

University of Technology
الجامعة التكنولوجية



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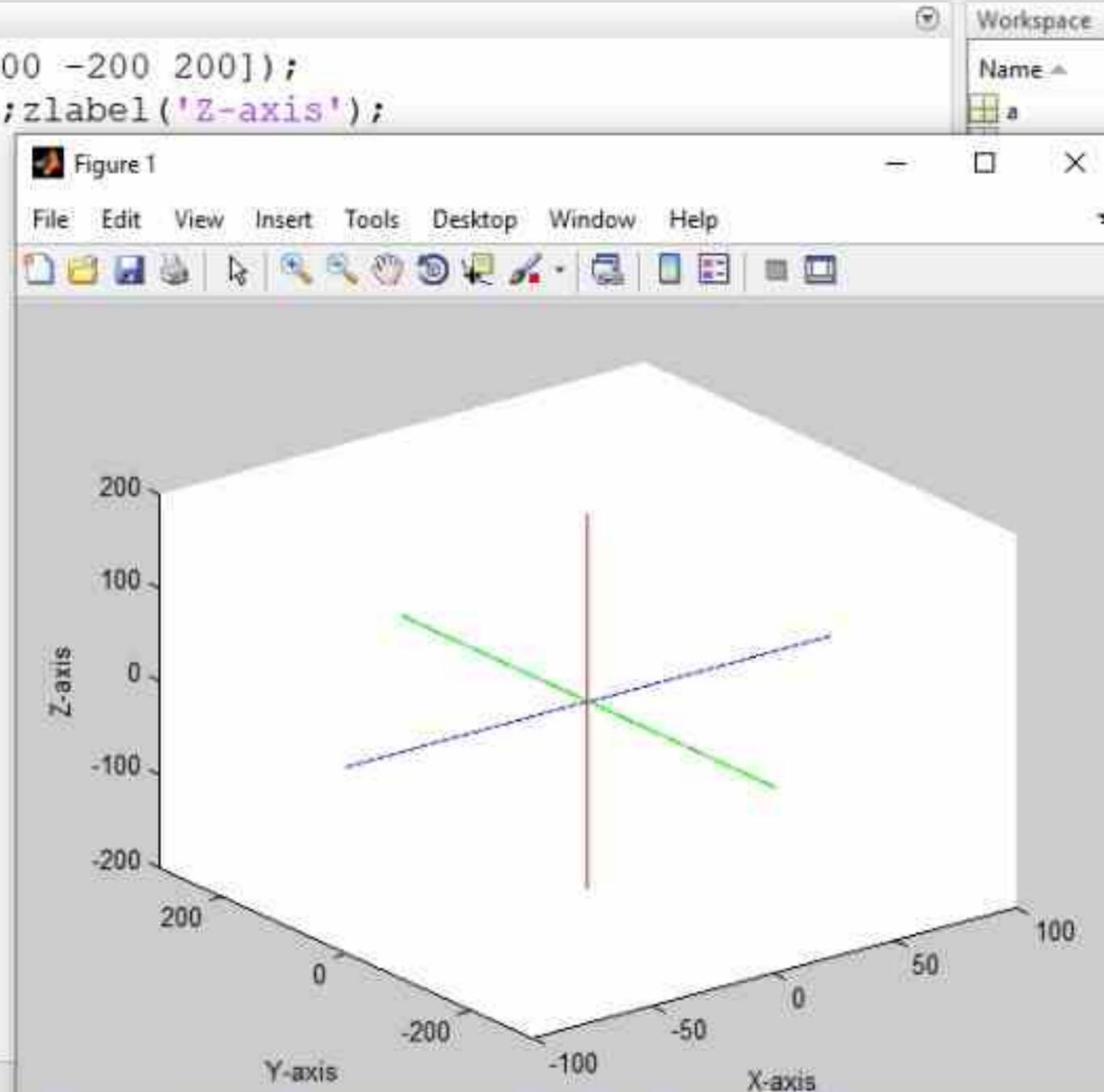
C:\Users\master\Documents\MATLAB

Current Folder

Name

Details

```
>> hold on; axis([-100 100 -300 300 -200 200]);
xlabel('X-axis');ylabel('Y-axis');zlabel('Z-axis');
plot3(-100:100,0,0,'b')% x-axis
plot3(0,-300:300,0,'g')% y-axis
plot3(0,0,-200:200,'r');% z-axis
view(3)
fx >>
```



Workspace

Name	Value
a	<5x3>
	10.34
	174.0
	174.0
	90
	@(p)
	9.48e
	10.34
	123.3
	-0.55
	[5,-8
	[-1.5

History

```
plot3(0,-300:300,0,'g')
plot3(-100:100,0,0,'b')
hold on; axis([-100 100 -300 300 -200 200]);
xlabel('X-axis');ylabel('Y-axis');zlabel('Z-axis');
plot3(0,0,-200:200,'r');% z-axis
view(3)
```

