 38.78595 = \mathbf{1.54997}$$

ITERACION #4

$X_3 = -37.2$

$X_4 = 1.54997$

$f(x4) = 1.54997^3 - 2(1.54997)^2 - 5$

$= 3.723658779 - 4.804814002 - 5 = -6.081155223$

Método secante:

$$x_5 = 1.54997 - \frac{(-6.08116)(1.54997 + 37.23598)}{(-6.08116) + 54251528}$$

$$x_5 = 1.54997 - \frac{-235.8635677}{54245.44684} = 1.54997 + 0.00434808 = 1.55431808$$

x	x_0	x_1	$f(x_0)$	$f(x_1)$	n	$f(x_n)$	Er %
1	4	1	27	-6,00000000	1,545	-1,09441759	
2	1	1,5	-6	-6,08564989	-37,21052632	73,87712395	-104,2
3	1,5	-37,2	-6,0856499	-54296,80711474	1,549798848	-1,10182664	2500,99
4	-37,2	1,5	-54296,807	-6,08132755	1,554140552	-1,10923630	0,2794
5	1,5	1,6	-6,0813276	-6,07690789	7,523857627	-12,60905503	79,34383359
6	1,6	7,5	-6,0769079	307,69692764	1,669757014	-1,30832028	350,595958829597000
7	7,5	1,7	307,69693	-5,92074667	1,780275806	-1,50154497	6,207959023296750
8	1,7	1,8	-5,9207467	-5,69638989	4,586333854	-6,81655052	61,183030644146500
9	1,8	4,6	-5,6963899	49,40213137	2,070381608	-2,01992447	121,521184062628000
10	4,6	2,1	49,402131	-4,69831064	2,288877517	-2,41886155	9,545985164282340
11	2,1	2,3	-4,6983106	-3,48658216	2,917569463	-3,59454502	21,548482538094100
12	2,3	2,9	-3,4865822	2,81054540	2,636970533	-3,06561266	10,640958120479200
13	2,9	2,6	2,8105454	-0,57075305	2,684334791	-3,15447825	1,764469128373660
14	2,6	2,7	-0,570753	-0,06892077	2,690839716	-3,16669704	0,241743301922935
15	2,7	2,7	-0,0689208	0,00210675	2,690646774	-3,16633457	0,007170857356015
16	2,7	2,7	0,0021067	-0,00000739	2,690647448	-3,16633584	0,000025056582126

$$\left(\frac{2{,}690647448 - 2{,}7}{2{,}690647448}\right) * 100 = \frac{0{,}000000674}{2{,}690647448} * 100 = 0.00002504$$

Después de 16 iteraciones el error de aproximación es 0.00002504, siendo menor que 10^{-4}=0.0001

b) $f(x) = x - \cos(x) = 0.$

$X_0 = 0$

$X_1 = \frac{\pi}{2} = 1{,}5708$

$f(0) = 0 - \cos(0) = \mathbf{-1}$

$$f(1{,}5708) = 1{,}5708 - \cos(1{,}5708) \ = 1{,}5708 - (-3.6732 \times 10^{-6}) = \ \mathbf{1.5708}$$

Método secante:

$$x_2 = x_1 - \frac{f(x1)(x1 - x0)}{f(x1) - f(x0)}$$

$$x_2 = 1.5708 - \frac{1.5708\ (1.5708 - 0)}{1.5708 - (-1)} = \ 1.5708 - \frac{1.5708\ (1.5708)}{2.5708} = \ 1.5708 - \frac{2.46741264}{2.5708}$$

$$= \ 1.5708 - 0.959784 = \mathbf{0.611016}$$

ITERACION #2

X_1 = **1.5708**

X_2= $\mathbf{0.611016}$

$f(0.611016) = 0.611016 - \cos(0.611016) \ = 0.611016 - 0.819066 =$ **- 0.20805**

$$x_3 = 0.611016 - \frac{-0.20805\ (0.611016 - 1.5708)}{-0.20805 - 1.5708} = 0.611016 - \frac{-0.20805\ (-0.959784)}{-1.77885}$$

$$= 0.611016 - \frac{0.1996830612}{-1.77885} = \ 0.611016 - (-0.112254) = \ \mathbf{0.72327}$$

ITERACION #3

$X_2 = \mathbf{0.611016}$

$X_3 = \mathbf{0.72327}$

$f(0.72327) = 0.72327 - \cos(0.72327) = 0.72327 - 0.749646 = \mathbf{-0.0263755}$

Método secante:

$$x_4 = 0.72327 - \frac{-0.0263755\ (0.72327 - 0.611016)}{-0.0263755 - (-0.20805)} = \ 0.72327 - \frac{-0.0263755\ (0.112254)}{0.1816745}$$

$$= \ 0.72327 - \frac{-0.002960755377}{0.1816745} = \mathbf{0.739567}$$

ITERACION #4

$X_3 = \mathbf{0.72327}$

$X_4 = \mathbf{0.739567}$

$f(0.739567) = 0.739567 - \cos(0.739567) = \ 0.739567 - 0.73876 = \ 0.000806544$

$$x_5 = \ 0.739567 - \frac{0.000806544\ (0.739567 - 0.72327)}{0.000806544 - (-0.0263755)} = 0.739567 - \frac{0.000806544\ (0.016297)}{0.027182044}$$

$$= 0.739567 - \frac{0.000013144247568}{0.027182044} \ = \mathbf{0.739083}$$

ITERACION #5

$X_4 = \mathbf{0.739567}$

$X_5 = \mathbf{0.739083}$

$f(0.739083) = 0.739083 - \cos(0.739083) = 0.739083 - 0.739087 = 0.00000357017$

$$x_6 = 0.739083 - \frac{0.00000357017\ (0.739083 - 0.739567)}{0.00000357017 - 0.000806544} = 0.739083 - \frac{0.00000357017\ (-0.000484)}{0.00080297383} = \mathbf{0.739085}$$

ITERACION #6

$X_5 = \mathbf{0.739083}$

$X_6 = \mathbf{0.739085}$

$f(\mathbf{0.739085}) = \mathbf{0.739085} - \cos(\mathbf{0.739085}) = \mathbf{0.739085} - 0.739085 = 0$

$$x_7 = 0.739085 - \frac{0\ (\mathbf{0.739085} - \mathbf{0.739083})}{0 - 0.00000357017} = 0.739085 - \frac{0}{-0.00000357017} = 0.739085$$

