**PROBLEM 1**

**Name:** Amandeep Singh

**Course/Branch:** B.TECH/CSE

**Sem/Sec:** 5/E

**Roll no:** 09

**Date:** 14-Sep-2022

**Objective:** Write a C program to find the root of the given polynomial using Bisection method correct upto 3 decimal places.

**Question:** x^3 – 4\*x – 9

**Bisection Method:**

1. Enter the equation, say f(x).
2. By putting f(x) = 0, find the intervals (a and b where a < b) under which the above equation is converging or f(a) \* (f(b) < 0.
3. Now find, x = (a+b)/2
4. Then check, if f(x)\*f(b) < 0, change a = x or else f(x)\*f(a) < 0, change b = x.
5. Jump to step 3, till |x-a| or |x-b| >= 0.0001.
6. x is the required root.

**Implementation:**

#include <stdio.h>

#include <math.h>

double function(double x){

return x\*x\*x - 4\*x - 9;

}

int main(){

double a = 0, b = 0;

for (int i = 0; i < 10; i++){

if (function(i) > 0 && i > b){

b = i;

break;

}

else if (function(i) < 0 && i > a){

a = i;

}

}

printf("a = %lf , b = %lf\n", a, b);

double fx, fa, fb, x;

int steps = 0;

do{

fa = function(a);

fb = function(b);

x = (a+b)/2;

fx = function(x);

printf("Interation %d, x = %.4lf\n", ++steps, x);

if (fx\*fb < 0){

a = x;

}

else if (fx\*fa < 0){

b = x;

}

}while(fabs(x-a) >= 0.0001 || fabs(x-b) >= 0.0001);

printf("Root is %.4lf\n", x);

}

**PROBLEM 2**

**Name:** Amandeep Singh

**Course/Branch:** B.TECH/CSE

**Sem/Sec:** 5/E

**Roll no:** 09

**Date:** 14-Sep-2022

**Objective:** Write a C program to find the root of the given polynomial using Regular Falsi Method correct upto 3 decimal places.

**Question:** x^3 – 4\*x – 9

**Regular Falsi Method:**

1. Enter the equation, say f(x).
2. By putting f(x) = 0, find the intervals (a and b where a < b) under which the above equation is converging or f(a) \* (f(b) < 0.
3. Now find, x = (a+b)/2
4. Then check, if f(x)\*f(b) < 0, change a = x or else f(x)\*f(a) < 0, change b = x.
5. Jump to step 3, till |x-a| or |x-b| >= 0.0001.
6. x is the required root.

**Implementation:**

#include <stdio.h>

#include <math.h>

double function(double x){

return x\*x\*x-2\*x-5;

}

int main(){

double a= 0;

double b = 0;

for (int i = 0; i < 10; i++){

if (function(i) > 0 && i > b){

b = i;

break;

}

else if (function(i) < 0 && i > a){

a = i;

}

}

printf("a : %lf, b : %lf\n",a,b);

double fx, fa, fb, x, x1;

int step = 0;

do{

fa = function(a);

fb = function(b);

x = (a\*fb - b\*fa)/(fb-fa);

fx = function(x);

printf("Iteration %d, x = %lf\n", ++step, x);

if (fx < 0){

x1 = a;

a = x;

}

else if(fx > 0){

x1 = b;

b = x;

}

}while(fabs(x-x1) >= 0.0001);

printf("x : %lf\n", x);

}

**PROBLEM 3**

**Name:** Amandeep Singh

**Course/Branch:** B.TECH/CSE

**Sem/Sec:** 5/E

**Roll no:** 09

**Date:** 14-Sep-2022

**Objective:** Write a C program to find the root of the given polynomial using Secant Methodcorrect upto 3 decimal places.

**Question:** x^3 – 4\*x – 9

**Secant Method:**

1. Enter the equation, say f(x).
2. By putting f(x) = 0, find the intervals (a and b where a < b) under which the above equation is converging or f(a) \* (f(b) < 0.
3. Now find, x = (a+b)/2
4. Then check, if f(x)\*f(b) < 0, change a = x or else f(x)\*f(a) < 0, change b = x.
5. Jump to step 3, till |x-a| or |x-b| >= 0.0001.
6. x is the required root.