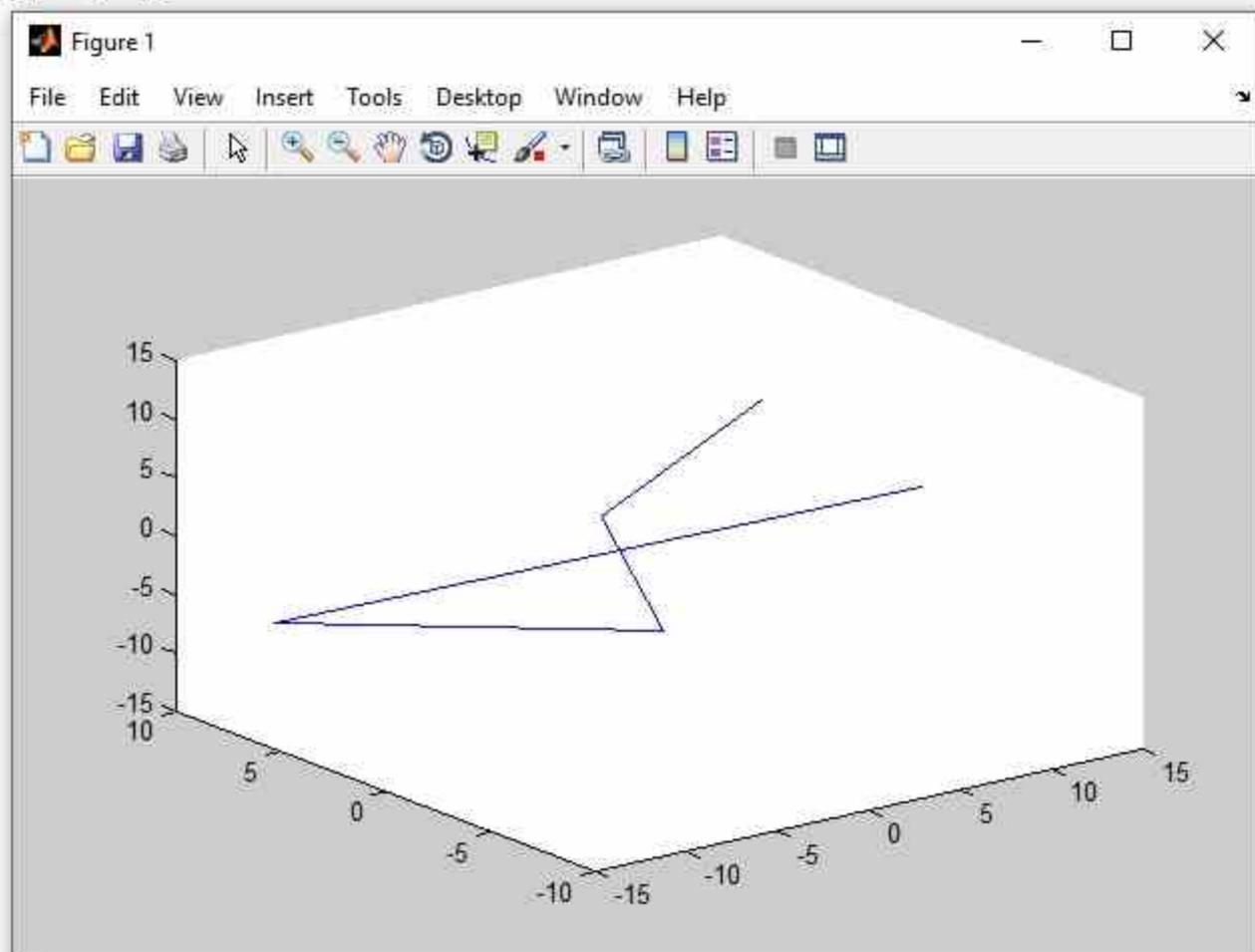
```
>> a=[8 2 9;-10 -6 11;6 5 -12;-13 7 -6;11 -3 4]
```

```
a =
```

```
     8     2     9
    -10    -6    11
     6     5    -12
    -13     7     -6
    11    -3     4
```

```
>> plot3(a(:,1),a(:,2),a(:,3))
```

```
fx >>
```



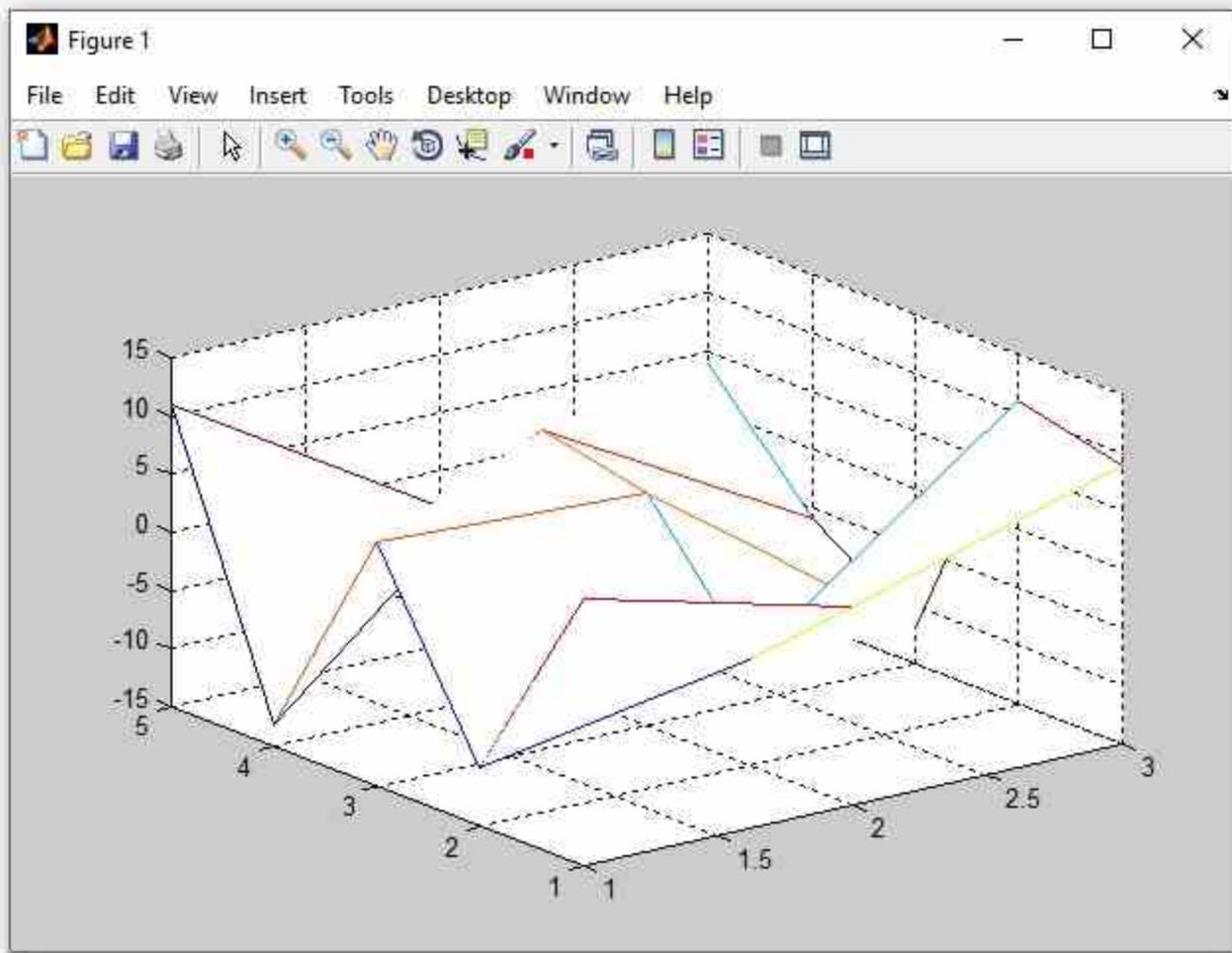
```
>> a
```

```
a =
```

```
     8     2     9  
    -10    -6    11  
     6     5    -12  
    -13     7     -6  
     11    -3     4
```

```
>> mesh(a)
```

