




Meet - tqf-fxqk-pzw


Generated on February 6, 2024

Summary

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National University
of computer and emerging sciences



Foundation for Advancement
of Science and Technology

Problem Statement. Use the **secant** method to estimate the root of $f(x) = e^{-x} - x$. Start with initial estimates of $x_{-1} = 0$ and $x_0 = 1.0$.

Solution. Recall that the true root is 0.56714329. . . *0.001*

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

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✦ Usama Antuley discusses the impact of tolerance structures with minimal variation on individuals.

▶ 10:18 AM

We stop on 2 values

x_i represents x_0

$x_i = x_0 = 1$

$f(1) = 1/e - 1$

$f(1) = -0.632\dots$

$$x-1=0$$

$$f(0)=1$$

▶ 10:18 AM

First iteration:

$$\begin{aligned} x_{-1} &= 0 & f(x_{-1}) &= 1.00000 \\ x_0 &= 1 & f(x_0) &= -0.63212 \\ x_1 &= 1 - \frac{-0.63212(0 - 1)}{1 - (-0.63212)} = 0.61270 & \varepsilon_t &= 8.0\% \end{aligned}$$

Second iteration:

$$\begin{aligned} x_0 &= 1 & f(x_0) &= -0.63212 \\ x_1 &= 0.61270 & f(x_1) &= -0.07081 \end{aligned}$$

(Note that both estimates are now on the same side of the root.)

$$x_2 = 0.61270 - \frac{-0.07081(1 - 0.61270)}{-0.63212 - (-0.07081)} = 0.56384 \quad \varepsilon_t = 0.58\%$$

Third iteration:

$$\begin{aligned} x_1 &= 0.61270 & f(x_1) &= -0.07081 \\ x_2 &= 0.56384 & f(x_2) &= 0.00518 \\ x_3 &= 0.56384 - \frac{0.00518(0.61270 - 0.56384)}{-0.07081 - (0.00518)} = 0.56717 & \varepsilon_t &= 0.0048\% \end{aligned}$$

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Similarity after 2 decimal places

✦ Usama Antuley discusses the potential impact of Next Generation technology on performance and value.

▶ 10:24 AM

Use the Secant method to find a solution to $x = \cos x$, and compare the approximations with those given in Example 1 which applied Newton's method.

n	p_n		
0	0.7853981635		
1	0.7071067810		
2	0.7602445972		
3	0.7246674808		
4	0.7487198858		
5	0.7325608446		
6	0.7434642113		
7	0.7361282565		

n	p_n
0	0.7853981635
1	0.7395361337
2	0.7390851781
3	0.7390851332
4	0.7390851332

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✦ Usama Antuley explains the iterative process of finding the capitated

value X in a mathematical function.

▷ 10:25 AM



$$f(x) = \cos x - x$$



Use the Secant method to find a solution to $x = \cos x$ and compare the approximations with those given in Example 1 which applied Newton's method.

$$p_0 = \pi/4$$

$$f(0) \neq 1$$

$$f(\pi/2) = -\pi/2$$

n	p_n ↓
0	0.7853981635
1	0.7071067810
2	0.7602445972
3	0.7246674808
4	0.7487198858
5	0.7325608446
6	0.7434642113
7	0.7361282565

Newton	
n	p_n
0	0.7853981635
1	0.7395361337
2	0.7390851781
3	0.7390851332
4	0.7390851332

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✦✦ Usama Antuley discusses the process of solving container X using mathematical functions and iterations.

▷ 10:26 AM

✦✦ Usama Antuley discusses the application of the secant method in mathematical functions and its convergence.

▷ 10:26 AM



▷ 10:26 AM



Use the Secant method to find a solution to $x = \cos x$, and compare the approximations with those given in Example 1 which applied Newton's method.

$$\left. \begin{array}{l} x_i = B = \pi/4 \\ x_{i-1} = A = 0.5 \end{array} \right\} \begin{array}{l} \textcircled{0} \\ \textcircled{\frac{\pi}{2}} \end{array} \quad x_{i+1} = x_i - \frac{f(x_i)(x_{i-1} - x_i)}{f(x_{i-1}) - f(x_i)} = B -$$

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✦ Usama Antuley discusses the application of a formula for computing hydration in a recent study.

▶ 10:28 AM

Use the Secant method to find a solution to $x = \cos x$, and compare the approximations with those given in Example 1 which applied Newton's method.

$$\left. \begin{array}{l} x_i = B = \pi/4 \\ x_{i-1} = A = 0.5 \end{array} \right\} \begin{array}{l} \textcircled{0} \\ \textcircled{\frac{\pi}{2}} \end{array} \quad x_{i+1} = x_i - \frac{f(x_i)(x_{i-1} - x_i)}{f(x_{i-1}) - f(x_i)} = B - \frac{(\cos B - B)(A - B)}{(\cos A - A) - (\cos B - B)}$$

x_{i-1}

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✦ Usama Antuley discusses the concept of gain between root for the secant method in mathematical analysis.

