

# Solutions for HW #6

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## HW6\_Solutions.m

### Problem 1(a)

#### Define inline function

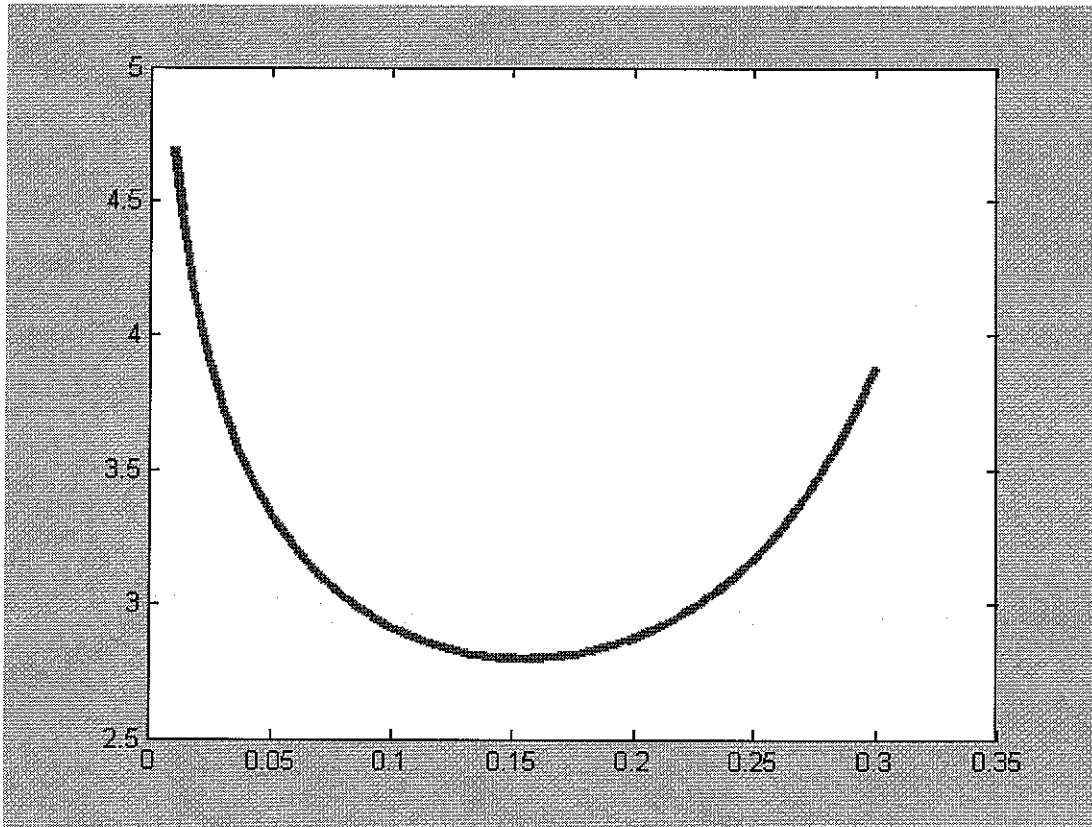
```
fa=inline('log(x)./(x.^2+2*x-1)', 'x')
```

```
fa =
```

```
Inline function:  
fa(x) = log(x)./(x.^2+2*x-1)
```

#### Plot the function

```
xx=linspace(0.01, .3, 100);  
% Evaluate the function  
fmax=fa(xx);  
figure, plot(xx, fmax, 'g', 'linewidth', 3)
```



