Find the minimum of .

1. Use Newton method to find .

by Taylor expansion at a,

That is ,

So, Step 1. Choose initial value

Step 2.

Step 3. repeat step2. until

Case 1:

The initial value .

the 1 -th step, x is 0.1 , f(x) is -6.4139

the 2 -th step, x is 0.6228762 , f(x) is -23.55557

the 3 -th step, x is 0.7691724 , f(x) is -24.36535

the 4 -th step, x is 0.7808111 , f(x) is -24.3696

the 5 -th step, x is 0.7808835 , f(x) is -24.3696

and

Hence, the minimum is -24.3696 , x is 0.7808835.

Case 2:

The initial value .

the 1 -th step, x is 1.9 , f(x) is 0.6061

the 2 -th step, x is -7.252268 , f(x) is 11769.76

the 3 -th step, x is -3.816278 , f(x) is 2131.211

the 4 -th step, x is -1.602691 , f(x) is 330.537

the 5 -th step, x is -0.2476316 , f(x) is 21.22985

the 6 -th step, x is 0.4755351 , f(x) is -21.17379

the 7 -th step, x is 0.7413672 , f(x) is -24.32074

the 8 -th step, x is 0.7800808 , f(x) is -24.36958

the 9 -th step, x is 0.7808831 , f(x) is -24.3696

and

Hence, the minimum is -24.3696 , x is 0.7808830.

And, I have tried different initial value ,,

All these value except will converge (i.e ).

1. Use golden-section method:

To

Let ,

Step 1. choose .

Step 2. choose .

Step 3.

In , If . Else .

In , If g. Else .

Step 4. repeat step 3. until

Simulation:

.

left g(x): 21.6875 , middle g(x): 23 , right g(x): -4

left g(x): 21.6875 , middle g(x): 23 , right g(x): 12.1875

left g(x): 21.6875 , middle g(x): 24.33984 , right g(x): 23

left g(x): 23.57788 , middle g(x): 24.33984 , right g(x): 23

left g(x): 23.57788 , middle g(x): 24.33984 , right g(x): 24.10522

left g(x): 24.09154 , middle g(x): 24.33984 , right g(x): 24.10522

left g(x): 24.09154 , middle g(x): 24.33984 , right g(x): 24.3391

left g(x): 24.24783 , middle g(x): 24.33984 , right g(x): 24.3391

left g(x): 24.33984 , middle g(x): 24.3696 , right g(x): 24.3391

left g(x): 24.36238 , middle g(x): 24.3696 , right g(x): 24.3391

left g(x): 24.36238 , middle g(x): 24.3696 , right g(x): 24.36175

left g(x): 24.36789 , middle g(x): 24.3696 , right g(x): 24.36175

left g(x): 24.36789 , middle g(x): 24.3696 , right g(x): 24.36754

left g(x): 24.36921 , middle g(x): 24.3696 , right g(x): 24.36754

left g(x): 24.36921 , middle g(x): 24.3696 , right g(x): 24.36904

left g(x): 24.36952 , middle g(x): 24.3696 , right g(x): 24.36904

left g(x): 24.36952 , middle g(x): 24.3696 , right g(x): 24.36944

left g(x): 24.36959 , middle g(x): 24.3696 , right g(x): 24.36944

left g(x): 24.36959 , middle g(x): 24.3696 , right g(x): 24.36955

left g(x): 24.36959 , middle g(x): 24.3696 , right g(x): 24.3696

left g(x): 24.3696 , middle g(x): 24.3696 , right g(x): 24.3696

left g(x): 24.3696 , middle g(x): 24.3696 , right g(x): 24.3696

left g(x): 24.3696 , middle g(x): 24.3696 , right g(x): 24.3696

left g(x): 24.3696 , middle g(x): 24.3696 , right g(x): 24.3696

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left g(x): 24.3696 , middle g(x): 24.3696 , right g(x): 24.3696

left g(x): 24.3696 , middle g(x): 24.3696 , right g(x): 24.3696

left g(x): 24.3696 , middle g(x): 24.3696 , right g(x): 24.3696

left point: 0.78088 , middle point: 0.7808838 ,right point: 0.7808876

Hence, the minimum of f(x)= -24.3696 , and x is 0.7808838.

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| --- |
| #newton method  f<-function(x){ x^4-14\*x^3+60\*x^2-70\*x }  seed<-1.9  for(i in 1:20){  epslon<-10^-5 ;h<-10^-6  x1<-0;x2<-seed ;loop<-1  while(abs(x2-x1)>=epslon &&loop<500){  cat("the ",loop,"-th step,","x is ",x2,", f(x) is ",f(x2),"\n")  loop<-loop+1  x1<-x2  firdif<-(f(x1+h)-f(x1))/h  secdif<-(f(x1+2\*h)-2\*f(x1+h)+f(x1) ) / h^2  x2<-x1-firdif/secdif  }  seed<-seed+0.1  }  #golden-section  g<-function(x){ -(x^4-14\*x^3+60\*x^2-70\*x) }  g(seq(0,100,1))  xl<-0 ;g(xl)  xm<-1 ;g(xm)  xr<-2 ;g(xr)  loop<-1  while((xr-xl)>=epslon){#f(xm)-f(xl)>=epslon && f(xm)-f(xr)>=epslon  if(abs(xl-xm)>=abs(xr-xm)){ #choose large interval  x4<-(xl+xm)/2  if(g(x4)>g(xm)){ xr<-xm ;xm<-x4 }else{ xl<-x4 }  }else{  x4<-(xr+xm)/2  if(g(x4)>g(xm)){ xl<-xm ;xm<-x4 }else{ xr<-x4 }  }  loop<-loop+1  cat("left g(x):",g(xl),", middle g(x):",g(xm),", right g(x):",g(xr),"\n")  };cat("left point:",xl,", middle point:",xm,", right point:",xr,"\n") |