fx >>



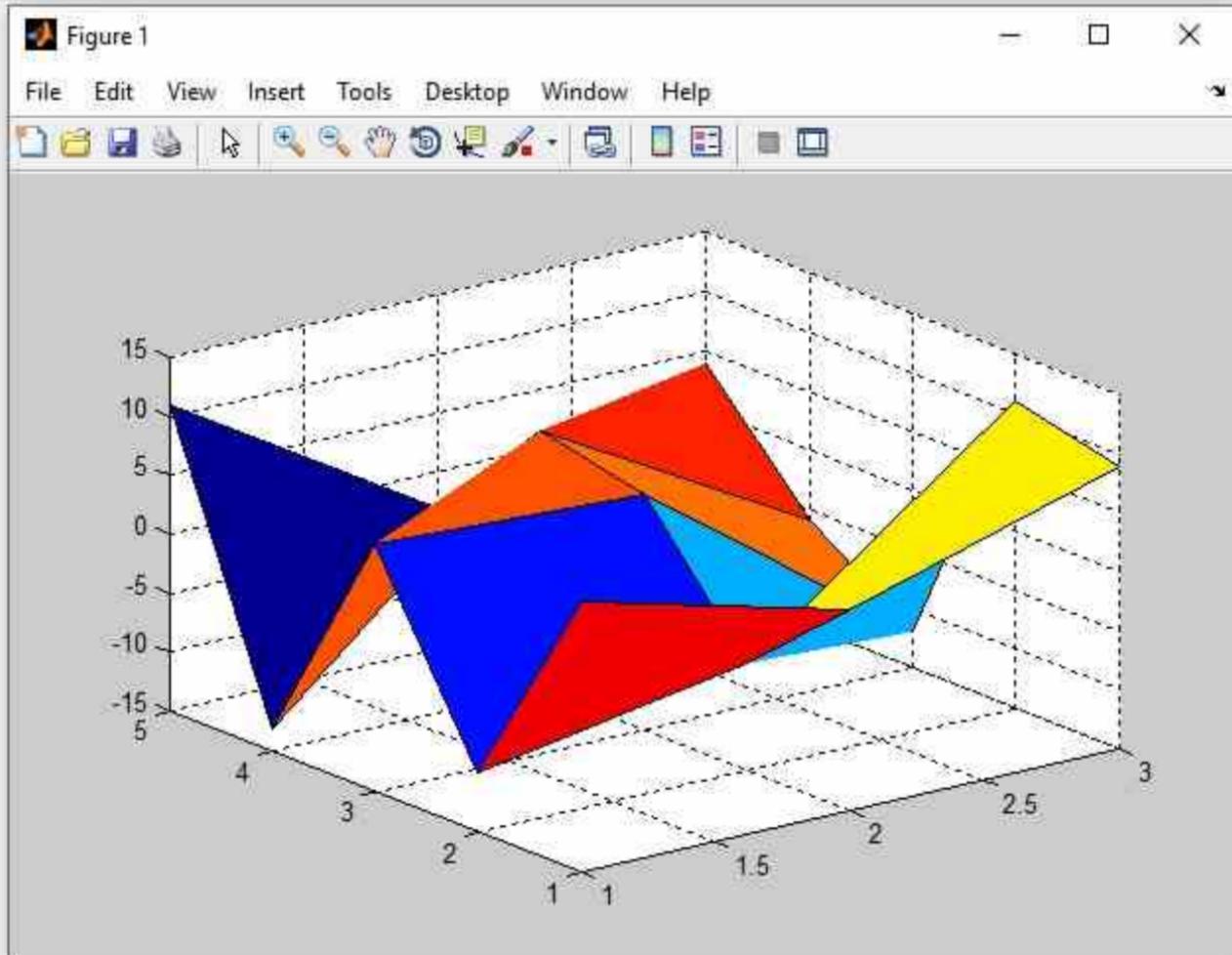
```
>> a
```

```
a =
```

```
     8     2     9  
    -10    -6    11  
     6     5    -12  
    -13     7    -6  
     11    -3     4
```

```
>> surf(a)
```

```
fx >>
```



```
>> v=[5 -8 1],w=[-1,5,-9]
```

```
v =
```

```
    5    -8     1
```

```
w =
```

```
   -1     5    -9
```

```
>> w+v
```

```
ans =
```

```
    4    -3    -8
```

```
>> w+v==v+w
```

```
ans =
```

```
    1     1     1
```

```
fx >> |
```

```
>> v=[5 -8 1],w=[-1,5,-9]
```

```
v =
```

```
    5    -8     1
```

```
w =
```

```
   -1     5    -9
```

```
>> v-w
```

```
ans =
```

```
    6   -13    10
```

```
>> v-w==w-v
```

```
ans =
```

```
    0     0     0
```

```
fx >> |
```

```
>> v=[5 -8 1],w=[-1,5,-9]
```

```
v =
```

```
    5    -8     1
```

```
w =
```

```
   -1     5    -9
```

```
>> dot(w,v)
```

```
ans =
```

```
   -54
```

```
>> dot(w,v)==dot(v,w)
```

```
ans =
```

```
     1
```

```
>> v=[5 -8 1],w=[-1,5,-9]
```

```
v =
```

```
     5     -8     1
```

```
w =
```

```
    -1     5    -9
```

```
>> cross(v,w)
```

```
ans =
```

```
    67    44    17
```

```
>> cross(v,w)==cross(w,v)
```

```
ans =
```

```
     0     0     0
```

```
fx >>
```

```
>> w,mw=modules(w)
```

```
w =
```

```
    -1     5    -9
```

```
|  
mw =
```

```
10.3441
```

```
>> ax=acosd(w(1)/mw), ay=acosd(w(2)/mw), az=acosd(w(3)/mw)
```

```
ax =
```

```
95.5477
```

```
ay =
```

```
61.0944
```

```
az =
```

```
150.4659
```

```
>> w,mw=modules(w)
```

```
w =
```

```
    -1     5    -9
```

```
|  
mw =
```

```
10.3441
```

```
>> ax=acosd(w(1)/mw), ay=acosd(w(2)/mw), az=acosd(w(3)/mw)
```

```
ax =
```

```
95.5477
```

```
ay =
```

```
61.0944
```

```
az =
```

```
150.4659
```

v =

5 -8 1

w =

-1 5 -9

>> wv=dot(w,v),mw=modules(w),mv=modules(v)

wv =

-54

$$\mathbf{w} \cdot \mathbf{v} = |\mathbf{w}| * |\mathbf{v}| * \cos(\mathbf{f}) \implies \cos(\mathbf{f}) = \mathbf{w} \cdot \mathbf{v} / (|\mathbf{w}| * |\mathbf{v}|)$$

mw =

10.3441

$$\mathbf{f} = \text{Inverse Cosine} [\mathbf{w} \cdot \mathbf{v} / (|\mathbf{w}| * |\mathbf{v}|)]$$

mv =

9.4868

~~fx~~ >> acosd(wv/(mw*mv)) |

```
>> a
```

```
a =
```

```
     8     2     9
    -10    -6    11
     6     5   -12
    -13     7    -6
    11    -3     4
```

```
>> a(:,4)=1
```

```
a =
```

```
     8     2     9     1
    -10    -6    11     1
     6     5   -12     1
    -13     7    -6     1
    11    -3     4     1
```