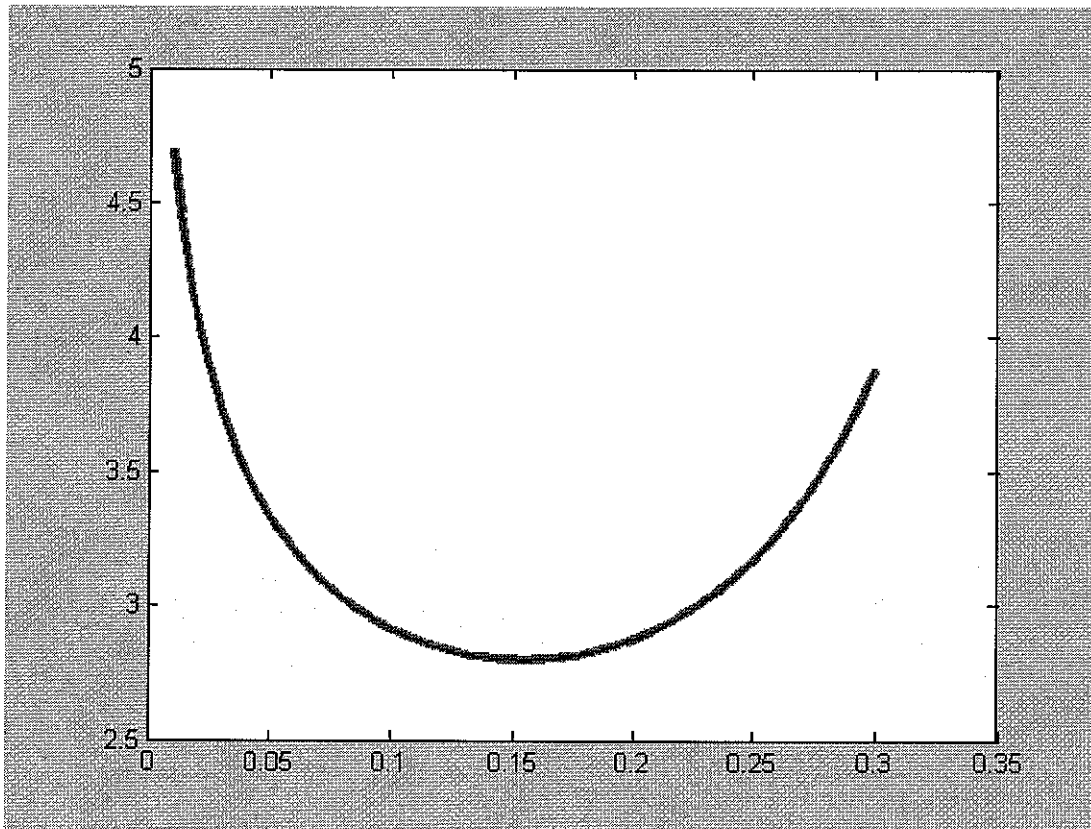
### Define m-file function

```
type HW6_Fun1a
% Evaluate the m-file function
```

```
F=HW6_Fun1a(xx);
hold on
plot(xx,F,'b--')
FUN=@HW6_Fun1a;
F2=feval(FUN,xx);
plot(xx,F2,'r')
```

```
%% HW6_Fun1a.m
function f=HW6_Fun1a(x)

f= log(x) ./ (x.^2+2*x-1);
```



```

X=0.1; dx=.0001
F=fa(X)
FP=fa(X+dx)
FM=fa(X-dx)
FC=fa(X+dx*sqrt(-1))
dfFD=(FP-F)/dx
dfBD=(F-FM)/dx
dfCD=(FP-FM)/dx/2
dfCVM=imag(FC)/dx

% Exact
syms x
f=log(x)/(x^2+2*x-1)
df=diff(f,x)
dfn=subs(df,x,0.1)
[dfFD dfBD dfCD dfCVM dfn]

```

dx =

1.0000e-004

F =

2.9147

FP =

2.9142

FM =

2.9151

FC =

2.9147 - 0.0005i

dfFD =

-4.5360

dfBD =

-4.5469

dfCD =

-4.5414

dfCVM =

-4.5414

f =

$\log(x) / (x^2+2x-1)$

df =

$1/x / (x^2+2x-1) - \log(x) / (x^2+2x-1)^2 * (2x+2)$

dfn =

-4.5414

ans =

Columns 1 through 4

-4.5360    -4.5469    -4.5414    -4.5414

Column 5

-4.5414

### Problem 1(b)

symbolic integration

```
syms x
f=log(x)/(x^2+2*x-1)
Intf=double(int(f,x,1,pi))
% Numerical integration
```

```
intfN=quad(fa,1,pi)
```

```
f =
```

```
log(x)/(x^2+2*x-1)
```

```
Intf =
```

```
0.1823 - 0.0000i
```

```
intfN =
```

```
0.1823
```

## Problem 2(a)

### Define inline function

```
fa=inline('(2*x+1)./sqrt(x.*(1-x))','x')
```

```
fa =
```

```
Inline function:
```

```
fa(x) = (2*x+1)./sqrt(x.*(1-x))
```

