Lab(1):Bisection Method

a) Use the Bisection method to find solutions accurate to within $10^{-4}$for problem $x^3 + 4x^2 - 10 = 0$ for $1 \le x \le 2$

$a = 1,\ \ b = 2,\qquad$ tol=10^{-4}

$f(x) = x^3 + 4x^2 - 10$

$f(a) = f(1) = 1^3 + 4(1)^2 - 10 = -5,$

$f(b) = f(2) = 2^3 + 4(2)^2 - 10 = 14$

$p_1 = \frac{a+b}{2} = \frac{1+2}{2} = 1.5,$

$f(p_1) = f(1.5) = (1.5)^3 + 4(1.5)^2 - 10 = 2.375$

i	a_i	b_i	p_i	$f(a_i)$	$f(b_i)$	$f(p_i)$
1	1	2	1.5	-5.0000	14.0000	2.3750
2	1	1.5	1.25	-5.0000	2.3750	-1.7969
3	1.25	1.5	1.375	-1.7969	2.3750	0.1621
4	1.25	1.375	1.3125	-1.7969	0.1621	-0.8484
5	1.3125	1.375	1.3438	-0.8484	0.1621	-0.3510
6	1.3438	1.375	1.3594	-0.3510	0.1621	-.0964
7	1.3594	1.375	1.3672	-0.0964	0.1621	0.0324
8	1.3594	1.3672	1.3633	-0.0964	0.0324	-0.0321
9	1.3633	1.3672	1.3652	-0.0321	0.0324	0.0001
10	1.3633	1.3652	1.3643	-0.0321	0.0001	-0.0160
11	1.3643	1.3652	1.3647	-0.0160	0.0001	-0.0080
12	1.3647	1.3652	1.3650	-0.0080	0.0001	-0.0040
13	1.3650	1.3652	1.3651	-0.0040	0.0001	-0.0019
14	1.3651	1.3652	1.3652	-0.0019	0.0001	-0.0009

```
a=1;b=2;tol=10^-4;

f=inline('x^3+4*x^2-10');

fa=f(a);
fb=f(b);
res=zeros(2,7);

for i=1:200
   p=(a+b)/2;
   fp=f(p);

   res(i,:)=[i,a,b,p,fa,fb,fp];
   if (b-a)/2<=tol
       i
       z=p
      break
   else

      if sign(fp)==sign(fa)
         a=p;
         fa=fp;
      else
         b=p;
         fb=fp;
      end
   end
end
```

b) Find The exact solution for problem $x^3 + 4x^2 - 10 = 0$ for $1 \leq x \leq 2$

```
exact=fzero('x^3+4*x^2-10',[1,2])
```

c) Find the actual error for above problem.

```
actule_error=abs(z-exact)
```

Lab(2):Fixed Point Method

a) Use Fixed Point method to find solutions accurate to within $10^{-4}$for problem $x^3 + 4x^2 - 10 = 0$ for $1 \le x \le 2$ with generating function is $g(x) = x - \frac{x^3+4x^2-10}{3x^2+8x}$

$a = 1, \quad b = 2, \qquad \text{tol}=10^{-4}$

$p_0 = \frac{a+b}{2} = \frac{1+2}{2} = 1.5,$

$$g(x) = x - \frac{x^3 + 4x^2 - 10}{3x^2 + 8x}$$

i	p_i
1	1.373333333333333
2	1.365262014874627
3	1.365230013916147

```
a=1;b=2;tol=10^-14;

p0=(a+b)/2;
g=inline('x-(x^3+4*x^2-10)/(3*x^2+8*x)');
res=zeros(2,2);
for i=1:200
    p1=g(p0);
    res(i,:)=[i,p1];
    e=abs(p0-p1);
    if e<=tol
       i,p
       break
    else
       p0=p1;
    end
end
```

b) Find The exact solution for problem $x^3 + 4x^2 - 10 = 0$ for $1 \le x \le 2$

c) Find the actual error for above problem.

Lab(3):Newton's Method

a) Use Newton's method to find solutions accurate to within 10^{-4} for problem $x^3 + 4x^2 - 10 = 0$ for $1 \le x \le 2$

$a = 1, \quad b = 2$, tol=10^{-4}

$p_0 = \frac{a+b}{2} = \frac{1+2}{2} = 1.5,$

$f(x) = x^3 + 4x^2 - 10, \quad f'(x) = 3x^2 + 8x$

$$p_1 = p_0 - \frac{f(p_0)}{f'(p_0)} = 1.5 - \frac{f(p_0)}{f'(p_0)} = 1.5 - \frac{2.375}{18.75} = 1.37333$$

i	p_i
1	1.373333333333333
2	1.365262014874627
3	1.365230013916147

```
a=1;b=2;tol=10^-4;

f=inline('x^3+4*x^2-10');
df=inline(diff('x^3+4*x^2-10'));
res=zeros(1,2);
p0=(a+b)/2;
for i=1:200
   p=p0-f(p0)/df(p0);
   res(i,:)=[i,p];
   if abs(p-p0)<tol
        i,z=p
      break
   else
      p0=p;
    end
end
```

b) Find The exact solution for problem $x^3 + 4x^2 - 10 = 0$ for $1 \le x \le 2$

c) Find the actual error for above problem.

Lab(4):Secant Method

a) Use Secant method to find solutions accurate to within $10^{-4}$for problem $x^3 + 4x^2 - 10 = 0$ for $1 \le x \le 2$

where $p_0 = 1$ and $p_2 = 2$

i	p_i
1	1.263157894736842
2	1.338827838827839
3	1.366616394719345
4	1.365211902631857
5	1.365230001110859
6	1.365230013414206

```
p0=1;p1=2;
tol=10^-4;

f=inline('x^3+4*x^2-10');
res=zeros(1,2);
for i=1:200
   p=p1-f(p1)*(p1-p0)/(f(p1)-f(p0));
   res(i,:)=[i,p];
   if abs(p-p0)<=tol
        i,z=p
      break
   else
      p0=p1;
      p1=p;
    end
end
```

b) Find The exact solution for problem $x^3 + 4x^2 - 10 = 0$ for $1 \le x \le 2$

c) Find the actual error for above problem.