▶ 10:29 AM

$$f(x) = \cos x - x$$

Use the Secant method to find a solution to $x = \cos x$, and compare the approximations with those given in Example 1 which applied Newton's method.

$x_i = B = \pi/4$
 $x_{i-1} = A = 0.5$

$$x_{i+1} = x_i - \frac{f(x_i)(x_{i-1} - x_i)}{f(x_{i-1}) - f(x_i)} = B - \frac{(\cos B - B)(A - B)}{(\cos A - A) - (\cos B - B)}$$

x_{i-1}	x_i	x_{i+1}	$tol = x_{i+1} - x_i $
0.5	$\pi/4$	$x_1 = 0.73638$	
$\pi/4$	0.73638		

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Usama Antuley discusses the updated points and computations for a Casio excitation in his latest findings.

10:32 AM

$$f(x) = \cos x - x$$

Use the Secant method to find a solution to $x = \cos x$, and compare the approximations with those given in Example 1 which applied Newton's method.

$x_i = B = \pi/4$
 $x_{i-1} = A = 0.5$

$$x_{i+1} = x_i - \frac{f(x_i)(x_{i-1} - x_i)}{f(x_{i-1}) - f(x_i)} = B - \frac{(\cos B - B)(A - B)}{(\cos A - A) - (\cos B - B)}$$

x_{i-1}	x_i	x_{i+1}	$tol = x_{i+1} - x_i $
0.5	$\pi/4$	$x_1 = 0.73638$	
$\pi/4$	0.73638	$\rightarrow 0.73905$	$0.73905 - 0.73638 < 0.0001$
0.73638	0.73905	—	

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The convergence rate of the point iteration method was discussed with a focus on achieving a tolerance of 0.001 in a recent seminar.

10:36 AM

Use the ~~Secant method~~ to find a solution to $x = \cos x$ and compare the approximations with those given in Example 1 which applied Newton's method.

$p_0 = \pi/4$ ✓

n	p_n ✓
0	0.7853981635
1	0.7071067810
2	0.7602445972
3	0.7246674808
4	0.7487198858
5	0.7325608446
6	0.7434642113
7	0.7361282565

$p_0 = \pi/4$

n	Newton p_n
0	0.7853981635
1	0.7395361337
2	0.7390851781
3	0.7390851332
4	0.7390851332

$f(x) = \cos x - x$ $f'(x) = -\sin x - 1$
 $f(\pi/4) = 1 - \pi/4 \approx -0.1768$
 $f(\pi/2) = 0 - \pi/2 \approx -1.5708$
 $p_0 = 0.5$
 $p_1 = \pi/4$

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✦ Usama Antuley discusses the continuous functional and bounded values of a function in his latest theorem.

▶ 10:39 AM

Root Finding Methods:

- *Bracketing methods.* As the name implies, these are based on two initial guesses that “bracket” the root—that is, are on either side of the root.
- *Open methods.* These methods can involve one or more initial guesses, but there is no need for them to bracket the root.

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▶ 10:39 AM

False Position Method:

The **method of False Position** (also called *Regula Falsi*) generates approximations in the same manner as the Secant method, but it includes a test to ensure that the root is always bracketed between successive iterations

$$\begin{array}{c} +ve \quad -ve \\ \downarrow p_0, p_1 \end{array} ; p_2 ; f(p_2) \quad +ve$$

$$f(p_0) \cdot f(p_1) < 0$$

$$f(p_0) \cdot f(p_2)$$

$$f(p_1) \cdot f(p_2)$$

The term *Regula Falsi*, literally a false rule or false position, refers to a technique that uses results that are known to be false, but in some specific manner, to obtain convergence to a true result. False position problems can be found on the Rhind papyrus, which dates from about 1650 B.C.E.

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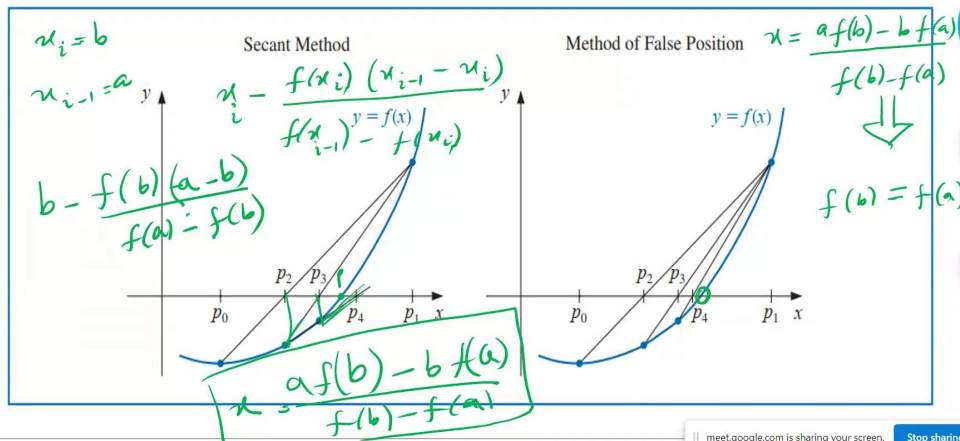
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✦ Usama Antuley discusses the impact of product profiles and negative Google ratings on businesses in Nova, Wisconsin.

