شهاب الدین اسفندیار

نقشه برداری 98

گروه 52

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سوالات 3 و 8 و9 با برنامه حل شده

$f(x) = x^3 + x - 1$ ← (آزمون وخطا) ① ✓۱ در بازه $[0,1]$ پیوسته است (الف

ب) $a=0 \rightarrow f(a) = -1 < 0$

$b=1 \rightarrow f(b) = 1 > 0$ ← $f(a)\cdot f(b) < 0$ ✓۱

ج) $f'(x) = 3x^2 + 1 \xrightarrow[\text{بازه}]{} > 0$ همواره مثبت (✓۱)

a^-	b^+	c	$f(c)$ علامت
0/0000	1/000	0/5000	0/3750 (-)
0/5000	0/7500	0/7500	0/1719 (+)
0/6250	0/7500	0/6250	0/1309 (-)
0/6250	0/6875	0/6875	0/0125 (+)
0/6562	0/6875	0/6562	0/0611 (-)
0/6719	0/6875	0/6719	0/0248 (-)
0/6797	0/6875	0/6797	0/0063 (-)
0/6797	0/6836	0/6836	0/0030 (+)
0/6816	0/6836	0/6816	0/0016 (-)
0/6816	0/6826	0/6826	0/0007 (+) → $f(c) < \varepsilon = 10^{-3}$

$x^3 + x - 1 = 0$

$\varepsilon = 10^{-3}$

$c = \frac{a+b}{2} = 0/5$

ریشه تا ۳ رقم اعشار ← $c = 0/682$

$f(x) = x^4 + 2x^2 - 1$

② معادله 2 ریشه حقیقی دارد :

* ریشه اول →
- الف) پیوسته است در بازه $[0/5, 1]$ (✓) (آزمون وخطا)
- ب) $a = 0/5 \rightarrow f(a) = -0/4375 < 0$, $b = 1 \rightarrow f(b) = 2 > 0$ $\rightarrow f(a).f(b) < 0$ (✓)
- ج) $f'(x) = 4x^3 + 4x \xrightarrow[\text{بازه}]{} +$ همواره مثبت (✓)

$x^4 + 2x^2 - 1 = 0$

$\varepsilon = 10^{-3}$

$c_1 = \frac{a+b}{2} = 0/7500$

a^-	b^+	c_1	$f(c_1)$	علامت
0/5000	1/0000	0/7500	0/4414	(+)
0/6250	0/7500	0/6250	0/0662	(−)
0/6250	0/6875	0/6875	0/1687	(+)
0/6250	0/6562	0/6562	0/0468	(+)
0/6406	0/6562	0/6406	0/0108	(−)
0/6406	0/6484	0/6484	0/0177	(+)
0/6406	0/6445	0/6445	0/0034	(+)
0/6424	0/6445	0/6426	0/0037	(−)
0/6436	0/6445	0/6436	0/0001	(−)

$f(c_1) < \varepsilon = 10^{-3}$ → ریشه تا 3 رقم اعشار

Ans $c_1 = 0/644$

* ریشه دوم →
- الف) پیوسته است در بازه $[-1, -0/5]$ (✓) (آزمون وخطا)
- ب) $a = -1 \rightarrow f(a) = 2 > 0$, $b = -0/5 \rightarrow f(b) = -0/4375 < 0$ $\rightarrow f(a).f(b) < 0$ (✓)
- ج) $f'(x) = 4x^3 + 4x \xrightarrow[\text{بازه}]{} -$ همواره منفی (✓)

$\varepsilon = 10^{-3}$

$c_2 = \frac{a+b}{2} = -0/75$

a^+	b^-	c_2	$f(c_2)$	علامت
−1/0000	−0/5000	−0/7500	0/4414	(+)
−0/7500	−0/6250	−0/6250	0/0662	(−)
−0/6875	−0/6250	−0/6875	0/1687	(+)
−0/6562	−0/6250	−0/6562	0/0468	(+)
−0/6562	−0/6406	−0/6406	0/0108	(−)
−0/6484	−0/6406	−0/6486	0/0177	(+)
−0/6445	−0/6406	−0/6445	0/0034	(+)
−0/6445	−0/6426	−0/6426	0/0037	(−)
−0/6445	−0/6436	−0/6436	0/0001	(−)

