Numerical Analysis programming homework # 1

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A.

Create a parent class EquationSolver,and create a pure virtual function solve() under that class,so that the pure virtual function can be instantiated with different code for different subclass iteration methods. You can see EquationSolver.hpp for the specific code of the iteration methods. In addition,the Function class is created to unify the call of different functions.To compute the derivative of the function,a differential approximations is employed.

B.

the results are as follows:

a.

Solving $\frac{1}{x} - \tan(x)$ on $[0, \frac{\pi}{2}]$
A root is: 0.860334

b.

Solving $\frac{1}{x} - 2^x$ on $[0, 1]$
A root is: 0.641186

c.

Solving $2^{-x} + e^x + 2\cos(x) - 6$ on $[1, 3]$
A root is: 1.82938

d.

Solving $\frac{x^3+4x^2+3x+5}{2x^3-9x^2+18x-2}$ on $[0, 4]$
A root is: 0.117877

C.

Solving $\tan(x)$ on $[4.5, 7.7]$
A root is: 6.28319

D.

a.first we use the initial value given by the question

Solving $\sin(\frac{x}{2}) - 1$ with $x_0 = 0$, $x_1 = \frac{\pi}{2}$
A root is: 3.14093
Solving $e^x - \tan(x)$ with $x_0 = 1$, $x_1 = 1.4$
A root is: 1.30633
Solving $x^3 - 12x^2 + 3x + 1$ with $x_0 = 0$, $x_1 = -0.5$
A root is: -0.188685

b.next we use the different initial value

Solving $\sin(\frac{x}{2}) - 1$ with $x_0 = -1$, $x_1 = 1$
A root is: 3.14093
Solving $e^x - \tan(x)$ with $x_0 = 1.1$, $x_1 = 1.5$
A root is: 1.30633
Solving $x^3 - 12x^2 + 3x + 1$ with $x_0 = 0.1$, $x_1 = -1$
A root is: -0.188685

E.

use bisection method to solve $10(\frac{\pi}{2} - \arcsin(x) - x(1-x^2)^{\frac{1}{2}})$
A root is: 0.166166
use Newton method to solve $10(\frac{\pi}{2} - \arcsin(x) - x(1-x^2)^{\frac{1}{2}})$
A root is: 0.166166
use bisection method to solve $10(\frac{\pi}{2} - \arcsin(x) - x(1-x^2)^{\frac{1}{2}})$
A root is: 0.166166

F.

a.

$\alpha = 32.8864$ degree

b.

$\alpha = 33.1689$ degree

c.

when $x_0 = \frac{33\pi}{180}$,$x_1 = 3\pi$, $\alpha = -1811.5$ degree
when $x_0 = \frac{33\pi}{180}$,$x_1 = 2\pi$, $\alpha = -11.5$ degree
when $x_0 = \frac{33\pi}{180}$,$x_1 = \pi$, $\alpha = 33.1689$ degree