ERROR DE APROX

$$\frac{0.739085 - 0.739085}{0.739085} * \mathbf{100} = \mathbf{0}$$

c) $f(x) = x^3 + 3 * x^2 - 1 = 0.$

$X_0 = -4$

$X_1 = 0$

$\boldsymbol{f}(-4) = -4^3 + 3 * -4^2 - 1 = 64 + 3 * 16 - 1 = -17$

$\boldsymbol{f}(0) = 0^3 + 3 * 0^2 - 1 = -1$

Método secante

$$x_2 = x_1 - f(x_1) \cdot \frac{x_1 - x_0}{f(x_1) - f(x_0)}$$

$$x_2 = 0 - (-1) \cdot \frac{0 - (-4)}{-1 - (-17)}$$

$$x_2 = 0 + \frac{4}{16} = 0.25$$

ITERACION #2

$$x_0 = 0, x_1 = 0.25$$

$$f(x_0) = -1$$

$$f(x_1) = (0.25)^3 + 3(0.25)^2 - 1 = 0.015625 + 0.1875 - 1 = -0.796875$$

Método secante

$$x_3 = x_1 - f(x_1) \cdot \frac{x_1 - x_0}{f(x_1) - f(x_0)}$$

$$x_3 = 0.25 - (-0.796875) \cdot \frac{0.25 - 0}{-0.796875 - (-1)}$$

$$x_3 = 0.25 + 0.25 \cdot \frac{0.25}{0.203125} \approx 0.25 + 0.3077 \approx 0.5577$$

ITERACION #3

$$x_0 = 0.25, x_1 = 0.5577$$

$$f(x_0) = -0.796875$$

$$f(x_1) = (0.5577)^3 + 3(0.5577)^2 - 1 \approx 0.1734 + 0.9335 - 1 = 0.1069$$

Método secante

$$x_4 = x_1 - f(x_1) \cdot \frac{x_1 - x_0}{f(x_1) - f(x_0)}$$

$$x_4 = 0.5577 - 0.1069 \cdot \frac{0.5577 - 0.25}{0.1069 - (-0.796875)}$$

$$x_4 = 0.5577 - 0.1069 \cdot \frac{0.3077}{0.903775} \approx 0.5577 - 0.0364 = 0.5213$$

ITERACION #4

$$x_0 = 0.5577,\ x_1 = 0.5213$$

$$f(x_0) = 0.1069$$

$$f(x_1) = (0.5213)^3 + 3(0.5213)^2 - 1 \approx 0.1418 + 0.8157 - 1 = -0.0425$$

Método secante

$$x_5 = x_1 - f(x_1) \cdot \frac{x_1 - x_0}{f(x_1) - f(x_0)}$$

$$x_5 = 0.5213 - (-0.0425) \cdot \frac{0.5213 - 0.5577}{-0.0425 - 0.1069}$$

$$x_5 = 0.5213 + 0.0425 \cdot \frac{-0.0364}{-0.1494} \approx 0.5213 + 0.0103 = 0.5316$$

ITERACION #5

$$x_0 = 0.5213,\ x_1 = 0.5316$$

$$f(x_0) = -0.0425$$

$$f(x_1) = (0.5316)^3 + 3(0.5316)^2 - 1 \approx 0.1502 + 0.8468 - 1 = -0.0030$$

Método secante

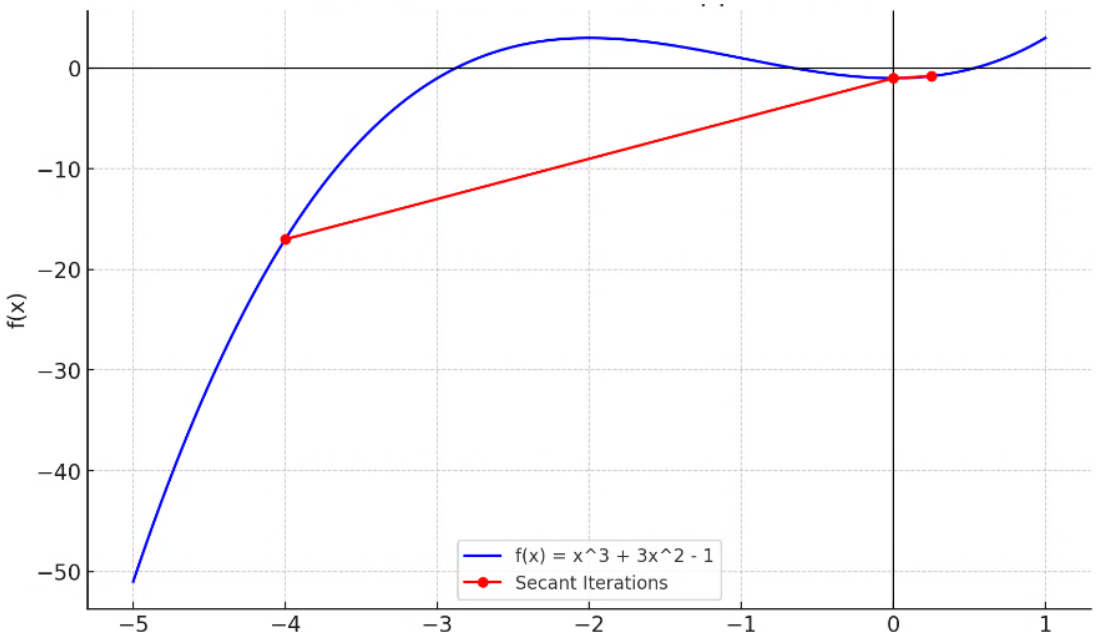
$$x_6 = x_1 - f(x_1) \cdot \frac{x_1 - x_0}{f(x_1) - f(x_0)}$$

$$x_6 = 0.5316 - (-0.0030) \cdot \frac{0.5316 - 0.5213}{-0.0030 - (-0.0425)}$$

$$x_6 = 0.5316 + 0.0030 \cdot \frac{0.0103}{0.0395} \approx 0.5316 + 0.0008 = 0.5324$$

ERROR DE APROX

$\frac{0.5324 - 0.5316}{0.5324} * \mathbf{100} = 0.150$



d) . $f(x) = x - 0.8 - 0.2\,sinx = 0$

$X_0 = 0$

$X_1 = \frac{\pi}{2} = 1{,}5708$

$f(0) = 0 - 0.8 - 0.2 * \sin(0) = -0.8$

$f(1.5708) = 1.5708 - 0.8 - 0.2\ \sin(1.5708) = \ 1.5708 - 0.8 - 0.2 * 1 = \ -0.5708$