**Implementation:**

#include <stdio.h>

#include <math.h>

double function(double x){

return x\*x\*x-4\*x-9;

}

int main(){

double a = 0, b = 0;

for (int i = 0; i < 10; i++){

if (function(i) > 0 && i > b){

b = i;

break;

}

else if (function(i) < 0 && i > a){

a = i;

}

}

printf("a = %lf , b = %lf\n", a,b);

double fx, fa, fb;

double x;

int step = 0;

do{

fa = function(a);

fb = function(b);

x = b - ((b-a)/(fb-fa))\*(fb);

fx = function(x);

printf("Interation %d, x: %lf\n", ++step, x);

a = b;

b = x;

fa = fb;

fb = fx;

}while(fabs(x-a) >= 0.0001 || fabs(x-b) >= 0.0001);

printf("x : %lf", x);

}

**PROBLEM 4**

**Name:** Amandeep Singh

**Course/Branch:** B.TECH/CSE

**Sem/Sec:** 5/E

**Roll no:** 09

**Date:** 14-Sep-2022

**Objective:** Write a C program to find the root of the given polynomial using Newton-Raphson Methodcorrect upto 3 decimal places.

**Question:** x^4 - x - 10

**Newton-Raphson Method:**

1. Enter the equation, say f(x).
2. By putting f(x) = 0, find the intervals (a and b where a < b) under which the above equation is converging or f(a) \* (f(b) < 0.
3. Now find, x = (a+b)/2
4. Then check, if f(x)\*f(b) < 0, change a = x or else f(x)\*f(a) < 0, change b = x.
5. Jump to step 3, till |x-a| or |x-b| >= 0.0001.
6. x is the required root.

**Implementation:**

#include <stdio.h>

#include <math.h>

double function(double x){

return (x\*x\*x\*x - x - 10);

}

double derivative(double x){

return (4\*x\*x\*x - 1);

}

double ex(double x){

return (x - (function(x)/derivative(x)));

}

int main(){

double a = 0, b = 0;

for (int i = 0; i < 10; i++){

if (function(i) > 0 && i > b){

b = i;

break;

}

else if (function(i) < 0 && i > a){

a = i;

}

}

printf("a : %lf , b : %lf\n", a, b);

double x = (a+b)/2;

double x1;

int step = 0;

do{

x1 = x;

x = ex(x);

printf("Interation %d, x : %lf\n", ++step, x);

}while(fabs(x-x1) >= 0.001);

printf("x : %lf\n", x);

}

**PROBLEM 4**

**Name:** Amandeep Singh

**Course/Branch:** B.TECH/CSE

**Sem/Sec:** 5/E

**Roll no:** 09

**Date:** 14-Sep-2022

**Objective:** Write a C program to find the root of the given polynomial using Iterative correct upto 3 decimal places.

**Question:** x^3 – 2\*x – 4

**Iterative:**

1. Enter the equation, say f(x).
2. By putting f(x) = 0, find the intervals (a and b where a < b) under which the above equation is converging or f(a) \* (f(b) < 0.
3. Now find, x = (a+b)/2
4. Then check, if f(x)\*f(b) < 0, change a = x or else f(x)\*f(a) < 0, change b = x.
5. Jump to step 3, till |x-a| or |x-b| >= 0.0001.
6. x is the required root.

**Implementation:**

#include <stdio.h>

#include <math.h>

double function(double x){

return (x\*x\*x - 2\*x\*x - 4);

}

double ex(double x){

return cbrt(2\*x\*x + 4);

}

double derivative(double x){

return ((4\*x)/(3\*cbrt((2\*x\*x + 4)\*(2\*x\*x + 4))));

}

int main(){

double a = 0, b = 0;

for (int i = 0; i < 10; i++){

if (function(i) > 0 && i > b){

b = i;

break;

}

else if (function(i) < 0 && i > a){

a = i;

}

}

double x = (a+b)/2;

double x1;

int step = 0;

do{

x1 = x;

x = ex(x);

printf("Interation %d, x : %lf\n", ++step, x);

}while(fabs(x-x1) >= 0.001);

printf("x : %lf\n", x);

}