ASSIGNMENT NO:8 **DATE:13/03/2015**

PROGRAM STATEMENT: **Using Regular-Falsi Method, find a root of $x^3+2x-2=0$ correct upto 3 significant figures.**

THEORY: In this method we first find a sufficiently small interval $[a_0,b_0]$,such that $f(a_0)f(b_0)<0$,by tabulation oe graphical method,and which contains only one root x (say) of $f(x)=0$,i.e.,$f'(x)$ maintains same sign in $[a_0,b_0]$.

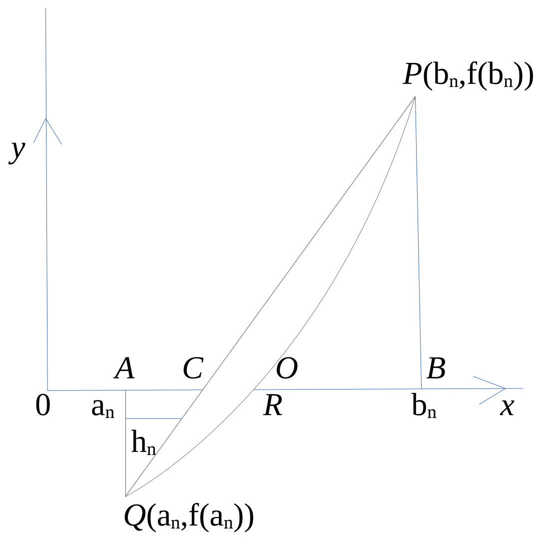
This method is method based on the assumption that the graph of $y=f(x)$ in small interval $[a_0,b_0]$ can be represented by the chord joining $(a_0,f(a_0))$ and $(b_0,f(b_0))$.Therefore, the point $x=a_1=a_0+h_0$ at which the chord meets the x-axis gives us an approximate value of the root x of the equation $f(x)=0$.Thus,we obtain two intervals $[a_0,x_1]$ and $[x_1,b_0]$,one of which must contain the root x,depending upon the conditions $f(a_0)f(x_1)<0$ or $f(x_1).f(b_0)<0$.If $f(x_1)f(b_0)<0$,then x lies in the interval $[x_1,b_0]$ which we rename as $[a_1,b_1]$.Again we consider that the graph of $y=f(x)$ in $[a_1,b_1]$ as the chord joining $(a_1,f(a_1))$ and $(b_1,f(b_1))$,thus the point of intersection of the chord with the x-axis (say) $x_2=a_1+h_1$ gives us an approximate value of the root x and x_2 is called *second approximation* of the root x.

Proceeding in this way,we shall get a sequence $\{x_1,x_2,x_3.........x_n\}$.Each member of which is the successive approximation of the exact root x of the equation $f(x)=0$.

Now we are going to establish an iteration formula which may generate a sequence of successive approximations of an exact root x of the equation $f(x)=0$,geometrically.

In the adjoining Fig. 6.8,we assume that one real root x of $f(x)=0$ lies in the small interval $[a_n,b_n]$ and $f(a_n)<0$ and $f(b_n)>0$.Let PRQ be the graph of $y=f(x)$ in $[a_n,b_n]$ intersecting the x-axis at R.

Thus,$x=0,R(=x)$ gives the exact value of the root x .If we consider curve PRQ as the chord PQ,in the small interval $[a_n,b_n]$,which intersects the x-axis at C,then $OC=x_{n+1}=a_n+h_n$ approximates the root x of the equation $f(x)=0$.



Now from similar triangles AQC and CBP ,we get ,

$$\frac{AC}{AQ}=\frac{CB}{BP} \quad \text{or} \quad AC=\frac{(AQ*CB)}{BP}=\frac{|f(a_n)|}{|f(b_n)|}(AB-AC)$$

$$\text{or} \quad AC\left[1+\frac{|f(a_n)|}{|f(b_n)|}\right]=\frac{|f(a_n)|}{|f(a_n)|}.AB=(b_n-a_n)$$

$$AC=h_n=\frac{|f(a_n)|*(b-a)}{|f(a_n)|+|f(b_n)|}$$

$$x_{n+1} = a_n + h_n = a_n + \frac{|f(a_n)| * (b-a)}{|f(a_n)| + |f(b_n)|}$$

PROGRAM CODE:

```
//C Program to find the Soln of an Equation using Regular-Falsi Method
#include <stdio.h>
#include <math.h>
double eq(double x)
{
	return (pow(x,3)+2*x-2);
}
double mod(double x)
{
	if(x<0)
		return -x;
	else
		return x;
}
double error(int a)
{
	return 5*pow(10,-a-1);
}
int main()
{
	int i=0;
	double a,b,h=0.0,k,l,e;
	printf("The equation we are solving is->   x^3+2*x-2=0\n");
	printf("Enter value of a::");
	scanf("%lf",&a);
	printf("Enter value of b::");
	scanf("%lf",&b);
	printf("You need the answer correct upto how many decimal places? ::");
	scanf("%lf",&e);
	e=error(e);
	if((eq(a)>0&&eq(b)<0)||(eq(b)>0&&eq(a)<0))//Condition that proves that the result lies between a and b
	{

printf("n\ta(n)\t\tb(n)\t\tf(a(n))\t\tf(b(n))\t\th(n)\t\tx(n+1)\t\tf(x(n+1))\n");
		do
		{
			l=h;
			h=(mod(eq(a))*(b-a))/(mod(eq(a))+mod(eq(b)));
			k=a+h;
			printf("%d\t%lf\t%lf\t%lf\t%lf\t%lf\t%lf\t%lf\n",i++,a,b,eq(a),eq(b),h,k,eq(k));
			if(eq(k)>0)
				b=k;
			else if(eq(k)<0)
				a=k;
			else
				break;
```

```
            }
            while(mod(l-h)>e);
            printf("The root is %.3lf\n",k);
      }
      else
      {
            printf("The result doesn't lie between a and b. Program 
Terminated.\n");
      }
      return 0;
}
```

OUTPUT:

```
The equation we are solving is->x^3+2*x-2=0
Enter value of a::0
Enter value of b::1
You need the answer correct upto how many decimal places? ::3
n     a(n)       b(n)         f(a(n))     f(b(n))    h(n)  x(n+1)      f(x(n+1))
0     0.000000 1.000000     -2.000000  1.00  0.666667   0.666667   -0.370370
1     0.666667   1.000000   -0.370370  1.00  0.090090   0.756757   -0.053106
2     0.756757   1.000000   -0.053106  1.00  0.012266   0.769023   -0.007156
3     0.769023   1.000000   -0.007156  1.00  0.001641   0.770664   -0.000956
4     0.770664   1.000000   -0.000956  1.00  0.000219   0.770883   -0.000128
5     0.770883   1.000000   -0.000128  1.00  0.000029   0.770912   -0.000017
The root is 0.771
```