Método secante

$$x_2 = x_1 - f(x_1) \cdot \frac{x_1 - x_0}{f(x_1) - f(x_0)}$$

$$x_2 = 1.5708 - 0.5708 \cdot \frac{1.5708 - 0}{0.5708 - (-0.8)}$$

$$x_2 = 1.5708 - 0.5708 \cdot \frac{1.5708}{1.3708} \approx 1.5708 - 0.6537 \approx 0.9171$$

ITERACION #2

$X_1 = \frac{\pi}{2} = 1{,}5708$

$X_2 = 0.9171$

$f(0.9171) = 0.9171 - 0.8 - 0.2 * \sin(0.9171) = 0.9171 - 0.8 - 0.2(0.7931) = -0.0415$

Metodo secante

$$x_3 = 0.9171 - \frac{-0.0415\ (0.9171 - 1{,}5708)}{-0.5708 - (-0.0415)} = 0.9614$$

ITERACION #3

$X_2 = 0.9171$

$X_3 = 0.9614$

$$f(x_1) = 0.9614 - 0.8 - 0.2\sin(0.9614)$$

$$f(x_1) = 0.9614 - 0.8 - 0.2(0.8197) = 0.9614 - 0.8 - 0.1639 = -0.0025$$

Metodo secante

$$x_4 = x_1 - f(x_1) \cdot \frac{x_1 - x_0}{f(x_1) - f(x_0)}$$

$$x_4 = 0.9614 - (-0.0025) \cdot \frac{0.9614 - 0.9171}{-0.0025 - (-0.0415)}$$

$$x_4 = 0.9614 + 0.0025 \cdot \frac{0.0443}{0.039} \approx 0.9614 + 0.0028 = 0.9642$$

$$f(0.9642) = 0.9642 - 0.8 - 0.16424 = 0.9642 - 0.96424 \approx -0.00004$$

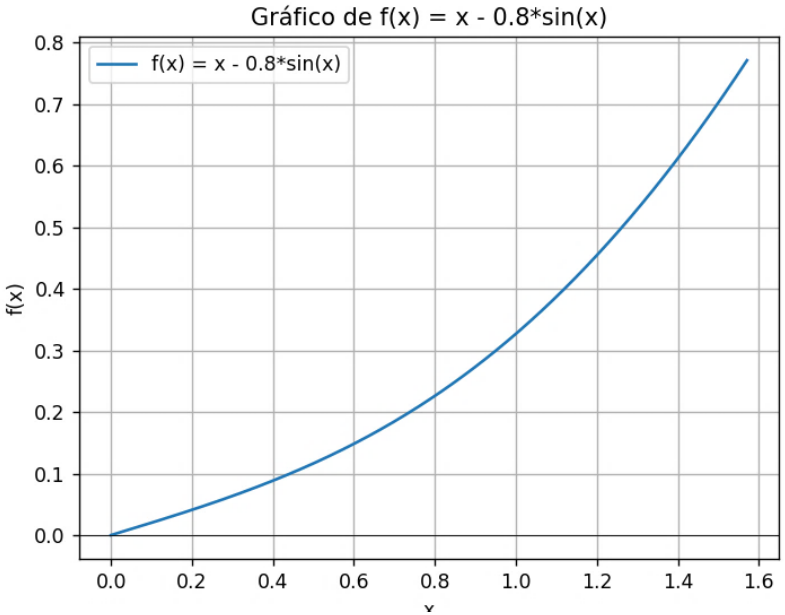


Gráfico de f(x) = x - 0.8*sin(x)
f(x) = x - 0.8*sin(x)
f(x)
x
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6

2. Encuentre una raíz aproximada de $x^3 - x - 1 = 0$ en $[1, 2]$ con precisión de 10^{-5} por el método de la secante.

ITERACION #1

$$x_0 = 1, \quad x_1 = 2$$

$$f(x_0) = 1^3 - 1 - 1 = -1$$

$$f(x_1) = 2^3 - 2 - 1 = 8 - 2 - 1 = 5$$

Metodo secante

$$x_2 = x_1 - f(x_1) \cdot \frac{x_1 - x_0}{f(x_1) - f(x_0)}$$

$$x_2 = 2 - 5 \cdot \frac{2 - 1}{5 - (-1)}$$

$$x_2 = 2 - 5 * \frac{1}{6} = 2 - 0.8333 = 1.1667$$

ITERACION #2

$$x_0 = 2, x_1 = 1.1667$$

$$f(x_1) = (1.1667)^3 - 1.1667 - 1$$

$$f(x_1) = 1.588 - 1.1667 - 1 = -0.5787$$

Metodo secante

$$x_3 = x_1 - f(x_1) \cdot \frac{x_1 - x_0}{f(x_1) - f(x_0)}$$

$$x_3 = 1.1667 - (-0.5787) \cdot \frac{1.1667 - 2}{-0.5787 - 5}$$

$$x_3 = 1.1667 + 0.5787 \cdot \frac{-0.8333}{-5.5787} \approx 1.1667 + 0.0864 = 1.2531$$

ITERACION #3

$$x_0 = 1.1667, x_1 = 1.2531$$

$$f(x_0) = -0.5787$$

$$f(x_1) = (1.2531)^3 - 1.2531 - 1$$

$$(1.2531)^3 \approx 1.9696$$

$$f(x_1) = 1.9696 - 1.2531 - 1 = -0.2835$$

Metodo secante

$$x_4 = x_1 - f(x_1) \cdot \frac{x_1 - x_0}{f(x_1) - f(x_0)}$$

$$x_4 = 1.2531 - (-0.2835) \cdot \frac{1.2531 - 1.1667}{-0.2835 - (-0.5787)}$$

$$x_4 = 1.2531 + 0.2835 \cdot \frac{0.0864}{0.2952} \approx 1.2531 + 0.0829 = 1.3360$$

ITERACION #4

$$x_0 = 1.2531, x_1 = 1.3360$$

$$f(x_0) = -0.2835$$

$$f(x_1) = (1.3360)^3 - 1.3360 - 1$$

$$(1.3360)^3 \approx 2.382$$

$$f(x_1) = 2.382 - 1.3360 - 1 = 0.046$$

Metodo secante

$$x_5 = 1.3360 - 0.046 \cdot \frac{1.3360 - 1.2531}{0.046 - (-0.2835)}$$

$$x_5 = 1.3360 - 0.046 \cdot \frac{0.0829}{0.3295} \approx 1.3360 - 0.0116 = 1.3244$$