Add homogeneons in 3D point or 3D Matrix

That Need in 3D matrix transformations

```
show3=@(f) (plot3(f(:,1),f(:,2),f(:,3))); modules=@(p) (sum(p.^2)^0.5);
```

```
shift3=@(tx ,ty,tz) ([1 0 0 0  
                     0 1 0 0  
                     0 0 1 0  
                     tx ty tz 1]);
```

```
scale3=@(sx ,sy,sz) ([sx 0 0 0  
                     0 sy 0 0  
                     0 0 sz 0  
                     0 0 0 1]);
```

```
rotate3x=@(th) ([1 0 0 0  
                0 cosd(th) sind(th) 0  
                0 -sind(th) cosd(th) 0  
                0 0 0 1]);
```

```
rotate3y=@(th) ([cosd(th) 0 sind(th) 0  
                0 1 0 0  
                -sind(th) 0 cosd(th) 0  
                0 0 0 1]);
```

```
rotate3z=@(th) ([cosd(th) sind(th) 0 0  
                -sind(th) cosd(th) 0 0  
                0 0 1 0  
                0 0 0 1]);
```

```
Mirror3o=([-1 0 0 0
           0 -1 0 0
           0 0 -1 0
           0 0 0 1]);
```

```
Mirror3x=([ 1 0 0 0
           0 -1 0 0
           0 0 -1 0
           0 0 0 1]);
```

```
Mirror3y=([-1 0 0 0
           0 1 0 0
           0 0 -1 0
           0 0 0 1]);
```

```
Mirror3z=([-1 0 0 0
           0 -1 0 0
           0 0 1 0
           0 0 0 1]);
```

```
Mirror3xy=([1 0 0 0
            0 1 0 0
            0 0 -1 0
            0 0 0 1]);
```

```
Mirror3xz=([1 0 0 0
            0 -1 0 0
            0 0 1 0
            0 0 0 1]);
```

```
Mirror3yz=([-1 0 0 0
            0 1 0 0
            0 0 1 0
            0 0 0 1]);
```

```
>> a=[0 0 0;0 9 0;11 0 0;0 0 0;5 7 -7;0 9 0]
hold on;xlabel('X');ylabel('Y');zlabel('Z');
axis([-20 20 -30 30 -10 10]); view(3);
```

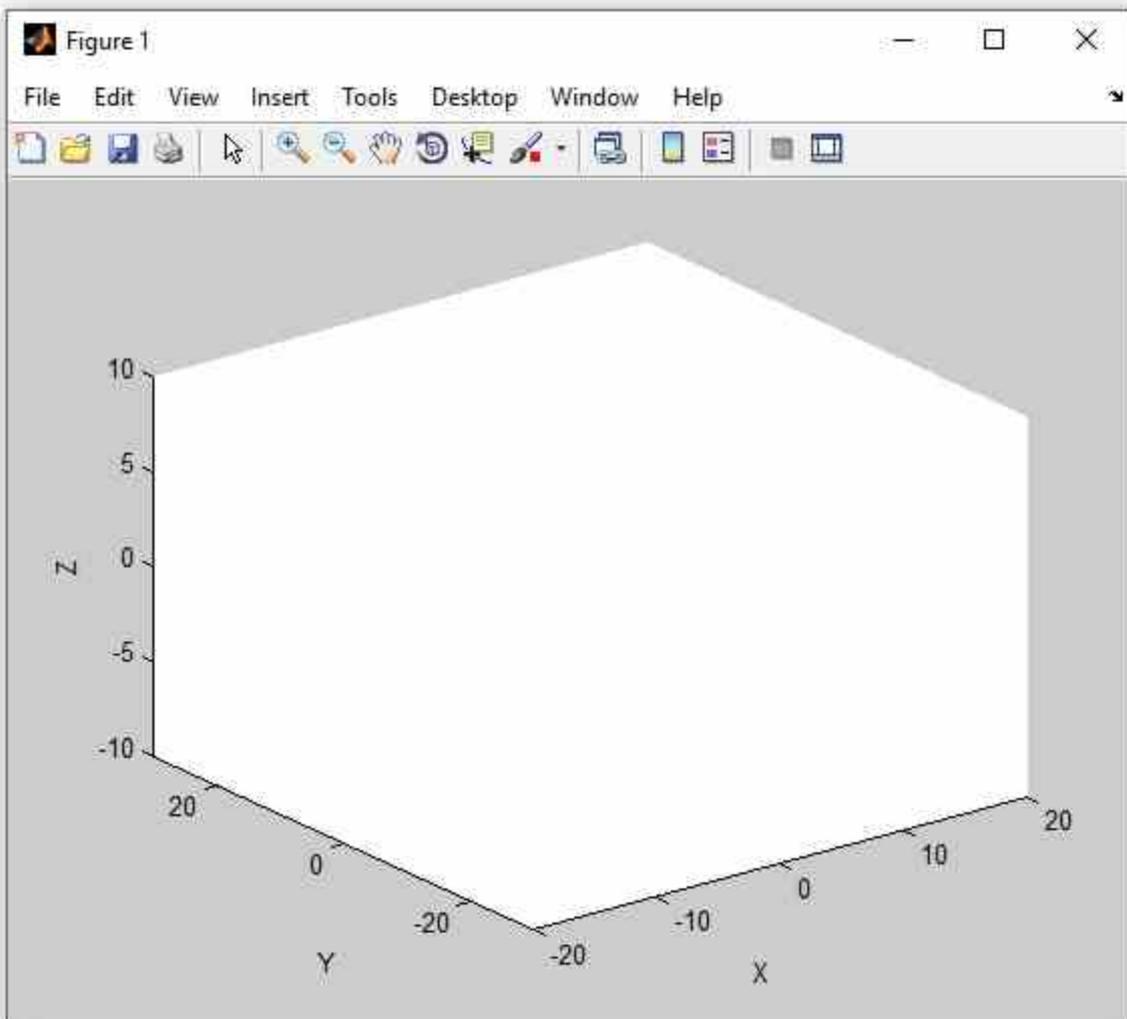
```
a =
```

```
    0    0    0
    0    9    0
   11    0    0
    0    0    0
    5    7   -7
    0    9    0
```

```
>> a(:,4)=1
```

```
a =
```

```
    0    0    0    1
    0    9    0    1
   11    0    0    1
    0    0    0    1
    5    7   -7    1
    0    9    0    1
```