### Plot the function

```
xx=linspace(0.01,.8,100);
% Evaluate the function
fmax=fa(xx);
figure,plot(xx,fmax,'g','linewidth',3)
```

```
%%
```

```
X=0.5; dx=.0001
```

```
F=fa(X)
```

```
FP=fa(X+dx)
```

```
FM=fa(X-dx)
```

```
FC=fa(X+dx*sqrt(-1))
```

```
dfFD=(FP-F)/dx
```

```
dfBD=(F-FM)/dx
```

```
dfCD=(FP-FM)/dx/2
```

```
dfCVM=imag(FC)/dx
```

```
% Exact
```

```
syms x
```

```
f=(2*x+1)/sqrt(x*(1-x))
```

```
df=diff(f,x)
```

```
dfn=subs(df,x,0.5)
```

```
[dfFD dfBD dfCD dfCVM dfn]
```

```
dx =
```

```
1.0000e-004
```

F =

4

FP =

4.0004

FM =

3.9996

FC =

4.0000 + 0.0004i

dfFD =

4.0008

dfBD =

3.9992

dfCD =

4.0000

dfCVM =

4.0000

f =

 $(2*x+1)/(x*(1-x))^{1/2}$ 

df =

 $2/(x*(1-x))^{1/2} - 1/2*(2*x+1)/(x*(1-x))^{3/2}*(1-2*x)$ 

dfn =

4

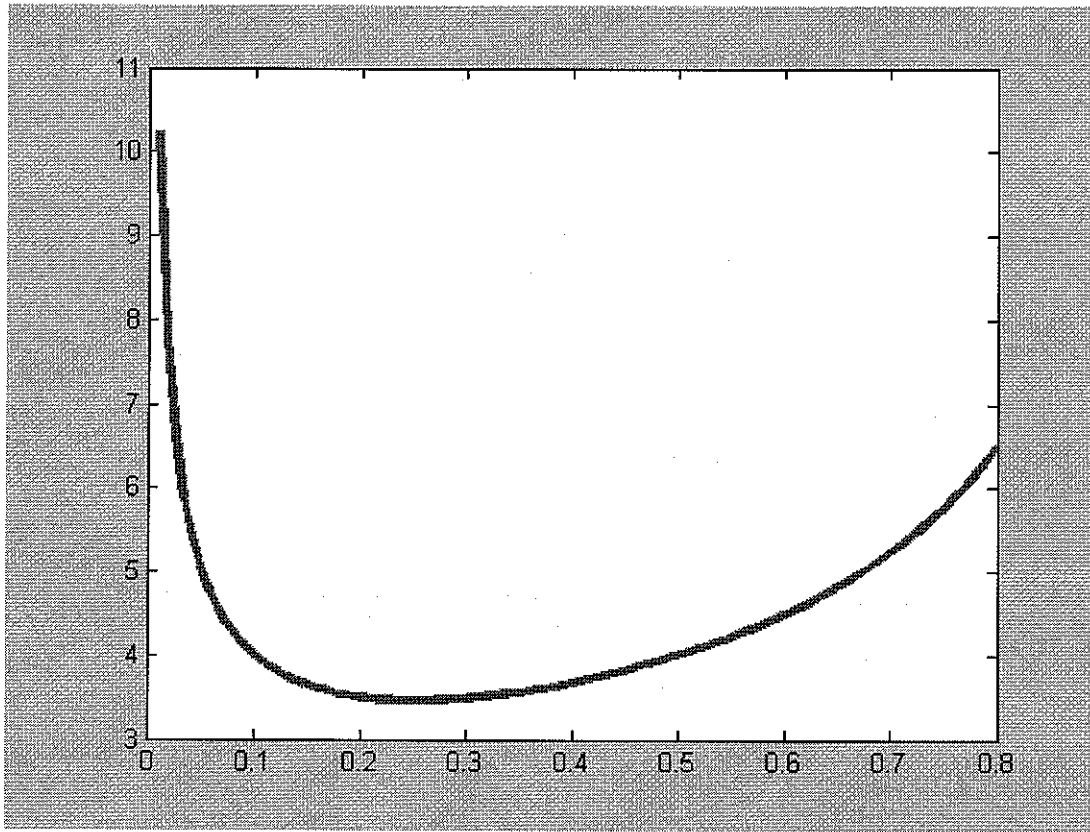
ans =

Columns 1 through 4

4.0008    3.9992    4.0000    4.0000

Column 5

4.0000

**Problem 2(b)**

symbolic integration

```
Intf=double(int(f,x,0,1))
% Numerical integration
intfN=quad(fa,0,1)
```