$f(c_2) < \varepsilon = 10^{-3}$ → ریشه تا 3 رقم اعشار

Ans $c_2 = -0/644$

$-0/644$

$f(x) = x^2 - \frac{1}{4}\cos x - 3$

(4) معادله ۲ ریشه دارد

★ ریشه اول ←
- الف) آزمون وجود ریشه در بازه $[1,5, 2]$ پیوسته است (✓)
- ب) $a = 1,5 \rightarrow f(a) = -0,7612 < 0$ ، $b = 2 \rightarrow f(b) = 0,9623 > 0$ ← $f(a) \cdot f(b) < 0$ (✓)
- ج) $f'(x) = 2x + \frac{1}{4}\sin x \xrightarrow{\text{بازه}} f'(x) \neq 0$

a^-	b^+	c_1	$f(c_1)$	علامت
1,5000	2,0000	1,7500	0,1071	(+)
1,6250	1,7500	1,6250	0,3458	(-)
1,8775	1,7500	1,6875	0,1232	(-)
1,7188	1,7500	1,7188	0,0090	(+)
1,7188	1,7344	1,7344	0,0488	(+)
1,7188	1,7266	1,7266	0,0198	(+)
1,7188	1,7227	1,7227	0,0054	(+)
1,7207	1,7227	1,7207	0,0018	(-)
1,7207	1,7217	1,7217	0,0018	(+)
1,7212	1,7217	1,7212	0,0000	(-)

$x^2 - \frac{1}{4}\cos x - 3 = 0$

$\varepsilon = 10^{-3}$

$c_1 = \frac{a+b}{2} = 1,75$

$f(c_1) < \varepsilon = 10^{-3}$

ریشه تا ۳ رقم اعشار

Ans $\rightarrow c_1 = 1,721$

★ ریشه دوم ←
- الف) آزمون وجود ریشه در بازه $[-2; -1,5]$ پیوسته است (✓)
- ب) $a = -2 \rightarrow f(a) = 1,104 > 0$ ، $b = -1,5 \rightarrow f(b) = -0,1767 < 0$ ← $f(a) \cdot f(b) < 0$ (✓)
- ج) $f'(x) \neq 0 \rightarrow$ بازه (✓)

a^+	b^-	c_2	$f(c_2)$	علامت
-2,0000	-1,5000	-1,7500	0,1071	(+)
-1,7500	-1,6250	-1,6250	0,3458	(-)
-1,7500	-1,6875	-1,6875	0,1232	(-)
-1,7500	-1,7188	-1,7188	0,0090	(-)
-1,7344	-1,7188	-1,7344	0,0488	(+)
-1,7266	-1,7188	-1,7266	0,0198	(+)
-1,7227	-1,7188	-1,7227	0,0054	(+)
-1,7227	-1,7207	-1,7207	0,0018	(-)
-1,7217	-1,7207	-1,7217	0,0018	(+)
-1,7217	-1,7212	-1,7212	0,0000	(-)

$\varepsilon = 10^{-3}$

$c_2 = \frac{a+b}{2} = -1,175$

$f(c_2) < \varepsilon = 10^{-3}$

ریشه تا ۳ رقم اعشار

Ans $\rightarrow c_2 = -1,721$

$f(x) = x^4 - 7x^3 + 21x^2 - 8x - 7$

معادله 2 ریشه دارد ⑤

* ریشه اول ←
- الف) پیوسته است (آزمون وجود) (✓) ← بازه $[0,5 , 1,5]$
- ب) $a = 0,5 \rightarrow f(a) = -6,562 < 0$ ، $b = 1,5 \rightarrow f(b) = 9,687 > 0$ ← $f(a) \cdot f(b) < 0$ (✓)
- ج) $f'(x) = 4x^3 - 21x^2 + 42x - 8 \xrightarrow[\text{بازه}]{} f'(x) \neq 0$ (✓)

a^-	b^+	c_1	$f(c_1)$	علامت
0,5000	1,5000	1,000	0,0000	ندارد

$x^4 - 7x^3 + 21x^2 - 8x - 7 = 0$

$\varepsilon = 10^{-3}$

$c_1 = \frac{a+b}{2} = 1$

$f(c_1) < \varepsilon = 10^{-3}$ ← ریشه تا 3 رقم اعشار ← Ans ← $c_1 = 1,000$

* ریشه دوم ←
- الف) پیوسته است (آزمون وجود) (✓) ← بازه $[-1 , 0]$
- ب) $a = 0 \rightarrow f(a) = -7 < 0$ ، $b = -1 \rightarrow f(b) = 30 > 0$ ← $f(a) \cdot f(b) < 0$ (✓)
- ج) $f'(x) \neq 0 \rightarrow$ بازه (✓)