Name	Value
Mirror3o	<4x4 double>
Mirror3x	<4x4 double>
Mirror3xy	<4x4 double>
Mirror3xz	<4x4 double>
Mirror3y	<4x4 double>
Mirror3z	<4x4 double>
a	<6x4 double>
modules	@(p)(sum(p.^2)^0.5)
rotate3x	@(th)([1,0,0,0;0,cosd(th),s...
rotate3y	@(th)([cosd(th),0,sind(th),...
rotate3z	@(th)([cosd(th),sind(th),0...
s	<4x4 double>
scale3	@(sx,sy,sz)([sx,0,0,0;0,sy,0...
shift3	@(tx,ty,tz)([1,0,0,0;0,1,0,0...
show3	@(f)(plot3(f(:,1),f(:,2),f(:,3)

```
>> a
```

```
a =
```

```
    0    0    0    1
    0    9    0    1
   11    0    0    1
    0    0    0    1
    5    7   -7    1
    0    9    0    1
```

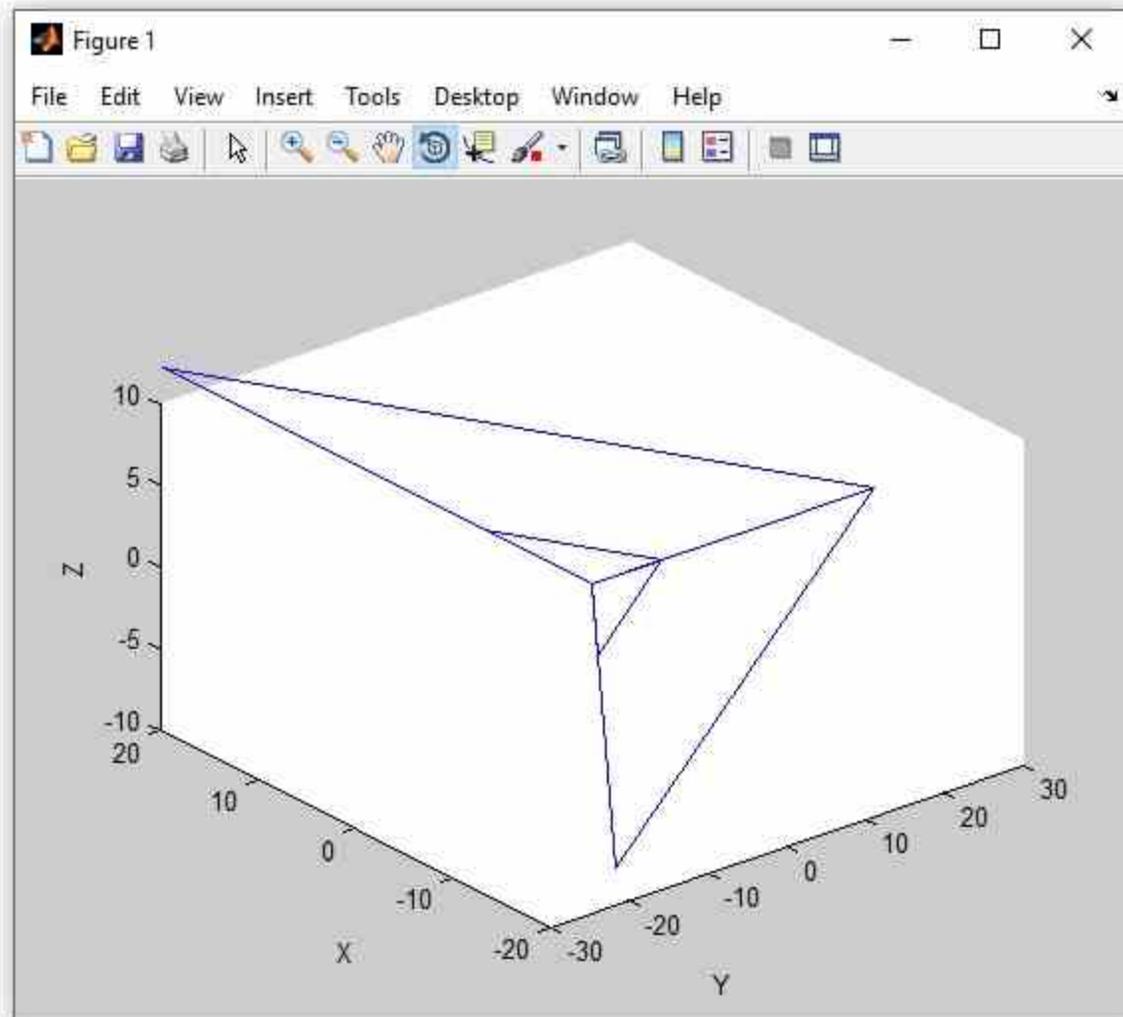
```
>> s=scale3(4,4,4)
```

```
s =
```

```
    4    0    0    0
    0    4    0    0
    0    0    4    0
    0    0    0    1
```

```
>> show3(a), show3(a*s)
```

```
fx >>
```



```
>> a
```

```
a =
```

```
    0    0    0    1
    0    9    0    1
   11    0    0    1
    0    0    0    1
    5    7   -7    1
    0    9    0    1
```

