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Lagrange Multipliers Method

```
clc
clear all
close all
syms x y lam
f=x^2+2*y^2
g=x^2+y^2-1
gradf = gradient(f,[x,y])
gradg = gradient(g,[x,y])
lagr = gradf-lam*gradg
[lamsol,xsol,ysol]=solve(lagr(1),lagr(2),g);
double([xsol,ysol,lamsol]);
real(double([xsol,ysol,lamsol]))
hfun = inline(vectorize(f))
values = real (double(hfun(xsol,ysol)))
```

```
f =

x^2 + 2*y^2


g =

x^2 + y^2 - 1


gradf =

2*x
4*y


gradg =

2*x
2*y


lagr =

2*x - 2*lam*x
4*y - 2*lam*y
```

```
ans =

    -1     0     1
     1     0     1
     0    -1     2
     0     1     2


hfun =

     Inline function:
     hfun(x,y) = x.^2 + 2.*y.^2


values =

     1
     1
     2
     2
```

Dimension of closed rect box with max volume can be inscribed in the unit sphere

```
clc
clear all
close all
syms x y z lam
f=x*y*z
g=x^2+y^2+z^2-1
gradf = gradient(f,[x,y,z])
gradg = gradient(g,[x,y,z])
lagr = gradf-lam*gradg
[lamsol,xsol,ysol,zsol]=solve(lagr(1),lagr(2),lagr(3),g);
double([xsol,ysol,zsol,lamsol]);
real(double([xsol,ysol,zsol,lamsol]))
hfun = inline(vectorize(f))
values = real (double(hfun(xsol,ysol,zsol)))
```

```
f =

x*y*z


g =

x^2 + y^2 + z^2 - 1
```

```
gradf =

y*z
x*z
x*y


gradg =

2*x
2*y
2*z


lagr =

y*z - 2*lam*x
x*z - 2*lam*y
x*y - 2*lam*z


ans =

   -0.5774   -0.5774   -0.5774   -0.2887
    0.5774   -0.5774   -0.5774    0.2887
   -0.5774    0.5774   -0.5774    0.2887
    0.5774    0.5774   -0.5774   -0.2887
   -0.5774   -0.5774    0.5774    0.2887
    0.5774   -0.5774    0.5774   -0.2887
   -0.5774    0.5774    0.5774   -0.2887
    0.5774    0.5774    0.5774    0.2887
   -1.0000         0         0         0
    1.0000         0         0         0
         0   -1.0000         0         0
         0    1.0000         0         0
         0         0   -1.0000         0
         0         0    1.0000         0


hfun =

     Inline function:
     hfun(x,y,z) = x.*y.*z


values =

   -0.1925
    0.1925
    0.1925
   -0.1925
    0.1925
   -0.1925
   -0.1925
```

```
    0.1925
         0
         0
         0
         0
         0
         0
```

Locating a radio Telescope

```
clc
clear all
close all
syms x y z lam
f=6*x-y^2+x*z+60
g=x^2+y^2+z^2-36
gradf = gradient(f,[x,y,z])
gradg = gradient(g,[x,y,z])
lagr = gradf-lam*gradg
[lamsol,xsol,ysol,zsol]=solve(lagr(1),lagr(2),lagr(3),g);
double([xsol,ysol,zsol,lamsol]);
real(double([xsol,ysol,zsol,lamsol]))
hfun = inline(vectorize(f))
values = real (double(hfun(xsol,ysol,zsol)))
```

```
f =

- y^2 + 6*x + x*z + 60


g =

x^2 + y^2 + z^2 - 36


gradf =

z + 6
 -2*y
    x


gradg =

2*x
2*y
2*z


lagr =
```

```
z - 2*lam*x + 6
- 2*y - 2*lam*y
    x - 2*lam*z


ans =

         0         0   -6.0000         0
   -4.0000   -4.0000    2.0000   -1.0000
   -4.0000    4.0000    2.0000   -1.0000
   -5.1962         0    3.0000   -0.8660
    5.1962         0    3.0000    0.8660


hfun =

     Inline function:
     hfun(x,y,z) = 6.*x + x.*z - y.^2 + 60


values =

   60.0000
   12.0000
   12.0000
   13.2346
  106.7654
```

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