$\varepsilon = 10^{-3}$

$c = \frac{a+b}{2} = -0,5$

a^-	b^+	c_2	$f(c_2)$	علامت
0,0000	-1,0000	-0,5000	3,1875	(+)
-0,2500	-0,5000	-0,2500	-3,5742	(-)
-0,3750	-0,5000	-0,3750	0,6580	(-)
-0,3750	-0,4375	-0,4375	1,1423	(+)
-0,3750	-0,4062	-0,4062	0,2124	(+)
-0,3906	-0,4062	-0,3906	0,2301	(-)
-0,3984	-0,4062	-0,3984	0,0107	(-)
-0,3984	-0,4023	-0,4023	0,1004	(+)
-0,3984	-0,4004	-0,4004	0,0447	(+)
-0,3984	-0,3994	-0,3994	0,0170	(+)
-0,3984	-0,3989	-0,3989	0,0031	(+)
-0,3987	-0,3989	-0,3987	0,0038	(-)
-0,3988	-0,3989	-0,3988	0,0004	(-)

⑥ $f(x) = 2^x - 5x + 2 = 0$ → الف) پیوستگی در بازه $[0,1]$ (آزمون و خطا) (✓)

ب) $a=0 \rightarrow f(a) = 3 > 0$, $b=1 \rightarrow f(b) = -1 < 0$ → $f(a).f(b) < 0$ (✓)

ج) $f'(x) = \ln 2 \cdot 2^x - 5$ در بازه → $f'(x) \neq 0$ (✓)

a^+	b^-	c	$f(c)$	علامت
0/000	1/000	0/500	0/914	(+)
0/500	0/750	0/750	0/068	(−)
0/625	0/750	0/625	0/417	(+)
0/688	0/750	0/688	0/173	(+)
0/719	0/750	0/719	0/052	(+)
0/719	0/734	0/734	0/008	(−) → $\lvert f(c)\rvert < \varepsilon = 10^{-2}$

$2^x - 5x + 2 = 0$

$\varepsilon = 10^{-2}$

$c = \frac{a+b}{2} = 0/5$

Ans → $c = 0/73$ (تا 2 رقم اعشار)

⑦ روش وتری: (آزمون و خطا) (✓) الف) پیوستگی در بازه $[0,1]$ (✓)

$f(x) = x - \frac{1}{2}\cos x$

ب) $a=0 \rightarrow f(a) = -0/5 < 0$, $b=1 \rightarrow f(b) = 0/729 > 0$ → $f(a).f(b) < 0$ (✓)

ج) $f'(x) = 1 + \frac{1}{2}\sin x$ در بازه → علامت ثابت (✓)

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

a^-	b^+	c	$f(c)$	علامت
0/0000	1/0000	0/4066	0/0527	(−)
0/4065	1/000	0/4465	0/0045	(−)
0/4499	1/000	0/4499	0/0004	(−)

$x - \frac{1}{2}\cos x = 0$

$\varepsilon = 10^{-3}$

$c = 0/4066$

$\lvert f(c)\rvert < \varepsilon = 10^{-3}$

Ans ← $c = 0/450$ (تا 3 رقم اعشار)