ITERACION #5

$$x_0 = 1.3360,\ x_1 = 1.3244$$

$$f(x_0) = 0.046$$

$$f(x_1) = (1.3244)^3 - 1.3244 - 1$$

$$f(x_1) = 2.323 - 1.3244 - 1 = -0.0014$$

Metodo secante

$$x_6 = x_1 - f(x_1) \cdot \frac{x_1 - x_0}{f(x_1) - f(x_0)}$$

$$x_6 = 1.3244 - (-0.0014) \cdot \frac{1.3244 - 1.3360}{-0.0014 - 0.046}$$

$$x_6 = 1.3244 + 0.0014 \cdot \frac{-0.0116}{-0.0474} \approx 1.3244 + 0.000342 = 1.3247$$

ITERACION #6

$$x_0 = 1.3244,\ x_1 = 1.3247$$

$$f(x_0) = -0.0014$$

$$f(x_1) = (1.3247)^3 - 1.3247 - 1$$

$$(1.3247)^3 \approx 2.323$$

$$f(x_1) = 2.323 - 1.3247 - 1 \approx 0.000036$$

Metodo secante

$$x_7 = x_1 - f(x_1) \cdot \frac{x_1 - x_0}{f(x_1) - f(x_0)}$$

$$x_7 = 1.3247 - 0.000036 \cdot \frac{1.3247 - 1.3244}{0.000036 - (-0.0014)}$$

$$x_7 = 1.3247 - 0.000036 \cdot \frac{0.0003}{0.001436} \approx 1.3247 - 0.0000075 = 1.3247$$

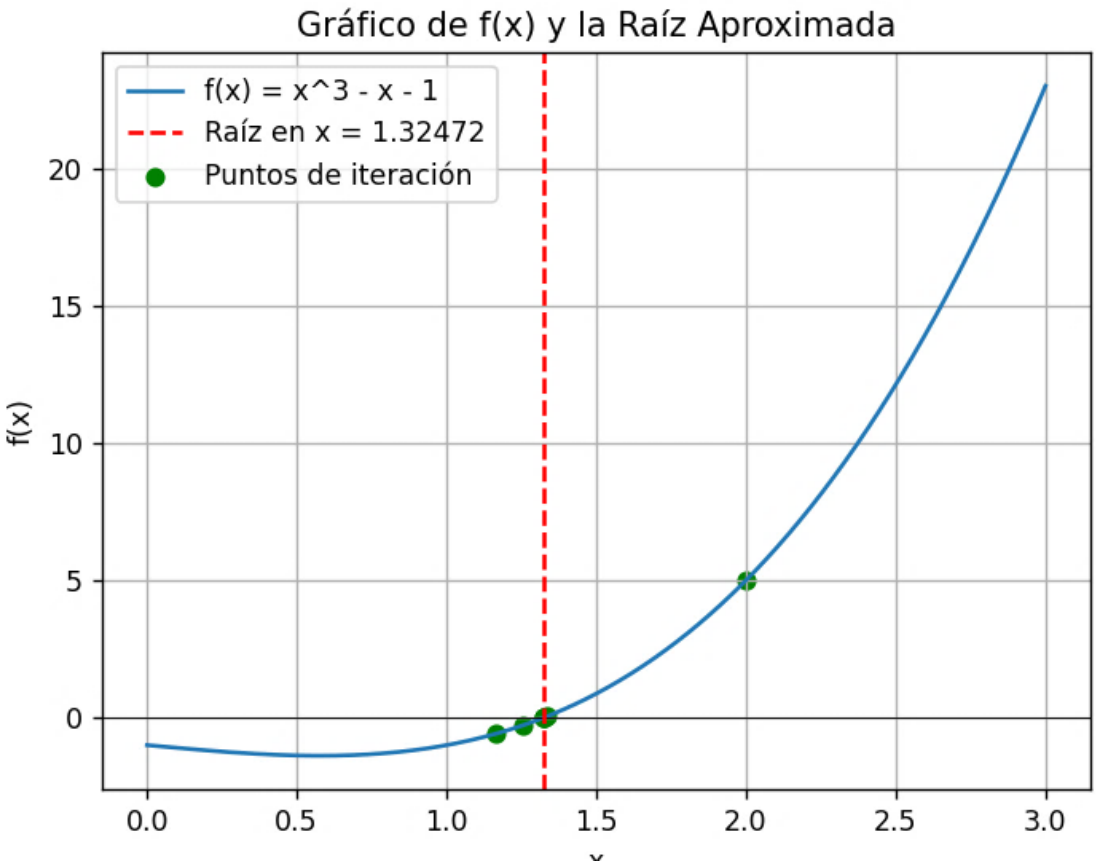


Gráfico de f(x) y la Raíz Aproximada
f(x) = x^3 - x - 1
Raíz en x = 1.32472
Puntos de iteración
f(x)
20
15
10
5
0
0.0
0.5
1.0
1.5
2.0
2.5
3.0

(3 - A)

Primera Iteración

$$x_0 = 0,\ x_1 = 1$$

$$f(x_0) = 0 - \frac{2 - e^0 + 0^2}{3} = 0 - \frac{2 - 1}{3} = -\frac{1}{3} = -0.3333$$

$$f(x_1) = 1 - \frac{2 - e^1 + 1^2}{3} = 1 - \frac{2 - 2.718 + 1}{3} = 1 - \frac{0.282}{3} = 1 - 0.094 = 0.906$$

$$x_2 = x_1 - f(x_1) \cdot \frac{x_1 - x_0}{f(x_1) - f(x_0)}$$

$$x_2 = 1 - 0.906 \cdot \frac{1 - 0}{0.906 - (-0.3333)} = 1 - 0.906 \cdot \frac{1}{1.2393} \approx 1 - 0.7308 = 0.2692$$