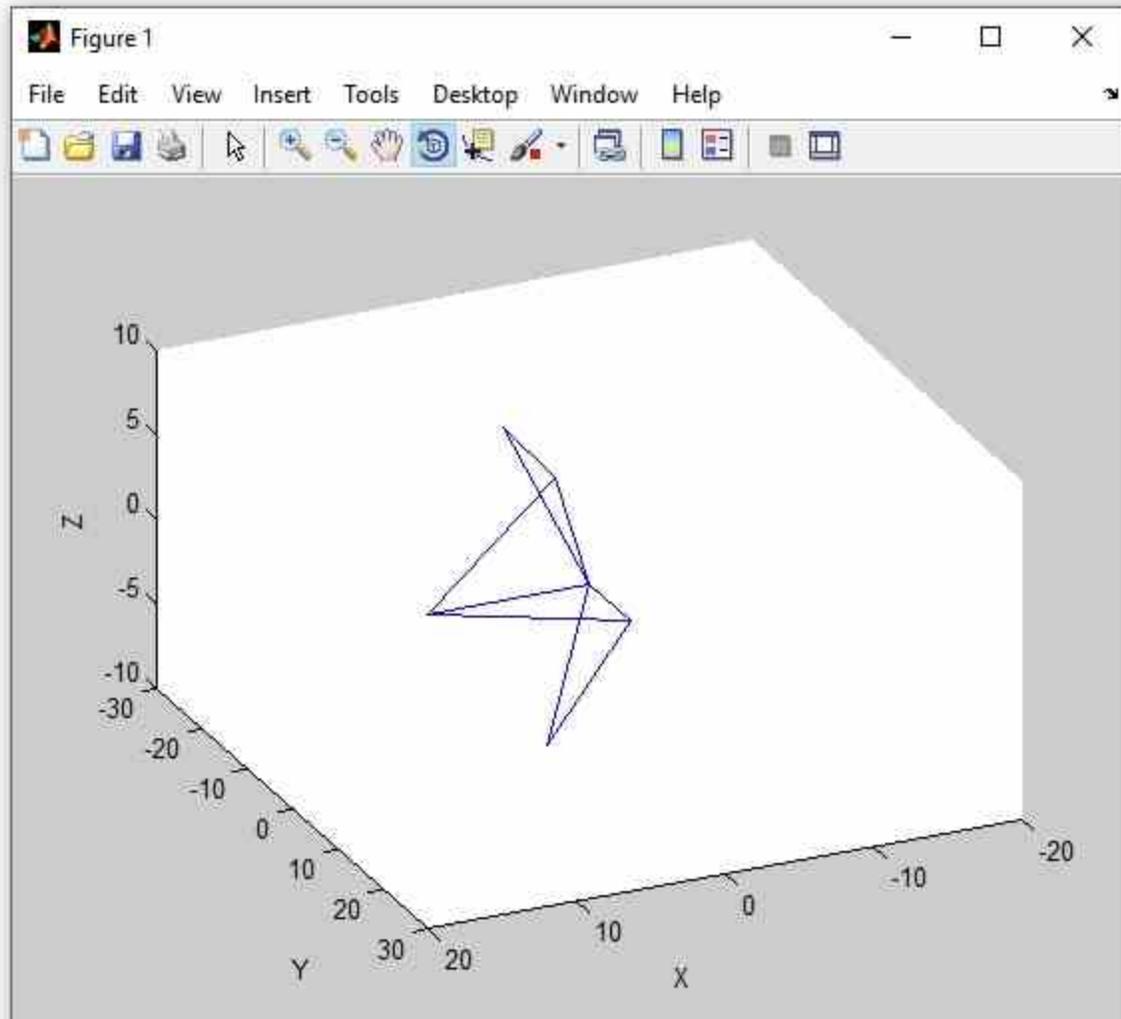
```
>> rx=rotate3x(150)
```

```
rx =
```

```
    1.0000         0         0         0
         0   -0.8660    0.5000         0
         0   -0.5000   -0.8660         0
         0         0         0    1.0000
```

```
>> show3(a), show3(a*rx)
```

```
fx >>
```



>> a

a =

0	0	0	1
0	9	0	1
11	0	0	1
0	0	0	1
5	7	-7	1
0	9	0	1

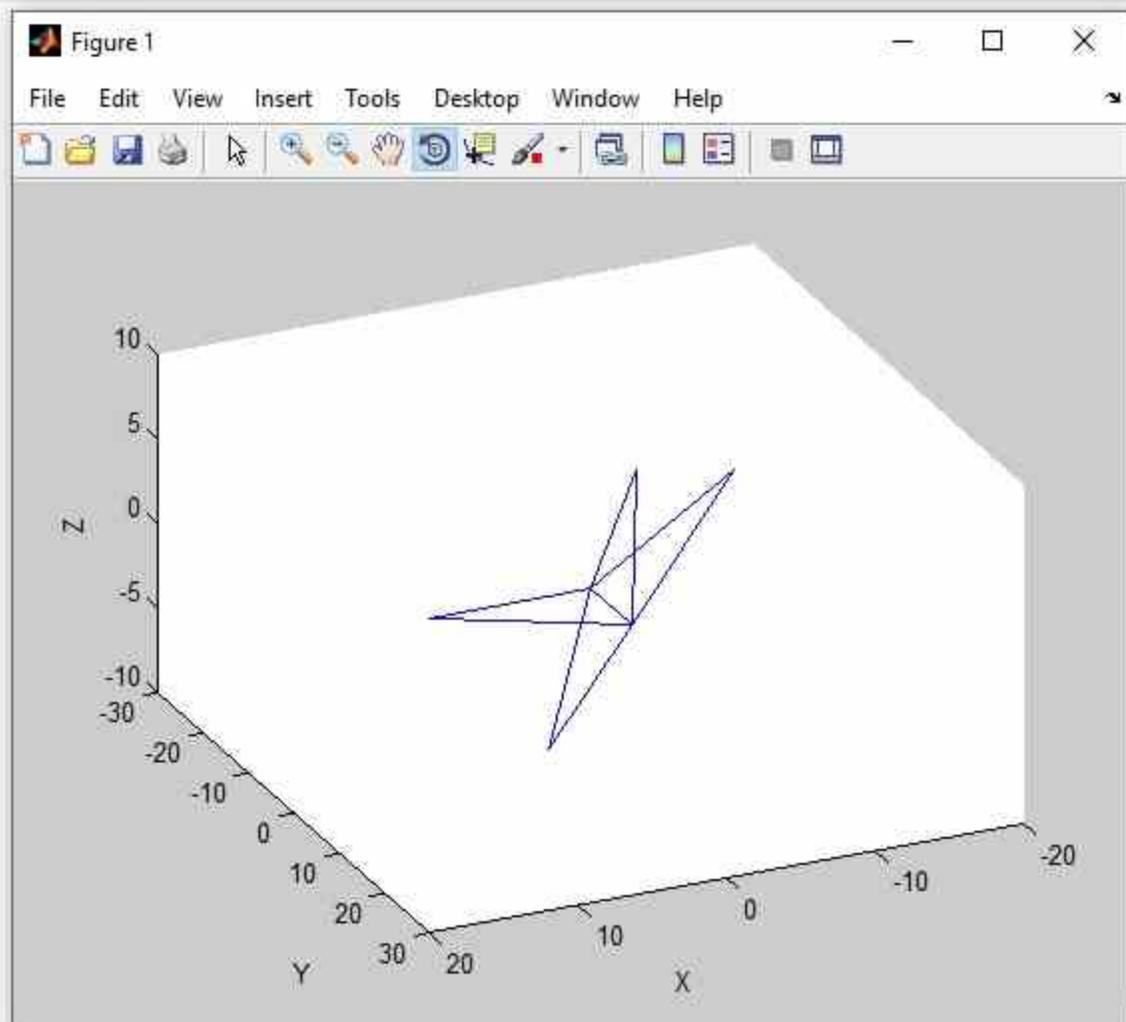
>> ry=rotate3y(150)

ry =

-0.8660	0	0.5000	0
0	1.0000	0	0
-0.5000	0	-0.8660	0
0	0	0	1.0000

>> show3(a), show3(a*ry)

fx >>



```
>> a
```

```
a =
```

```
    0    0    0    1
    0    9    0    1
   11    0    0    1
    0    0    0    1
    5    7   -7    1
    0    9    0    1
```