Question 3 :

```
#include <iomanip>
#include <bits/stdc++.h>
#include <cmath>
using namespace std;
#define EPSILON 0.001
double func(double x) {
   return (pow(x,4) + 2*pow(x,3) - 7*pow(x,2) + 3) ;
}
void bisection(double a, double b) {
   if (func(a)*func(b) >= 0) {
      cout << "  You haven't assumed right a and b\n" <<endl ;
      return;
   }
   double c;
   do {
      c = (a+b)/2;
      if (func(c) == 0.0)
         break;
      else if (func(c)*func(a) < 0) {
         cout<<setprecision(4);
         cout<<std::fixed;
         cout<<"\t"<<"\t"<<"\t"<<a<<"\t"<<"|"<<"\t"<<b<<"\t"<<"|"<<"\t"<<c<<"\t"<<"|"<<"\t"<<func(c)<<endl;
         b = c ;
      }
      Else {
         cout<<setprecision(4);
         cout<<std::fixed;
         cout<<"\t"<<"\t"<<"\t"<<a<<"\t"<<"|"<<"\t"<<b<<"\t"<<"|"<<"\t"<<c<<"\t"<<"|"<<"\t"<<func(c)<<endl;
         a = c;
      }
   }  while (!(abs(func(c)) < EPSILON)) ;
   cout<<"                                                    -------> the ANSWER is "<<c<<endl;
   cout<<"-------------------------------------------------------------------------------------------------------------------------"<<endl;
```

```
}
int main()
{
   cout<<endl;
   cout<<"  Question 3"<<endl;
   cout<<endl;
   cout<<"  F(x)= x^4 + 2(x^3) - 7(x^2) + 3 , EPSILON = 0.001"<<endl;
   cout<<endl;
   cout<<"  F'(x)= 4(x^3) + 6(x^2) - 14x"<<endl;
   cout<<endl;
   cout<<"  Root ranges ----> (a1,b1)=[-4,-3.5]    (a2,b2)=[-1,-0.5]    (a3,b3)=[0.5,1]    (a4,b4)=[1.5,2]"<<endl;
   cout<<endl;
   cout<<"-------------------------------------------------------------------------------------------------------------------------------"<<endl;
   cout<<endl;
   double a, b;
   for(int i1=1 ; i1 <=1 ; i1++)
   {
      cout<<"  in (a1,b1)=[-4,-3.5] |----> 1. the function is continuous"<<endl;
      cout<<"                       |----> 2. [F(a1).F(b1) < 0] ----> (correct)"<<endl;
      cout<<"                       |----> 3. [F'(x) != 0] ----> (correct)"<<endl;
      cout<<endl;
      cout<<endl;
      a=-4, b=-3.5;
      cout<<"\t"<<"\t"<<"\t"<<"a"<<"\t"<<"|"<<"\t"<<"b"<<"\t"<<"|"<<"\t"<<"c"<<"\t"<<"|"<<"\t"<<"func(c)"<<endl;
      cout<<"                    ------------------------------------------------------------"<<endl;
      bisection(a,b);
   }
   cout<<endl;
   for(int i2=1 ; i2 <=1 ; i2++)
   {
      cout<<"  in (a2,b2)=[-1,-0.5] |----> 1. the function is continuous"<<endl;
      cout<<"                       |----> 2. [F(a2).F(b2) < 0] ----> (correct)"<<endl;
      cout<<"                       |----> 3. [F'(x) != 0] ----> (correct)"<<endl;
      cout<<endl;
```

```
    cout<<endl;
    a=-1, b=-0.5;
    cout<<"\t"<<"\t"<<"\t"<<"a"<<"\t"<<"|"<<"\t"<<"b"<<"\t"<<"|"<<"\t"<<"c"<<"\t"<<"|"<<"\t"<<"func(c)"<<endl;
    cout<<"                ------------------------------------------------------------"<<endl;
    bisection(a,b);
  }
  cout<<endl;
  for(int i3=1 ; i3 <=1 ; i3++)
  {
    cout<<"  in (a3,b3)=[0.5,1]  |----> 1. the function is continuous"<<endl;
    cout<<"                |----> 2. [F(a3).F(b3) < 0] ----> (correct)"<<endl;
    cout<<"                |----> 3. [F'(x) != 0] ----> (correct)"<<endl;
    cout<<endl;
    cout<<endl;
    a=0.5, b=1;
    cout<<"\t"<<"\t"<<"\t"<<"a"<<"\t"<<"|"<<"\t"<<"b"<<"\t"<<"|"<<"\t"<<"c"<<"\t"<<"|"<<"\t"<<"func(c)"<<endl;
    cout<<"                ------------------------------------------------------------"<<endl;
    bisection(a,b);
  }
  cout<<endl;
  for(int i4=1 ; i4 <=1 ; i4++)
  {
    cout<<"  in (a4,b4)=[1.5,2]  |----> 1. the function is continuous"<<endl;
    cout<<"                |----> 2. [F(a1).F(b1) < 0] ----> (correct)"<<endl;
    cout<<"                |----> 3. [F'(x) != 0] ----> (correct)"<<endl;
    cout<<endl;
    cout<<endl;
    a=1.5, b=2;
    cout<<"\t"<<"\t"<<"\t"<<"a"<<"\t"<<"|"<<"\t"<<"b"<<"\t"<<"|"<<"\t"<<"c"<<"\t"<<"|"<<"\t"<<"func(c)"<<endl;
    cout<<"                ------------------------------------------------------------"<<endl;
    bisection(a,b);
  }
  return 0;
}
```

C:\Users\IHC\Desktop\Q3.exe

Question 3

F(x)= x^4 + 2(x^3) - 7(x^2) + 3 , EPSILON = 0.001

F'(x)= 4(x^3) + 6(x^2) - 14x

Root ranges ----> (a1,b1)=[-4,-3.5] (a2,b2)=[-1,-0.5] (a3,b3)=[0.5,1] (a4,b4)=[1.5,2]

---

in (a1,b1)=[-4,-3.5] |----> 1. the function is continuous
|----> 2. [F(a1).F(b1) < 0] ----> (correct)
|----> 3. [F'(x) != 0] ----> (correct)

a	b	c	func(c)
-4.0000	-3.5000	-3.7500	-3.1523
-4.0000	-3.7500	-3.8750	6.9885
-3.8750	-3.7500	-3.8125	1.6941
-3.8125	-3.7500	-3.7812	-0.7839
-3.8125	-3.7812	-3.7969	0.4413
-3.7969	-3.7812	-3.7891	-0.1748
-3.7969	-3.7891	-3.7930	0.1324
-3.7930	-3.7891	-3.7910	-0.0214
-3.7930	-3.7910	-3.7920	0.0554
-3.7920	-3.7910	-3.7915	0.0170
-3.7915	-3.7910	-3.7913	-0.0022
-3.7915	-3.7913	-3.7914	0.0074
-3.7914	-3.7913	-3.7913	0.0026
-3.7913	-3.7913	-3.7913	0.0002

