

# 用牛顿法求下列方程的根

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- $x^2 - e^x = 0$
- $xe^x - 1 = 0$
- $\lg x + x - 2 = 0$

In [1]:

```
import math
def f1(x):
    if (2*x-math.exp(x) == 0):
        return "error"
    else:
        return x-(x*x-math.exp(x))/(2*x-math.exp(x))

def f2(x):
    if ((x+1)*math.exp(x) == 0):
        return "error"
    else:
        return x-(x*math.exp(x)-1)/((x+1)*math.exp(x))

def f3(x):
    if (x <= 0):
        return "error"
    if (1/(x*math.log(10))+1 == 0):
        return "error"
    else:
        return x-(math.log(x)/math.log(10)+x-2)/(1/(x*math.log(10))+1)
```

In [2]:

```
x = 1
temp = 0
while (abs(x-temp)>0.0000000000000001):
    temp = x
    x = f1(x)
    print(x)
```

```
-1.3922111911773332
-0.8350875293671394
-0.7098340945745987
-0.7034834042362847
-0.703467422599462
-0.7034674224983917
-0.7034674224983917
```

In [3]:

```
x = 1
temp = 0
while (abs(x-temp)>0.0000000000000001):
    temp = x
    x = f2(x)
    print(x)
```

```
0.6839397205857212
0.5774544771544498
0.5672297377301171
0.5671432965302959
0.567143290409784
0.5671432904097838
0.5671432904097838
```

In [4]:

```
x = 1
temp = 0
while (abs(x-temp)>0.0000000000000001):
    temp = x
    x = f3(x)
print(x)
```

```
1.6972068934358862
1.7553795434500208
1.75557949700258
1.755579499261178
1.755579499261178
```

## Result

- $x^2 - e^x = 0$  根为  $-0.7034674224983917$
- $xe^x - 1 = 0$  根为  $0.5671432904097838$
- $\lg x + x - 2 = 0$  根为  $1.755579499261178$

## 编写一个割线法的程序，求解上述各方程

- $x^2 - e^x = 0$
- $xe^x - 1 = 0$
- $\lg x + x - 2 = 0$

In [5]:

```
import math
def f4(x1, x2):
    if ((x1*x1-math.exp(x1))-(x2*x2-math.exp(x2)) == 0):
        return x1
    else:
        return x1-(x1*x1-math.exp(x1))/((x1*x1-math.exp(x1))-(x2*x2-math.exp(x2)))

def f5(x1, x2):
    if ((x1*math.exp(x1)-1)-(x2*math.exp(x2)-1) == 0):
        return x1
    else:
        return x1-(x1*math.exp(x1)-1)/((x1*math.exp(x1)-1)-(x2*math.exp(x2)-1))*(x1

def f6(x1, x2):
    if (x1 <= 0 or x2 <= 0):
        return "error"
    if ((math.log(x1)/math.log(10)+x1-2)-(math.log(x2)/math.log(10)+x2-2) == 0):
        return x1
    else:
        return x1-(math.log(x1)/math.log(10)+x1-2)/((math.log(x1)/math.log(10)+x1-2
```

In [6]:

```
x1 = 1
x2 = 0
while (abs(x2-x1)>0.0000000000000001):
    temp = x1
    x1 = f4(x1, x2)
    x2 = temp
print(x1)
```

```
-1.3922111911773332
-0.20612751271406604
-0.5778333714634147
```

```
-0.7330842972939767  
-0.7019544393346077  
-0.7034498327184769  
-0.7034674330341212  
-0.7034674224983183  
-0.7034674224983917  
-0.7034674224983917
```

In [7]:

```
x1 = 1  
x2 = 0  
while (abs(x2-x1)>0.0000000000000001):  
    temp = x1  
    x1 = f5(x1, x2)  
    x2 = temp  
    print(x1)
```

```
0.36787944117144233  
0.5033143321329856  
0.5786158630519874  
0.5665323438586994  
0.5671375717285394  
0.5671432932720224  
0.5671432904097705  
0.5671432904097838  
0.5671432904097838
```

In [8]:

```
x1 = 1  
x2 = 0.5  
while (abs(x2-x1)>0.0000000000000001):  
    temp = x1  
    x1 = f6(x1, x2)  
    x2 = temp  
    print(x1)
```

```
1.624196350581785  
1.7476883930575944  
1.7555181658929515  
1.755579471853784  
1.755579499261083  
1.7555794992611777  
1.755579499261178  
1.755579499261178
```