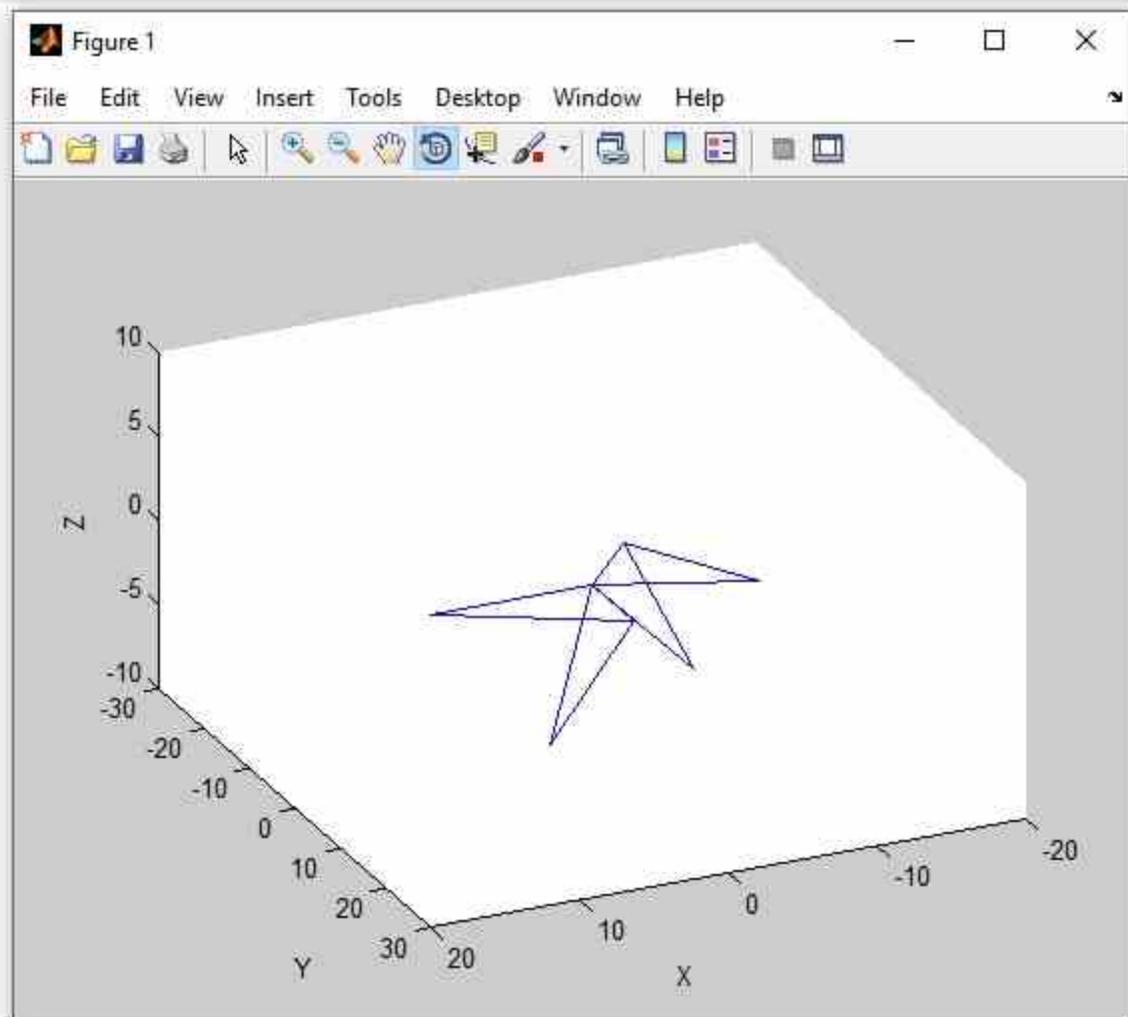
```
>> rz=rotate3z(150)
```

```
rz =
```

```
 -0.8660    0.5000         0         0
 -0.5000   -0.8660         0         0
         0         0    1.0000         0
         0         0         0    1.0000
```

```
>> show3(a), show3(a*rz)
```

```
fx >>
```



a =

0	0	0	1
0	9	0	1
11	0	0	1
0	0	0	1
5	7	-7	1
0	9	0	1

>> t=shift3(9,-5,11)

t =

1	0	0	0
0	1	0	0
0	0	1	0
9	-5	11	1

>> a*t

ans =

9	-5	11	1
9	4	11	1
20	-5	11	1
9	-5	11	1
14	2	4	1
9	4	11	1

Tray**show3(a)****show3(a*t) ...what happen?****H.w// Try Mirror Transform & 3D shear Transform**

```
Command Window  
>> l3=[-15,20,3,11,5,-5]
```

```
l3 =
```

```
    -15    20     3  
     11     5    -5
```

```
>> show3(a), surf(a), plot3(l3(:,1),l3(:,2),l3(:,3))  
>> s1=shift3(15,-20,-3)
```

```
s1 =
```

```
     1     0     0     0  
     0     1     0     0  
     0     0     1     0  
    15    -20    -3     1
```