-------> the ANSWER is -3.7913

Type here to search

C:\Users\IHC\Desktop\Q3.exe

in (a2,b2)=[-1,-0.5] |----> 1. the function is continuous
|----> 2. [F(a2).F(b2) < 0] ----> (correct)
|----> 3. [F'(x) != 0] ----> (correct)

a	b	c	func(c)
-1.0000	-0.5000	-0.7500	-1.4648
-0.7500	-0.5000	-0.6250	-0.0701
-0.6250	-0.5000	-0.5625	0.5293
-0.6250	-0.5625	-0.5938	0.2379
-0.6250	-0.5938	-0.6094	0.0860
-0.6250	-0.6094	-0.6172	0.0085
-0.6250	-0.6172	-0.6211	-0.0307
-0.6211	-0.6172	-0.6191	-0.0111
-0.6191	-0.6172	-0.6182	-0.0013
-0.6182	-0.6172	-0.6177	0.0036
-0.6182	-0.6177	-0.6179	0.0011
-0.6182	-0.6179	-0.6180	-0.0001

-------> the ANSWER is -0.6180

C:\Users\IHC\Desktop\Q3.exe

in (a3,b3)=[0.5,1] |----> 1. the function is continuous
|----> 2. [F(a3).F(b3) < 0] ----> (correct)
|----> 3. [F'(x) != 0] ----> (correct)

a	b	c	func(c)
0.5000	1.0000	0.7500	0.2227
0.7500	1.0000	0.8750	-0.4333
0.7500	0.8750	0.8125	-0.1125
0.7500	0.8125	0.7812	0.0537
0.7812	0.8125	0.7969	-0.0298
0.7812	0.7969	0.7891	0.0119
0.7891	0.7969	0.7930	-0.0090
0.7891	0.7930	0.7910	0.0015
0.7910	0.7930	0.7920	-0.0038
0.7910	0.7920	0.7915	-0.0012
0.7910	0.7915	0.7913	0.0001

-------> the ANSWER is 0.7913

C:\Users\IHC\Desktop\Q3.exe

```
in (a4,b4)=[1.5,2]  |----> 1. the function is continuous
                    |----> 2. [F(a1).F(b1) < 0] ----> (correct)
                    |----> 3. [F'(x) != 0] ----> (correct)
```

a	b	c	func(c)
1.5000	2.0000	1.7500	1.6602
1.5000	1.7500	1.6250	0.0706
1.5000	1.6250	1.5625	-0.5000
1.5625	1.6250	1.5938	-0.2321
1.5938	1.6250	1.6094	-0.0852
1.6094	1.6250	1.6172	-0.0085
1.6172	1.6250	1.6211	0.0308
1.6172	1.6211	1.6191	0.0111
1.6172	1.6191	1.6182	0.0013
1.6172	1.6182	1.6177	-0.0036
1.6177	1.6182	1.6179	-0.0011
1.6179	1.6182	1.6180	0.0001

```
-------> the ANSWER is 1.6180

Process returned 0 (0x0)   execution time : 0.564 s
Press any key to continue.
```