Intf =

6.2832

intfN =

6.2832

**Problem 3(Problem 18,page 407)**

Develop a function f to be minimized

```
syms r b h
% solve for h in terms of r and b
V=pi*r^2*((b/3)+h)
EQ=V-1
```

```

H=solve( EQ,h)
S=pi*r*(2*h+sqrt(b^2+r^2))
% function to be minimized
f=subs(S,h,H)
% write an m-file (HW6Fun3.m) to evaluate f
type HW6fun3
% find minimum by fminsearch
XMIN=fminsearch(@HW6Fun3,[1 1])

```

V =

$$\pi r^2 (1/3 b + h)$$

EQ =

$$\pi r^2 (1/3 b + h) - 1$$

H =

$$-1/3 (\pi r^2 b - 3) / \pi r^2$$

S =

$$\pi r (2h + (b^2 + r^2)^{1/2})$$

f =

$$\pi r (-2/3 (\pi r^2 b - 3) / \pi r^2 + (b^2 + r^2)^{1/2})$$

```

function f=HW6Fun3(x)
b=x(1);r=x(2);

```

$$f = -1/3/r * (2*\pi*r^2*b - 6 - 3*(b^2+r^2)^{1/2})*\pi*r^2 ;$$

XMIN =

0.6736    0.7531

### Plot the optimal design

```

x=XMIN;
b=x(1)
r=x(2)
h=-1/3*(pi*r^2*b-3)/pi/r^2
S=pi*r*(2*h+sqrt(b^2+r^2))

XX=[0 r r -r -r 0];
YY=[0 b b+h b+h b 0];

```

```
figure
plot(XX,YY,'b','linewidth',3)
title('\bfOptimal cylindrical container')

YT=1.3;
text(-.4,YT,'\bfOptimal design : ')
text(-.4+.2,YT-.08,['\bfb=' ,num2str(b)])
text(-.4+.2,YT-.16,['\bfh=' ,num2str(h)])
text(-.4+.2,YT-.24,['\bfr=' ,num2str(r)])
text(-.2,.8,['\bfSurface area=' ,num2str(S)])
```

