Matlab program for Bisection Method

Write the Matlab program which can be used to find the approximate root of $f(x) = x^2 + x - 1 = 0$, on the interval [0,1], with considering $\epsilon = 0.0001$.

```
a=0 ;
b=1 ;
 x=sym('x');
 f=x^2+x-1;;
fa=subs(f,x,a);
fb=subs(f,x,b);
k=0;
 if fa*fb>0
 fprintf('the function f(x) has no root')
  break;
   else
  while abs(b-a)>0.0001
  c=(a+b)/2;
  fc=subs(f,x,c);
  if fc==0
  fprintf('the exact root=%f',c);
   fprintf('the number of iteration=%d',k);
    break;
   end
   if fa*fc>0
    a=c; fa=fc;
  else
   b=c; fb=fc;
   end
   k=k+1;
  end
 fprintf('the approximate root=%f',c);
 fprintf('the number of iteration=%d',k)
```

```
29-     end
```

Answer: the approximate root=0.617981

the number of iteration=14

Matlab program for Newton-Raphson algorithm

Write a Matlab program to find the approximate roots , using **N.R.** algorithm, of the following equation

$$f(x) = \sin x - \frac{(x+1)}{(x-1)}, \quad \text{let } x_0 = -0.2 \quad \epsilon = 0.001$$

```
1-          x0=-0.2 ;
2-          x=sym('x');
3-          f=sin(x)-((x+1)/(x-1));
4-          g=diff(f);
5-          fx0=subs(f,x,x0)
6-          gx0=subs(g,x,x0)
7-          k=0;
8-          x1=x0-(fx0/gx0)
9-          fx1=subs(f,x,x1);
10-        while abs(fx0/gx0)>0.001;
11-         fx1=subs(f,x,x1);
12-         if fx1==0
13-         fprintf('The exact root=%f',x1);
14-         break;
15-         else
16-        x0=x1;
17-         end
18-         k=k+1;
19-        fx0=subs(f,x,x0)
20-        gx0=subs(g,x,x0)
21-        x1=x0-(fx0/gx0)
22-        end
23-        fprintf('the approximate root=%f',x1);
24-        fprintf('the number of iteration=%d',k);
```

Answer: the approximate root= - 0.420362 , the number of iteration=4

Matlab program for Fixed Point algorithm

Write a Matlab program to find the approximate roots , using **Fixed point** algorithm, of the following equation

$f(x) = x - e^{x}$, Let $x_0 = 0.9$, $on\ [0,1]$, $\epsilon = 0.0001$

```
1- a=0 ;
2- b=1;
3- x0=0.9 ;
4- x=sym('x');
5- f=x-exp(-x);
6- g=exp(-x);
7- fa=subs(f,x,a);
8- fb=subs(f,x,b);
9-        k=0;
10-       if fa*fb>0
11-        fprintf('the function f has no root');
12-       break
13-       end
14-        if abs(subs(diff(g),x,x0))>1
15-    fprintf('the algorithm is divergent' );
16-    break;
17-    end
18- x1=subs(g,x,x0);
19- while abs(x1-x0)>0.0001
20-    fx1=subs(f,x,x1);
21-    if fx1==0
22-        fprintf('the exact root=%f',x1);
23-        break;
24-    end
25-    k=k+1;
26-    x0=x1;
27-     x1=subs(g,x,x0);
28- end
29- fprintf('the approximate root=%f',x1)
30- fprintf('the number of iterations=%d',k)
```

Answer:- The exact root=0.567143

The number of iterations=63