Question 8 :

```
#include <iomanip>
#include <bits/stdc++.h>
#include <cmath>
using namespace std ;
#define EPSILON 0.001
double Func(double x) {
   return (((pow(x,4)) + (2*pow(x,3)) - (7*x*x)) + 3);
}
double Fprime(double x) {
   return (4*(pow(x,3)) + (6*x*x) - (14*x));
}
double Fzegond(double x) {
   return ((12*x*x) + (12*x) - 14) ; }
void newton(double a, double b)
{
   double X0, X1;
   if (Func(a)*Func(b) >= 0) {
      cout << "  You haven't assumed right a and b\n";
      return ; }
   else if (Func(a)*Fprime(a) > 0) {
      X0 = a;
   }
   else {
      X0 = b ;  }
   do {
      X1 = X0 - (Func(X0)/Fprime(X0));
      cout<<setprecision(4);
      cout<<std::fixed;
      cout<<"\t"<<"\t"<<"\t"<<X1<<"\t"<<"|"<<"\t"<<X0<<"\t"<<"|"<<"\t"<<Func(X1)<<endl;
      if (Func(X1) == 0.0)
      {
         break;
      }
```

```
      X0=X1;
   } while (!(abs(Func(X1)) < EPSILON));
   cout<<"                                        -------> the ANSWER is "<<X1<<endl;
   cout<<"-------------------------------------------------------------------------------------------------------------------
"<<endl;
}
int main()
{
   cout<<endl;
   cout<<"  Question 8"<<endl;
   cout<<endl;
   cout<<"  F(x)= x^4 + 2(x^3) - 7(x^2) + 3 , EPSILON = 0.001"<<endl;
   cout<<endl;
   cout<<"  F'(x)= 4(x^3) + 6(x^2) - 14x"<<endl;
   cout<<endl;
   cout<<"  F''(x)= 12(x^2) + 12x - 14"<<endl;
   cout<<endl;
   cout<<"  Root ranges ----> (a1,b1)=[-4,-3.5]   (a2,b2)=[-1,-0.5]   (a3,b3)=[0.5,1]   (a4,b4)=[1.5,2]"<<endl;
   cout<<endl;
   cout<<"-------------------------------------------------------------------------------------------------------------------
"<<endl;
   cout<<endl;
   double a, b;
   for(int i1=1 ; i1 <=1 ; i1++)   {
      cout<<"  in (a1,b1)=[-4,-3.5] |----> 1. the function is continuous"<<endl;
      cout<<"                       |----> 2. [F(a1).F(b1) < 0] ----> (correct)"<<endl;
      cout<<"                       |----> 3. [F'(x) != 0] ----> (correct)"<<endl;
      cout<<"                       |----> 4. [F\"(x) !=0] ----> (correct)"<<endl;
      cout<<endl;
      cout<<endl;
      a=-4, b=-3.5;
      cout<<"\t"<<"\t"<<"\t"<<"X(n)"<<"\t"<<"|"<<"\t"<<"X(n-1)"<<"\t"<<"|"<<"\t"<<"Func(X(n))"<<endl;
      cout<<"                  ----------------------------------------------"<<endl;
      newton(a,b);   }
   cout<<endl;
```

```
for(int i2=1 ; i2 <=1 ; i2++)   {
   cout<<"  in (a2,b2)=[-1,-0.5] |----> 1. the function is continuous"<<endl;
   cout<<"                     |----> 2. [F(a2).F(b2) < 0] ----> (correct)"<<endl;
   cout<<"                     |----> 3. [F'(x) != 0] ----> (correct)"<<endl;
   cout<<endl;
   cout<<endl;
   a=-1, b=-0.5;
   cout<<"\t"<<"\t"<<"\t"<<"X(n)"<<"\t"<<"|"<<"\t"<<"X(n-1)"<<"\t"<<"|"<<"\t"<<"Func(X(n))"<<endl;
   cout<<"                  ------------------------------------------------"<<endl;
   newton(a,b);  }
cout<<endl;
for(int i3=1 ; i3 <=1 ; i3++)  {
   cout<<"  in (a3,b3)=[0.5,1]  |----> 1. the function is continuous"<<endl;
   cout<<"                     |----> 2. [F(a3).F(b3) < 0] ----> (correct)"<<endl;
   cout<<"                     |----> 3. [F'(x) != 0] ----> (correct)"<<endl;
   cout<<endl;
   cout<<endl;
   a=0.5, b=1;
   cout<<"\t"<<"\t"<<"\t"<<"X(n)"<<"\t"<<"|"<<"\t"<<"X(n-1)"<<"\t"<<"|"<<"\t"<<"Func(X(n))"<<endl;
   cout<<"                  ------------------------------------------------"<<endl;
   newton(a,b) ;   }
cout<<endl;
for(int i3=1 ; i3 <=1 ; i3++)  {
   cout<<"  in (a4,b4)=[1.5,2]  |----> 1. the function is continuous"<<endl;
   cout<<"                     |----> 2. [F(a4).F(b4) < 0] ----> (correct)"<<endl;
   cout<<"                     |----> 3. [F'(x) != 0] ----> (correct)"<<endl;
   cout<<endl;
   cout<<endl;
   a=1.5, b=2;
   cout<<"\t"<<"\t"<<"\t"<<"X(n)"<<"\t"<<"|"<<"\t"<<"X(n-1)"<<"\t"<<"|"<<"\t"<<"Func(X(n))"<<endl;
   cout<<"                  ------------------------------------------------"<<endl;
   newton(a,b);
}
return 0; }
```