▶ 10:44 AM

$$f(a) \cdot f(b) < 0 \quad p_0 = a$$

$$p_1 = b$$



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✦ Usama Antuley discusses a formula for calculating false position in his latest research.

▶ 10:47 AM

Example: Find the solution $x = \cos x$

$$x = \frac{a f(b) - b f(a)}{f(b) - f(a)}$$

Solution To make a reasonable comparison we will use the same initial approximations as in the Secant method, that is, $p_0 = 0.5$ and $p_1 = \pi/4$. Table 2.6 shows the results of the method of False Position applied to $f(x) = \cos x - x$ together with those we obtained using the Secant and Newton's methods. Notice that the False Position and Secant approximations agree through p_3 and that the method of False Position requires an additional iteration to obtain the same accuracy as the Secant method.

$$A = a = p_0 = 0.5; p_1 = \pi/4 = b = B$$

a	b	f(a)	f(b)
0.5	$\pi/4$	+ve	-ve

$$A(\cos B - B) - (B(\cos A - A))$$

	False Position	Secant	Newton
n	p_n	p_n	p_n
0	0.5	0.5	0.7853981635
1	0.7853981635	0.7853981635	0.7395361337
2	0.7363841388	0.7363841388	0.7390851781
3	0.7390581392	0.7390581392	0.7390851332
4	0.7390848638	0.7390851493	0.7390851332
5	0.7390851305	0.7390851332	
6	0.7390851332		

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Usama Antuley discusses the calculation and formulation of a new root form in an incredible automation function.

10:50 AM

Example: Find the solution $x = \cos x$

$$x = \frac{a f(b) - b f(a)}{f(b) - f(a)}$$

Solution To make a reasonable comparison we will use the same initial approximations as in the Secant method, that is, $p_0 = 0.5$ and $p_1 = \pi/4$. Table 2.6 shows the results of the method of False Position applied to $f(x) = \cos x - x$ together with those we obtained using the Secant and Newton's methods. Notice that the False Position and Secant approximations agree through p_3 and that the method of False Position requires an additional iteration to obtain the same accuracy as the Secant method.

$$A = a = p_0 = 0.5; p_1 = \pi/4 = b = B$$

a	b	f(a)	f(b)
0.5	$\pi/4$	+ve	-ve

$$A(\cos B - B) - (B(\cos A - A))$$

	False Position	Secant	Newton
n	p_n	p_n	p_n
0	0.5	0.5	0.7853981635
1	0.7853981635	0.7853981635	0.7395361337
2	0.7363841388	0.7363841388	0.7390851781
3	0.7390581392	0.7390581392	0.7390851332
4	0.7390848638	0.7390851493	0.7390851332
5	0.7390851305	0.7390851332	
6	0.7390851332		

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10:50 AM

Example: Find the solution $x = \cos x$ $x = \frac{a f(b) - b f(a)}{f(b) - f(a)}$

Solution To make a reasonable comparison we will use the same initial approximations as in the Secant method, that is, $p_0 = 0.5$ and $p_1 = \pi/4$. Table 2.6 shows the results of the method of False Position applied to $f(x) = \cos x - x$ together with those we obtained using the Secant and Newton's methods. Notice that the False Position and Secant approximations agree through p_3 and that the method of False Position requires an additional iteration to obtain the same accuracy as the Secant method.

$A = a = p_0 = 0.5$ $p_1 = \pi/4 = b = B$

	False Position	Secant	Newton
n	p_n	p_n	p_n
0	0.5	0.5	0.7853981635
1	0.7853981635	0.7853981635	0.7395361337
2	0.7363841388	0.7363841388	0.7390851781
3	0.7390581392	0.7390581392	0.7390851332
4	0.7390848638	0.7390851493	0.7390851332
5	0.7390851305	0.7390851332	
6	0.7390851332		

Handwritten notes on the table:

- For False Position: $f(a) = +ve$, $f(b) = -ve$, $f(c) = 0.73638$ (circled in red).
- For Secant: $A(\cos B - B) - B(\cos A - A)$ is written below the table.
- For Newton: $(\cos B - B) - (\cos A - A)$ is written below the table.

✦ Function keys have both positive and negative values, with the positive pair being attributed to Rehan by Usama Antuley.

▶ 10:52 AM