Segunda Iteración

$$x_0 = 1,\ x_1 = 0.2692$$

$$f(x_1) = 0.2692 - \frac{2 - e^{0.2692} + (0.2692)^2}{3}$$

$$f(0.2692) = 0.2692 - \frac{2 - 1.3089 + 0.0724}{3} = 0.2692 - \frac{0.7635}{3} = 0.2692 - 0.2545 = 0$$

$$x_3 = x_1 - f(x_1) \cdot \frac{x_1 - x_0}{f(x_1) - f(x_0)}$$

$$x_3 = 0.2692 - 0.0147 \cdot \frac{0.2692 - 1}{0.0147 - 0.906} = 0.2692 + 0.0147 \cdot \frac{-0.7308}{-0.8913}$$

$$x_3 = 0.2692 + 0.0121 = 0.2813$$

Tercera Iteración

$$x_0 = 0.2692, x_1 = 0.2813$$

$$f(x_1) = 0.2813 - \frac{2 - e^{0.2813} + (0.2813)^2}{3}$$

$$f(0.2813) = 0.2813 - \frac{2 - 1.3247 + 0.0791}{3} = 0.2813 - \frac{0.7544}{3} = 0.2813 - 0.2515 = 0$$

$$x_4 = x_1 - f(x_1) \cdot \frac{x_1 - x_0}{f(x_1) - f(x_0)}$$

$$x_4 = 0.2813 - 0.0298 \cdot \frac{0.2813 - 0.2692}{0.0298 - 0.0147} = 0.2813 - 0.0298 \cdot \frac{0.0121}{0.0151}$$

$$x_4 = 0.2813 - 0.0239 = 0.2574$$

Cuarta Iteración

$$x_0 = 0.2692, x_1 = 0.2813$$

$$f(0.2813) = 0.2813 - \frac{2 - e^{0.2813} + (0.2813)^2}{3}$$

$$e^{0.2813} \approx 1.3247 \quad \text{y} \quad (0.2813)^2 \approx 0.0791$$

$$f(0.2813) = 0.2813 - \frac{2 - 1.3247 + 0.0791}{3} = 0.2813 - \frac{0.7544}{3} = 0.2813 - 0.2515 = 0$$

$$x_4 = 0.2813 - 0.0298 \cdot \frac{0.2813 - 0.2692}{0.0298 - 0.0147}$$

$$x_4 = 0.2813 - 0.0298 \cdot \frac{0.0121}{0.0151} \approx 0.2813 - 0.0239 = 0.2574$$

Quinta Iteracion

$$x_0 = 0.2813, x_1 = 0.2574$$

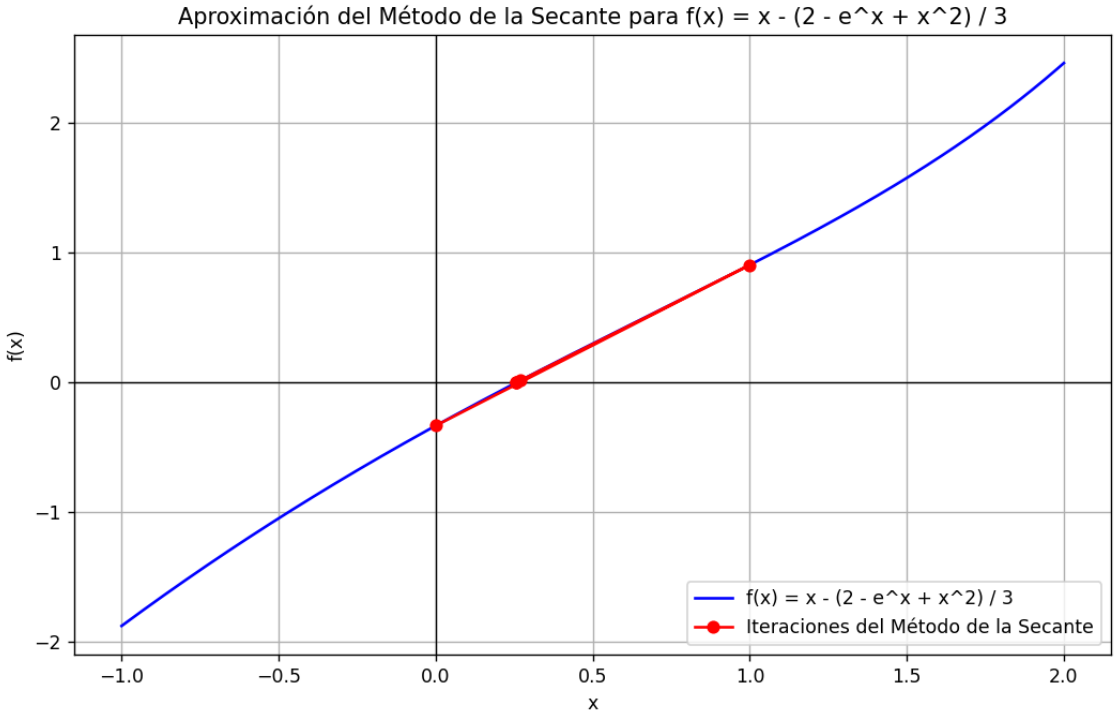
$$f(0.2574) = 0.2574 - \frac{2 - e^{0.2574} + (0.2574)^2}{3}$$

$$f(0.2574) = 0.2574 - \frac{2 - 1.2937 + 0.0663}{3} = 0.2574 - \frac{0.7726}{3} = 0.2574$$

$$x_5 = 0.2574 - (-0.0001) \cdot \frac{0.2574 - 0.2813}{-0.0001 - 0.0298}$$

$$x_5 = 0.2574 + 0.0001 \cdot \frac{-0.0239}{-0.0299} \approx 0.2574 + 0.0001 \approx 0.2575$$

$$\text{Error} = \left| \frac{0.2574 - 0.2813}{0.2574} \right| \times 100 = \left| \frac{-0.0239}{0.2574} \right| \times 100 \approx 9.29\%$$



(3 - B)

- $x_0 = 0$
- $x_1 = 1$

Primera Iteración

- $f(x_0) = 3 \cdot 0^2 - e^0 = -1$
- $f(x_1) = 3 \cdot 1^2 - e^1 = 3 - 2.7182818284 = 0.2817181716$
- $x_2 = x_1 - f(x_1) \cdot \frac{x_1 - x_0}{f(x_1) - f(x_0)}$
- $x_2 = 1 - 0.2817181716 \cdot \frac{1-0}{0.2817181716 - (-1)}$
- $x_2 = 1 - 0.2817181716 \cdot \frac{1}{1.2817181716}$
- $x_2 = 1 - 0.2192988321 = 0.7807011679$

Segunda Iteración

- $f(x_0) = -1$
- $f(x_1) = 0.2817181716$
- $f(x_2) = 3 \cdot (0.7807011679)^2 - e^{0.7807011679} = 1.8269893807 - 2.1833054892 = -0.3563161085$
- $x_3 = x_2 - f(x_2) \cdot \frac{x_2 - x_1}{f(x_2) - f(x_1)}$
- $x_3 = 0.7807011679 - (-0.3563161085) \cdot \frac{0.7807011679 - 1}{-0.3563161085 - 0.2817181716}$
- $x_3 = 0.7807011679 + 0.3563161085 \cdot \frac{-0.2192988321}{-0.6380342801}$
- $x_3 = 0.7807011679 + 0.1144724244 = 0.8951735923$