b =

0.6736

r =

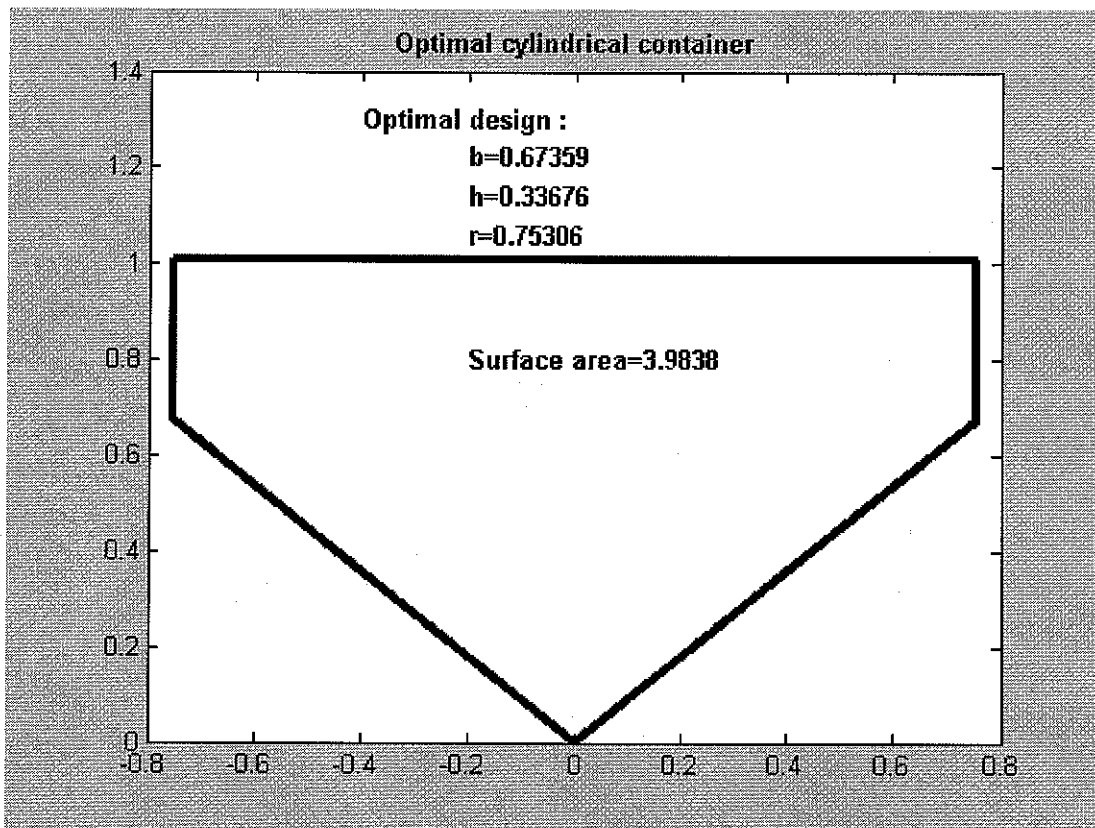
0.7531

h =

0.3368

S =

3.9838



**Problem 4 (Problem 9,page 404)**

write a function to evaluate the disyance

```

type HW6Fun4
% solution by fminsearch
[XOPT,dMin]=fminsearch(@HW6Fun4,0)
% Plot the solution
figure
x=linspace(-.2,2,100);
YOPT=XOPT^2
plot(x,x.^2)
hold on
plot(1,2,'bs','linewidth',3)
plot(XOPT,YOPT,'ro','linewidth',3)
plot([1 XOPT],[2 YOPT],'r','linewidth',2)
title(['\bfProblem 4','\bfmin distance=',num2str(dMin)])
text(XOPT+.02,YOPT,['\bf(' ,num2str(XOPT),',',',num2str(YOPT),') '])
text(1,2,'\bfP([1,2])')
xlabel('\bfx')
ylabel('\bfy')

```

```

function d=HW6Fun4(x)
XP=1;YP=2;
y=x^2;
d=sqrt((XP-x)^2+(YP-y)^2);

