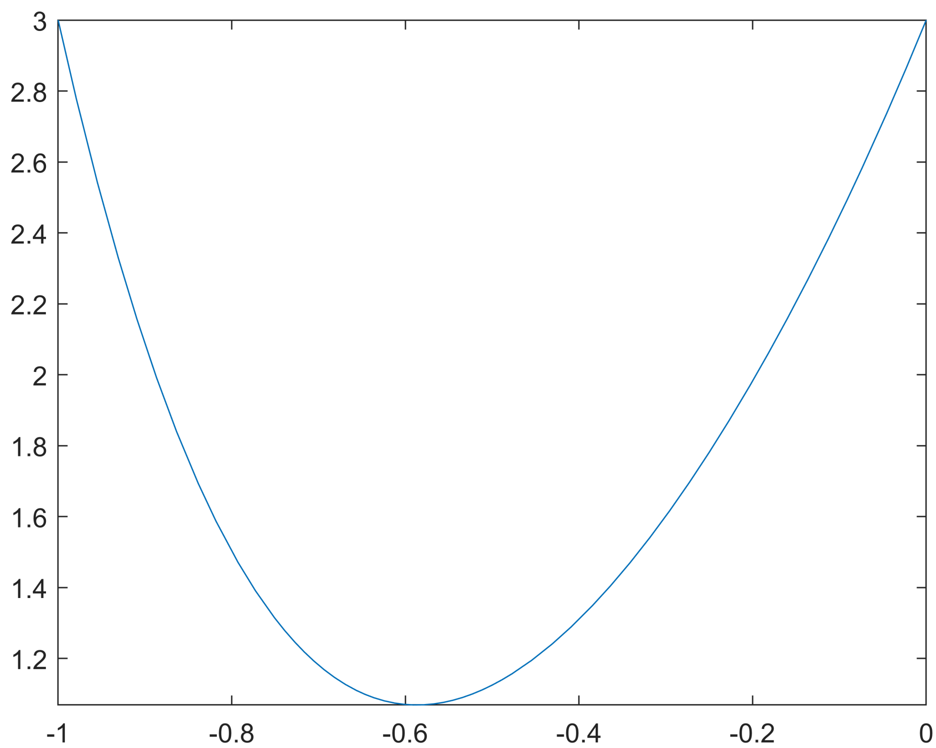
Ejercicios de optimización de funciones

Encontrar un máximo o un mínimo local

7.3 Locate the minimum of the function

f (*x*) = 3 + 6*x* + 5*x*^2 + 3*x*^3 + 4*x*^4

```
%
f=@(x) 3 + 6*x + 5*x.^2 + 3*x.^3 + 4*x.^4;
g=@(x) -1;
fplot(f,[-1,0])
```




```
%minimo goldenSS
[x,i]=goldenSS(f,-1,0)
```

```
x = -0.5867
i = 75
```

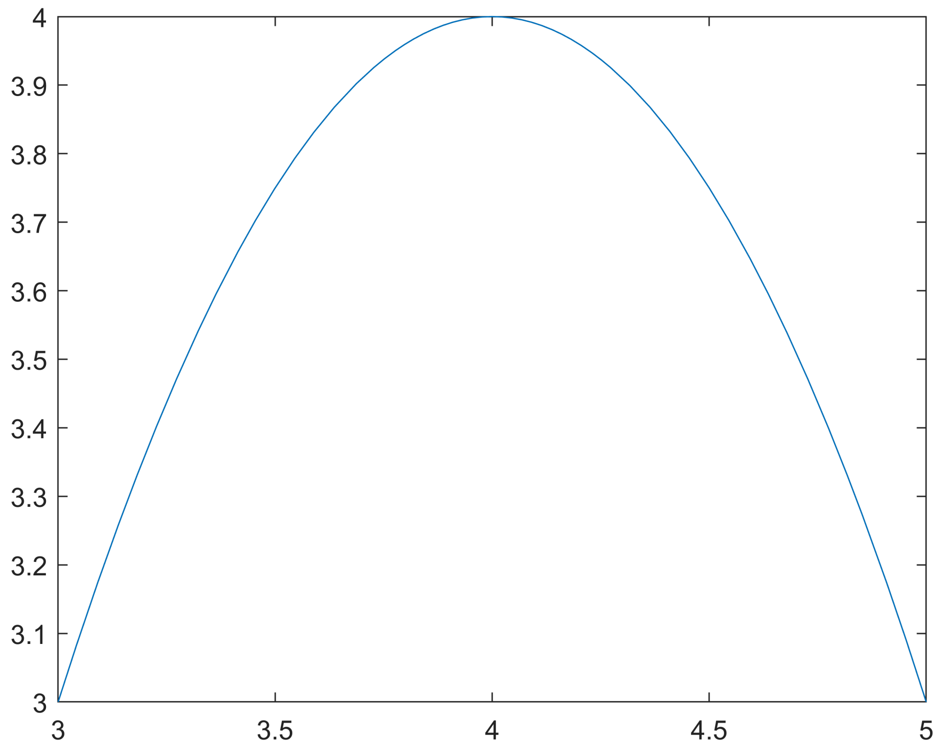
```
%minimo newtonOpt
[x,i,max]=newtonOpt(f,2)
```

```
x = -0.5867
i = 9
max = logical
   0
```