C:\Users\IHC\Desktop\Q8.exe

```
 Question 8

 F(x)= x^4 + 2(x^3) - 7(x^2) + 3 , EPSILON = 0.001

 F'(x)= 4(x^3) + 6(x^2) - 14x

 F''(x)= 12(x^2) + 12x - 14

 Root ranges ----> (a1,b1)=[-4,-3.5]    (a2,b2)=[-1,-0.5]    (a3,b3)=[0.5,1]    (a4,b4)=[1.5,2]

-------------------------------------------------------------------------------------------

 in (a1,b1)=[-4,-3.5] |----> 1. the function is continuous
                      |----> 2. [F(a1).F(b1) < 0] ----> (correct)
                      |----> 3. [F'(x) != 0] ----> (correct)
                      |----> 4. [F"(x) !=0] ----> (correct)

                       X(n)    |       X(n-1)  |       Func(X(n))
                     ------------------------------------------
                      -3.8763 |       -3.5000 |       7.1014
                      -3.7961 |       -3.8763 |       0.3783
                      -3.7913 |       -3.7961 |       0.0013
                      -3.7913 |       -3.7913 |       0.0000
                                                      -------> the ANSWER is -3.7913
-------------------------------------------------------------------------------------------

 in (a2,b2)=[-1,-0.5] |----> 1. the function is continuous
                      |----> 2. [F(a2).F(b2) < 0] ----> (correct)
                      |----> 3. [F'(x) != 0] ----> (correct)

                       X(n)    |       X(n-1)  |       Func(X(n))
                     ------------------------------------------
                      -0.6328 |       -0.5000 |       -0.1496
                      -0.6182 |       -0.6328 |       -0.0018
                      -0.6180 |       -0.6182 |       -0.0000
                                                      -------> the ANSWER is -0.6180
-------------------------------------------------------------------------------------------
```

C:\Users\IHC\Desktop\Q8.exe

```
------------------------------------------------------------------------------------------

 in (a3,b3)=[0.5,1]  |----> 1. the function is continuous
                     |----> 2. [F(a3).F(b3) < 0] ----> (correct)
                     |----> 3. [F'(x) != 0] ----> (correct)

                       X(n)    |       X(n-1)  |       Func(X(n))
                     ------------------------------------------
                       0.7500  |       1.0000  |       0.2227
                       0.7909  |       0.7500  |       0.0018
                       0.7913  |       0.7909  |       0.0000
                                                       -------> the ANSWER is 0.7913
------------------------------------------------------------------------------------------

 in (a4,b4)=[1.5,2]  |----> 1. the function is continuous
                     |----> 2. [F(a4).F(b4) < 0] ----> (correct)
                     |----> 3. [F'(x) != 0] ----> (correct)

                       X(n)    |       X(n-1)  |       Func(X(n))
                     ------------------------------------------
                       1.7500  |       2.0000  |       1.6602
                       1.6416  |       1.7500  |       0.2458
                       1.6190  |       1.6416  |       0.0096
                       1.6180  |       1.6190  |       0.0000
                                                       -------> the ANSWER is 1.6180
------------------------------------------------------------------------------------------

Process returned 0 (0x0)   execution time : 0.404 s
Press any key to continue.
```