Tercera Iteración

- $f(x_1) = 0.2817181716$
- $f(x_2) = -0.3563161085$
- $f(x_3) = 3 \cdot (0.8951735923)^2 - e^{0.8951735923} = 2.4083468171 - 2.4481236716 = -0.0397768545$
- $x_4 = x_3 - f(x_3) \cdot \frac{x_3 - x_2}{f(x_3) - f(x_2)}$
- $x_4 = 0.8951735923 - (-0.0397768545) \cdot \frac{0.8951735923 - 0.7807011679}{-0.0397768545 - (-0.3563161085)}$
- $x_4 = 0.8951735923 + 0.0397768545 \cdot \frac{0.1144724244}{0.3165392540}$
- $x_4 = 0.8951735923 + 0.0138428446 = 0.9090164369$

Cuarta Iteración

- $f(x_2) = -0.3563161085$
- $f(x_3) = -0.0397768545$
- $f(x_4) = 3 \cdot (0.9090164369)^2 - e^{0.9090164369} = 2.4776460801 - 2.4854475638 = -0.0078014837$
- $x_5 = x_4 - f(x_4) \cdot \frac{x_4 - x_3}{f(x_4) - f(x_3)}$
- $x_5 = 0.9090164369 - (-0.0078014837) \cdot \frac{0.9090164369 - 0.8951735923}{-0.0078014837 - (-0.0397768545)}$
- $x_5 = 0.9090164369 + 0.0078014837 \cdot \frac{0.0138428446}{0.0319753708}$
- $x_5 = 0.9090164369 + 0.0078014837 \cdot 0.4335566603 = 0.9090164369 + 0.0033793350 = 0.9123957719$

Quinta Iteración

- $f(x_3) = -0.0397768545$
- $f(x_4) = -0.0078014837$
- $f(x_5) = 3 \cdot (0.9123957719)^2 - e^{0.9123957719} = 2.4920785935 - 2.4947612217 = -0.0026826282$
- $x_6 = x_5 - f(x_5) \cdot \frac{x_5 - x_4}{f(x_5) - f(x_4)}$
- $x_6 = 0.9123957719 - (-0.0026826282) \cdot \frac{0.9123957719 - 0.9090164369}{-0.0026826282 - (-0.0078014837)}$
- $x_6 = 0.9123957719 + 0.0026826282 \cdot \frac{0.0033793350}{0.0051188555}$
- $x_6 = 0.9123957719 + 0.0026826282 \cdot 0.6592666796 = 0.9123957719 + 0.0017684193 = 0.9141641912$

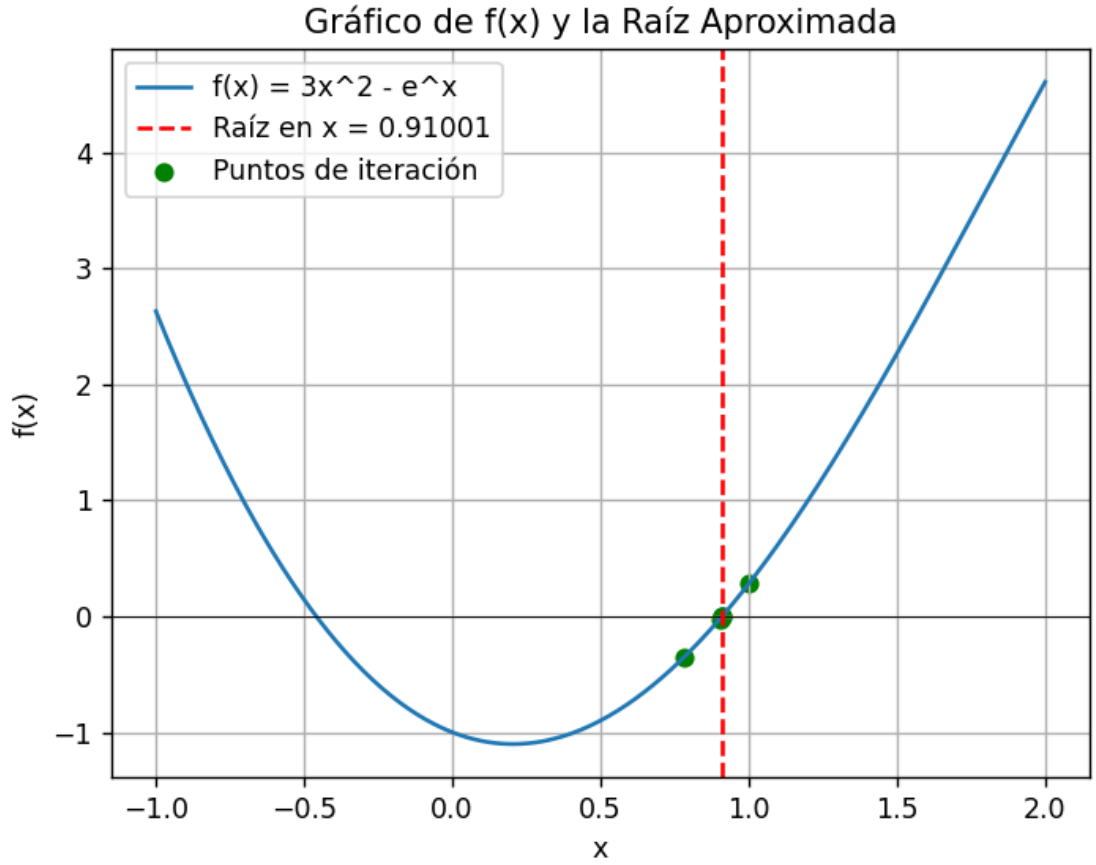


Gráfico de f(x) y la Raíz Aproximada
f(x) = 3x^2 - e^x
Raíz en x = 0.91001
Puntos de iteración
f(x)
x
4
3
2
1
0
−1
−1.0
−0.5
0.0
0.5
1.0
1.5
2.0

(3 - C)