7.2 Determine the maximum and the corresponding value of x for the function

$f(x) = -x^2 + 8x - 12$

```
%
f=@(x) -x.^2+8*x-12;
fplot(f,[3,5])
```



```
%maximo goldenSS
[x,i]=goldenSS(@(x) -f(x),3,5)
```

```
x = 4.0000
i = 72
```

```
%maximo newtonOpt
[x,i,max]=newtonOpt(f,2)
```

```
x = 4
i = 1
max = logical
   1
```

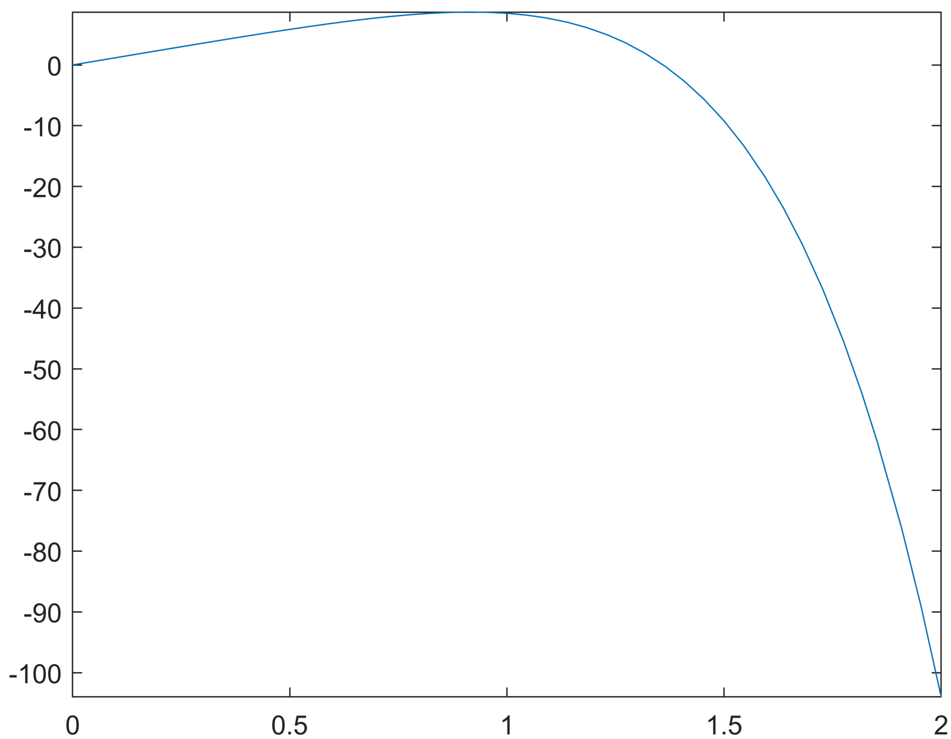
7.4 Given

$$f(x) = -1.5x^6 - 2x^4 + 12x$$

(a) Plot the function.

```
%
f=@(x) -1.5*x.^6-2*x.^4+12*x;
```

```
fplot(f,[0,2])
```



(b) Use analytical methods to prove that the function is concave for all values of *x*.

f´(x)=-9x^5-8x^3+12

f´´(x)=-45x^4-24x^2

Se puede observar que para todo x, se tiene que la segunda derivada es menor o igual a 0, que cumple con la condición de ser cóncava.