Question 9 :

```
#include <iomanip>
#include <bits/stdc++.h>
#include <cmath>
using namespace std ;
#define EPSILON 0.0001
double Func(double x) {
   return (((pow(x,3)) + (4*pow(x,2)) - (3*x)) - 7);
}
double Fprime(double x) {
   return (3*(pow(x,2)) + (8*x) - 3);
}
double Fzegond(double x) {
   return ((6*x) + 8);
}
void newton(double a, double b) {
   double X0, X1;
   if (Func(a)*Func(b) >= 0) {
      cout << "  You haven't assumed right a and b\n"<<endl;
      return;
   }
   else if (Func(a)*Fprime(a) > 0) {
      X0 = a;
   }
   else{
      X0 = b;
   {
   do {
      X1 = X0 - (Func(X0)/Fprime(X0));
      cout<<setprecision(4);
      cout<<std::fixed;
      cout<<"\t"<<"\t"<<"\t"<<X1<<"\t"<<"|"<<"\t"<<X0<<"\t"<<"|"<<"\t"<<Func(X1)<<endl;
      if (Func(X1) == 0.0) {
         break ; }
```

```
      X0=X1;
    } while (!(abs(Func(X1)) < EPSILON));
   cout<<"                                        -------> the ANSWER is "<<X1<<endl;
   cout<<"-------------------------------------------------------------------------------------------------------------------
"<<endl;
}
int main()
{
   cout<<endl;
   cout<<"  Question 9"<<endl;
   cout<<endl;
   cout<<"  F(x)= x^3 + 4(x^2) - 3x - 7 , EPSILON = 0.0001"<<endl;
   cout<<endl;
   cout<<"  F'(x)= 3(x^2) + 8x - 3"<<endl;
   cout<<endl;
   cout<<"  F''(x)= 6x + 8"<<endl;
   cout<<endl;
   cout<<"  Root ranges ----> (a1,b1)=[-5,-4]    (a2,b2)=[-2,-1]    (a3,b3)=[1,2]"<<endl;
   cout<<endl;
   cout<<"-------------------------------------------------------------------------------------------------------------------
"<<endl;
   cout<<endl;
   double a, b;
   for(int i1=1 ; i1 <=1 ; i1++)
   {
      cout<<"  in (a1,b1)=[-4,-3.5] |----> 1. the function is continuous"<<endl;
      cout<<"                       |----> 2. [F(a1).F(b1) < 0] ----> (correct)"<<endl;
      cout<<"                       |----> 3. [F'(x) != 0] ----> (correct)"<<endl;
      cout<<"                       |----> 4. [F\"(x) !=0] ----> (correct)"<<endl;
      cout<<endl;
      cout<<endl;
      a=-5, b=-4;
      cout<<"\t"<<"\t"<<"\t"<<"X(n)"<<"\t"<<"|"<<"\t"<<"X(n-1)"<<"\t"<<"|"<<"\t"<<"Func(X(n))"<<endl;
      cout<<"                    ------------------------------------------------"<<endl;
```

```
    newton(a,b);
  }
  cout<<endl;
  for(int i2=1 ; i2 <=1 ; i2++)
  {
    cout<<"  in (a2,b2)=[-1,-0.5] |----> 1. the function is continuous"<<endl;
    cout<<"                    |----> 2. [F(a2).F(b2) < 0] ----> (correct)"<<endl;
    cout<<"                    |----> 3. [F'(x) != 0] ----> (correct)"<<endl;
    cout<<endl;
    cout<<endl;
    a=-2, b=-1;
    cout<<"\t"<<"\t"<<"\t"<<"X(n)"<<"\t"<<"|"<<"\t"<<"X(n-1)"<<"\t"<<"|"<<"\t"<<"Func(X(n))"<<endl;
    cout<<"                  ----------------------------------------------"<<endl;
    newton(a,b);
  }
  cout<<endl;
  for(int i3=1 ; i3 <=1 ; i3++)
  {
    cout<<"  in (a3,b3)=[0.5,1]  |----> 1. the function is continuous"<<endl;
    cout<<"                    |----> 2. [F(a3).F(b3) < 0] ----> (correct)"<<endl;
    cout<<"                    |----> 3. [F'(x) != 0] ----> (correct)"<<endl;
    cout<<endl;
    cout<<endl;
    a=1, b=2;
    cout<<"\t"<<"\t"<<"\t"<<"X(n)"<<"\t"<<"|"<<"\t"<<"X(n-1)"<<"\t"<<"|"<<"\t"<<"Func(X(n))"<<endl;
    cout<<"                  ----------------------------------------------"<<endl;
    newton(a,b);
  }
  return 0;
}
```

C:\Users\IHC\Desktop\Q9.exe

Question 9

F(x)= x^3 + 4(x^2) - 3x - 7 , EPSILON = 0.0001

F'(x)= 3(x^2) + 8x - 3

F''(x)= 6x + 8

Root ranges ----> (a1,b1)=[-5,-4] (a2,b2)=[-2,-1] (a3,b3)=[1,2]

---

in (a1,b1)=[-4,-3.5] |----> 1. the function is continuous
|----> 2. [F(a1).F(b1) < 0] ----> (correct)
|----> 3. [F'(x) != 0] ----> (correct)
|----> 4. [F"(x) !=0] ----> (correct)

X(n)	X(n-1)	Func(X(n))
-4.3846	-4.0000	-1.2403
-4.3213	-4.3846	-0.0364
-4.3194	-4.3213	-0.0000

-------> the ANSWER is -4.3194

---

in (a2,b2)=[-1,-0.5] |----> 1. the function is continuous
|----> 2. [F(a2).F(b2) < 0] ----> (correct)
|----> 3. [F'(x) != 0] ----> (correct)

X(n)	X(n-1)	Func(X(n))
-1.1250	-1.0000	0.0137
-1.1233	-1.1250	0.0000

-------> the ANSWER is -1.1233

```
------------------------------------------------------------------------------------------

 in (a3,b3)=[0.5,1]  |----> 1. the function is continuous
                     |----> 2. [F(a3).F(b3) < 0] ----> (correct)
                     |----> 3. [F'(x) != 0] ----> (correct)


                      X(n)    |      X(n-1)  |      Func(X(n))
                     ----------------------------------------
                      1.5600  |      2.0000  |      1.8508
                      1.4497  |      1.5600  |      0.1042
                      1.4427  |      1.4497  |      0.0004
                      1.4427  |      1.4427  |      0.0000
                                                 -------> the ANSWER is 1.4427
------------------------------------------------------------------------------------------

Process returned 0 (0x0)   execution time : 0.426 s
Press any key to continue.
```