Primera Iteración

- $x_0 = 0$
- $x_1 = 1$
- $f(x_0) = e^0 + 2^{-0} + 2\cos(0) - 6 = 1 + 1 + 2 - 6 = -2$
- $f(x_1) = e^1 + 2^{-1} + 2\cos(1) - 6 = 2.7182818284 + 0.5 + 2 \cdot 0.5403023059 - 6 = 3.7585864402 - 6 = -2.2414135598$
- $x_2 = x_1 - f(x_1) \cdot \frac{x_1 - x_0}{f(x_1) - f(x_0)}$
- $x_2 = 1 - (-2.2414135598) \cdot \frac{1-0}{-2.2414135598-(-2)}$
- $x_2 = 1 - (-2.2414135598) \cdot \frac{1}{-0.2414135598}$
- $x_2 = 1 + 9.2787102441 = 10.2787102441$

Segunda Iteración

- $f(x_0) = -2$
- $f(x_1) = -2.2414135598$
- $f(x_2) = e^{10.2787102441} + 2^{-10.2787102441} + 2\cos(10.2787102441) - 6 \approx 27369.5667168566 + 0.0005389785 + 2 \cdot (-0.9611960077) - 6 = 27369.5667168566 - 1.9223920154 - 6 = 27361.6443248412$
- $x_3 = x_2 - f(x_2) \cdot \frac{x_2 - x_1}{f(x_2) - f(x_1)}$
- $x_3 = 10.2787102441 - 27361.6443248412 \cdot \frac{10.2787102441 - 1}{27361.6443248412 - (-2.2414135598)}$
- $x_3 = 10.2787102441 - 27361.6443248412 \cdot \frac{9.2787102441}{27363.8857384010}$
- $x_3 = 10.2787102441 - 9.2787102441 = 0.9999999999 \approx 1$

Tercera Iteracion

- $f(x_1) = -2.2414135598$
- $f(x_2) = 27361.6443248412$
- $f(x_3) = e^1 + 2^{-1} + 2\cos(1) - 6 = 2.7182818284 + 0.5 + 2 \cdot 0.5403023059 - 6 = 3.7585864402 - 6 = -2.2414135598$

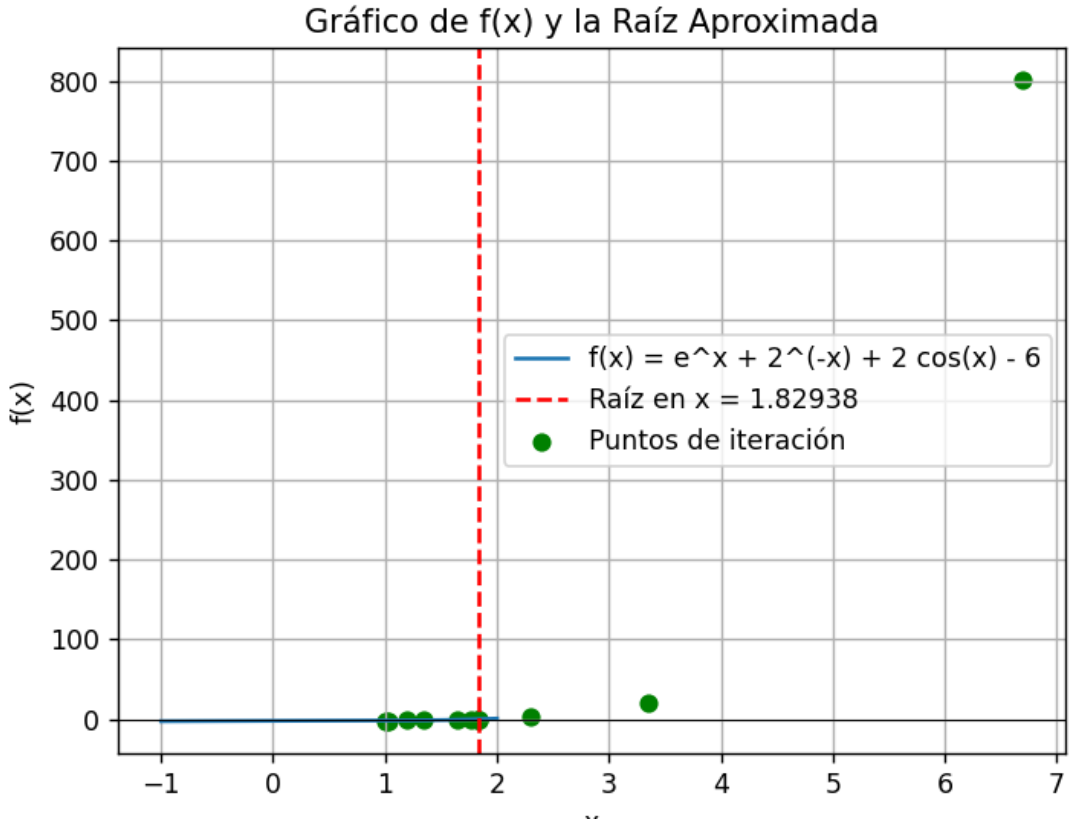


Gráfico de f(x) y la Raíz Aproximada
f(x) = e^x + 2^(-x) + 2 cos(x) - 6
Raíz en x = 1.82938
Puntos de iteración
f(x)
800
700
600
500
400
300
200
100
0
−1
0
1
2
3
4
5
6
7

(3 - D)