(c) Find the maximum *f*(*x*) and the corresponding value of *x*.

```
%maximo goldenSS
[x,i]=goldenSS(@(x) -f(x),0,2)
```

```
x = 0.9169
i = 76
```

```
%maximo newtonOpt
[x,i,max]=newtonOpt(f,-2 )
```

```
x = 0.9169
i = 20
max = logical
   1
```

Problema de la presentación:

g= 9.81 m/s^2

z0= 100 m

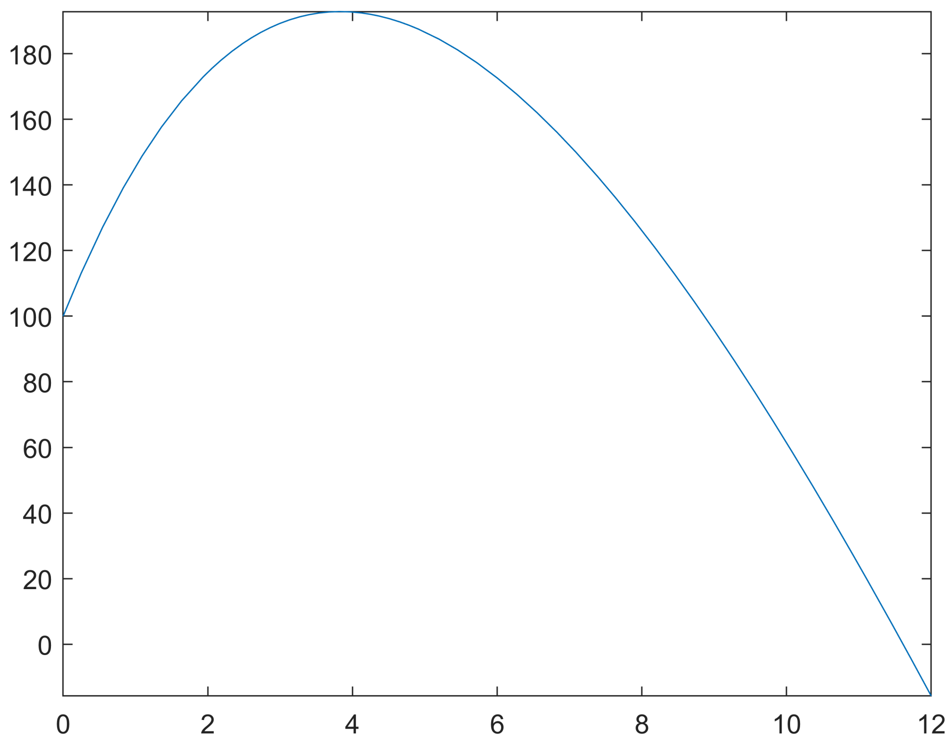
v0= 55 m/s

m=80 kg

c= 15 kg/s

z=z0+(m/c) * (v0 +m*g/c)*(1- e^(-c*t/m)) - m*g*t/c

```
g=9.81;
z0=100;
v0=55;
m=80;
c=15;
f=@(t) z0+(m/c) * (v0 +m*g/c)*(1- exp(-c*t/m)) - m*g*t/c;
fplot(f,[0,12])
```




```
%maximo goldenSS
[x,i]=goldenSS(@(t) -f(t),2,5)
```

```
x = 3.8317
i = 74
```

```
%maximo newtonOpt
[x,i,max]=newtonOpt(f,-2 )
```

```
x = 3.8317
i = 6
max = logical
```

1

Código de las funciones

Golden section search

```
function [res,i]=goldenSS(f,a,b)
    phi=(2-(1+sqrt(5))/2);
    e=(b-a) * phi;
    c = a + e;
    d = b - e;
    fc = f(c);
    fd = f(d);
    MAX=1000;
    i=0;
    while abs(b-a)/(abs(c)+abs(d))>eps && i<MAX
        i=i+1;
        if fc < fd
            b = d;
            d = c;
            c = a + (b-a) * phi;
            fd = fc;
            fc = f(c);

        else
            a = c;
            c = d;
            d = b - (b-a) * phi;
            fc = fd;
            fd = f(d);
        end
    end
    res=(a+b)/2;
end
```

Newton optimization

```
function [xfin,i,max]=newtonOpt(f,xi)
    syms x
    fsym=sym(f);
    dfs=diff(fsym);
    if dfs==0, error('La función es constante, no tiene máximos'), end
    df=matlabFunction(dfs);
    dfs2=diff(fsym,2);
    if dfs2==0,error('no hay maximos locales, el máximo se encuentra en un extremo'),end
    if isempty(symvar(dfs2))
        d2=matlabFunction(dfs2,'vars',x);
        df2=@(x) ones(size(x))*d2(x);
    else
        df2=matlabFunction(dfs2);
    end
    xp=xi;
    MAX=1000;
```

```
    i=0;


    xfin=xp-df(xp)/df2(xp);
    while abs((xfin-xp)/xfin)>eps && i<MAX
        xp=xfin;
        xfin=xp-df(xp)/df2(xp);
        i=i+1;
    end

    max=false;
    if(df2(xfin)<0)
        max=true;
    end
end
```