```

```

XOPT =
    1.3660

```

```

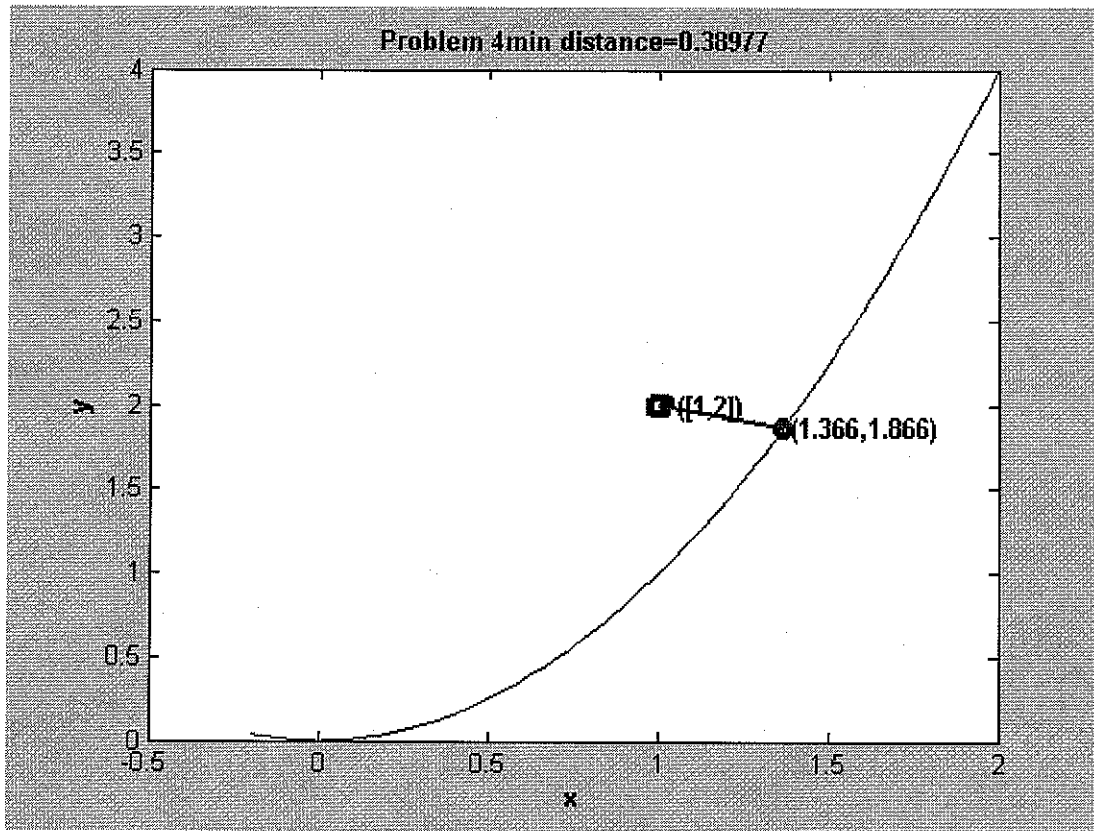
dMin =
    0.3898

```

```

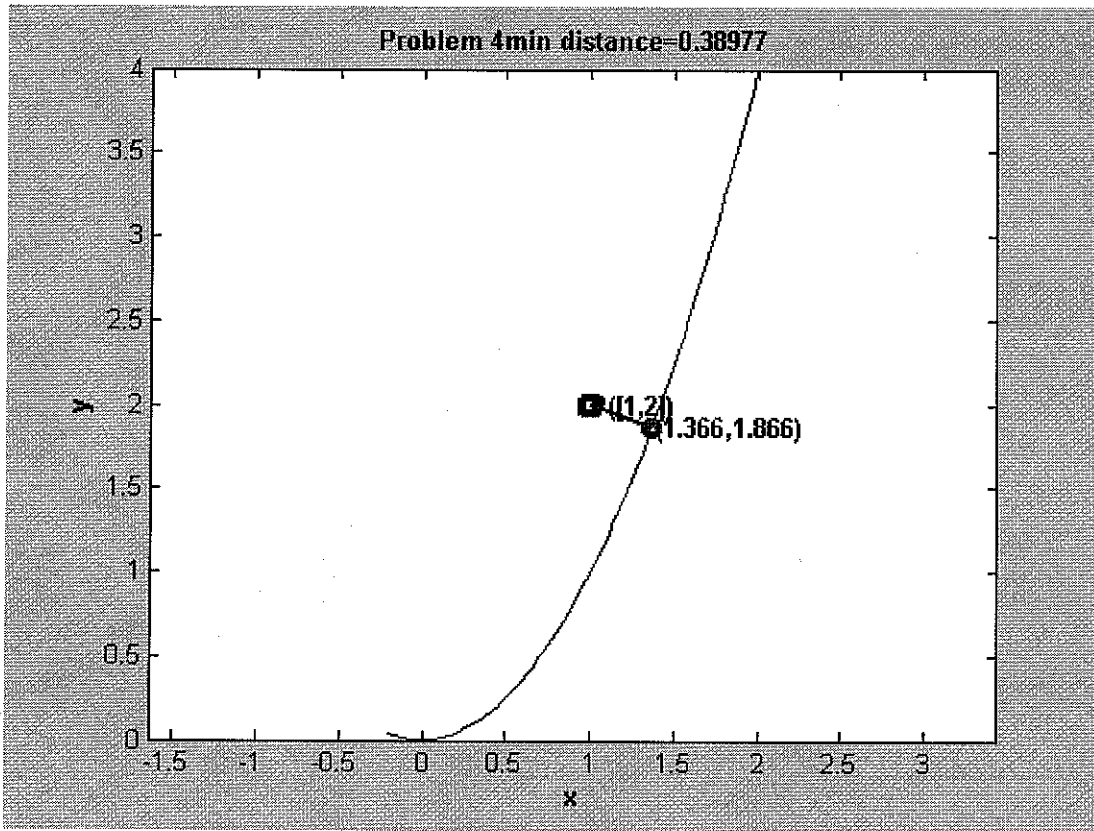
YOPT =
    1.8660

```



Change scale

axis equal



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