Primera Iteración

$$x_0 = 1.5, \quad x_1 = 2$$

$$f(x_0) = 2.95737, \quad f(x_1) = -0.1615$$

$$x_2 = 2 - (-0.1615) \cdot \frac{1.5 - 2}{2.95737 - (-0.1615)}$$

$$x_2 \approx 1.944$$

Segunda Iteración

$$x_0 = 2, \quad x_1 = 1.944$$

$$f(x_0) = -0.1615, \quad f(x_1) \approx -0.0578$$

$$x_3 = x_1 - f(x_1) \cdot \frac{x_0 - x_1}{f(x_0) - f(x_1)}$$

$$x_3 = 1.944 - (-0.0578) \cdot \frac{2 - 1.944}{-0.1615 - (-0.0578)}$$

$$x_3 \approx 1.917$$

Tercea Iteración

$$x_0 = 1.944, \quad x_1 = 1.917$$

$$f(x_0) \approx -0.0578, \quad f(x_1) \approx -0.0181$$

$$x_4 = 1.917 - (-0.0181) \cdot \frac{1.944 - 1.917}{-0.0578 - (-0.0181)}$$

$$x_4 \approx 1.905$$

Cuarta Iteración

$$x_0 = 1.917, \quad x_1 = 1.905$$

$$f(x_0) \approx -0.0181, \quad f(x_1) \approx -0.0053$$

$$x_5 = 1.905 - (-0.0053) \cdot \frac{1.917 - 1.905}{-0.0181 - (-0.0053)}$$

$$x_5 \approx 1.901$$

Quinta Iteración

$$x_0 = 1.905, \quad x_1 = 1.901$$

$$f(x_0) \approx -0.0053, \quad f(x_1) \approx -0.0016$$

$$x_6 = 1.901 - (-0.0016) \cdot \frac{1.905 - 1.901}{-0.0053 - (-0.0016)}$$

$$x_6 \approx 1.899$$

Sexta Iteración

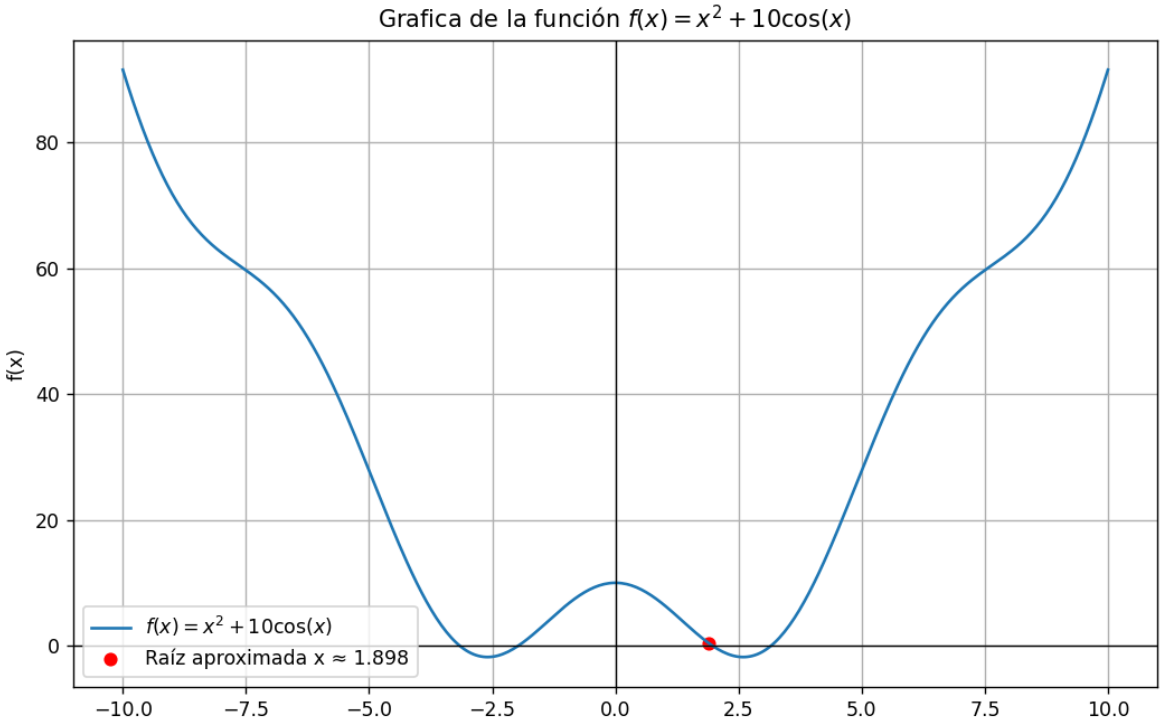
$$x_0 = 1.901, \quad x_1 = 1.899$$

$$f(x_0) \approx -0.0016, \quad f(x_1) \approx -0.0005$$

$$x_7 = 1.899 - (-0.0005) \cdot \frac{1.901 - 1.899}{-0.0016 - (-0.0005)}$$

$$x_7 \approx 1.898$$

$$|x_7 - x_6| = |1.898 - 1.899| = 0.001$$


Grafica de la función $f(x) = x^2 + 10\cos(x)$
f(x)
80
60
40
20
0
−10.0
−7.5
−5.0
−2.5
0.0
2.5
5.0
7.5
10.0
$f(x) = x^2 + 10\cos(x)$
Raíz aproximada x ≈ 1.898

(4)

$$x_0 = 8$$

$$x_1 = 9$$

Primera Iteración

$$f(x_0) = 8\log(8) - 10 = 8 \cdot 2.07944 - 10 = 16.63552 - 10 = 6.63552$$

$$f(x_1) = 9\log(9) - 10 = 9 \cdot 2.19722 - 10 = 19.77498 - 10 = 9.77498$$

$$x_2 = x_1 - f(x_1)\frac{x_0 - x_1}{f(x_0) - f(x_1)}$$

$$x_2 = 9 - 9.77498\frac{8 - 9}{6.63552 - 9.77498}$$

$$x_2 = 9 - 9.77498\frac{-1}{-3.13946}$$

$$x_2 \approx 5.887$$

Segunda Iteración

$$f(x_2) = 5.887\log(5.887) - 10 = 5.887 \cdot 1.7716 - 10 = 10.4261 - 10 = 0.4261$$

$$x_3 = x_2 - f(x_2)\frac{x_1 - x_2}{f(x_1) - f(x_2)}$$

$$x_3 = 5.887 - 0.4261\frac{9 - 5.887}{9.77498 - 0.4261}$$

$$x_3 = 5.887 - 0.4261\frac{3.113}{9.34888}$$

$$x_3 \approx 5.745$$

Tercera Iteración

$x_2 = 5.887$ y $x_3 = 5.748$:

$$f(x_3) = 5.748\log(5.748) - 10 \approx 0.019$$

$$x_4 = x_3 - f(x_3)\frac{x_2 - x_3}{f(x_2) - f(x_3)}$$

$$x_4 = 5.748 - 0.019\frac{5.887 - 5.748}{0.4261 - 0.019}$$

$$x_4 = 5.748 - 0.019\frac{0.139}{0.4071}$$

$$x_4 \approx 5.744$$

Cuarta Iteración

: $x_3 = 5.748$ y $x_4 = 5.744$:

$$f(x_4) = 5.744\log(5.744) - 10 \approx 0.001$$

$$x_5 = x_4 - f(x_4)\frac{x_3 - x_4}{f(x_3) - f(x_4)}$$

$$x_5 = 5.744 - 0.001\frac{5.748 - 5.744}{0.019 - 0.001}$$

$$x_5 = 5.744 - 0.001\frac{0.004}{0.018}$$

$$x_5 \approx 5.744$$

$$\text{Error} = |x_5 - x_4| = |5.744 - 5.744| = 0.000$$