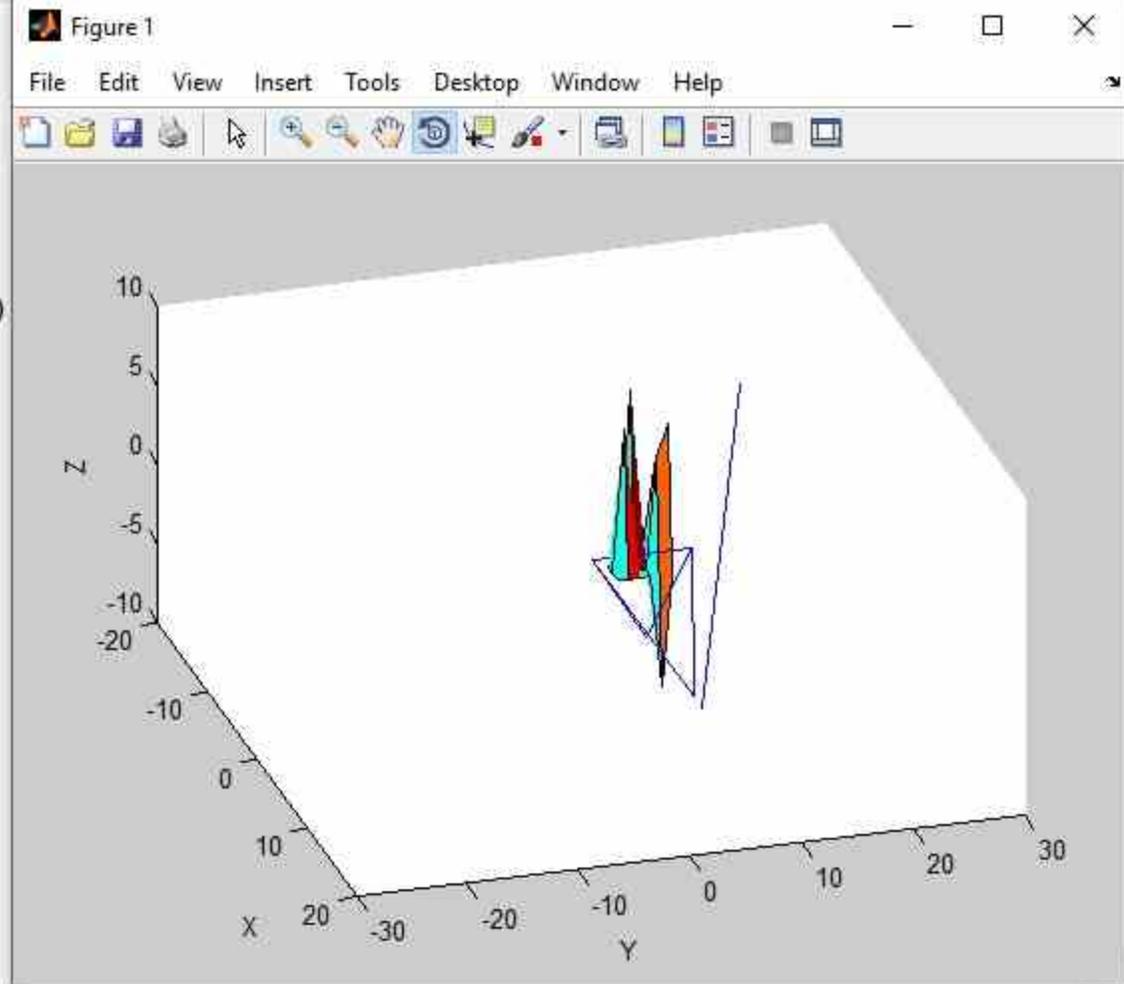
Step 1
shift start line into (0, 0, 0)
=> Tx=-x1, Ty=-y1, Tz=-z1

```
>> d1=diff(l3)
```

```
d1 =
```

=> dx= x2-x1, dy = y2-y1, dz= z2-z1

```
    26    -15    -8
```



```
d1 =
```

```
26 -15 -8 ==> (dx,dy,dz)
```

```
>> d=modules([-15 -8]) ==> d=(dy^2+dz^2)^(1/2)
```

```
d =
```

```
17
```

```
>> cz= -8/d,sz= -15/d
```

```
cz = ==> Cos= dz/d
```

```
-0.4706
```

```
sz = ==> Sin= dy / d
```

```
-0.8824
```

```
>> s2=[cz sz 0 0;-sz cz 0 0;0 0 1 0;0 0 0 1]
```

```
s2 =
```

```
-0.4706 -0.8824 0 0  
0.8824 -0.4706 0 0  
0 0 1.0000 0  
0 0 0 1.0000
```

l3 =

-15	20	3
11	5	-5

>> diff(l3)

ans =

dx	dy	dz	==> while d=17
26	-15	-8	

>> d2=modules([26,d])

d2 =

31.0644

>> cz=d/d2

cz = => **Cos = d / d2**

0.5472

>> sz=26/d2

sz = => **Sin = dx / d2**

0.8370

>> s3=[cz 0 sz 0;0 1 0 0;-sz 0 cz 0;0 0 0 1]

s3 =

0.5472	0	0.8370	0
0	1.0000	0	0
-0.8370	0	0.5472	0
0	0	0	1.0000

s4 =

```
[ cos(th), sin(th), 0, 0]
[ -sin(th), cos(th), 0, 0] ==>Rotate about (th) in quation
[      0,      0, 1, 0]
[      0,      0, 0, 1]
```

s5 =

```
  0.5473      0  -0.8370      0
      0      1.0000      0      0
  0.8370      0   0.5473      0 ==>Reverse Step3
      0      0      0      1.0000
```

s6 =

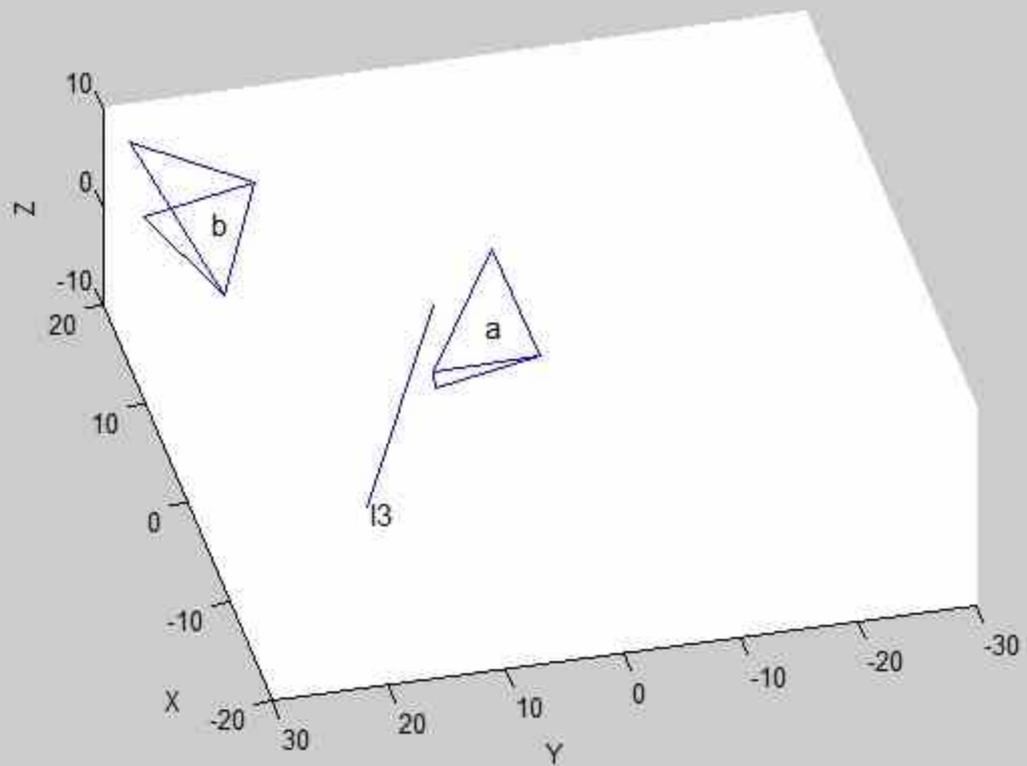
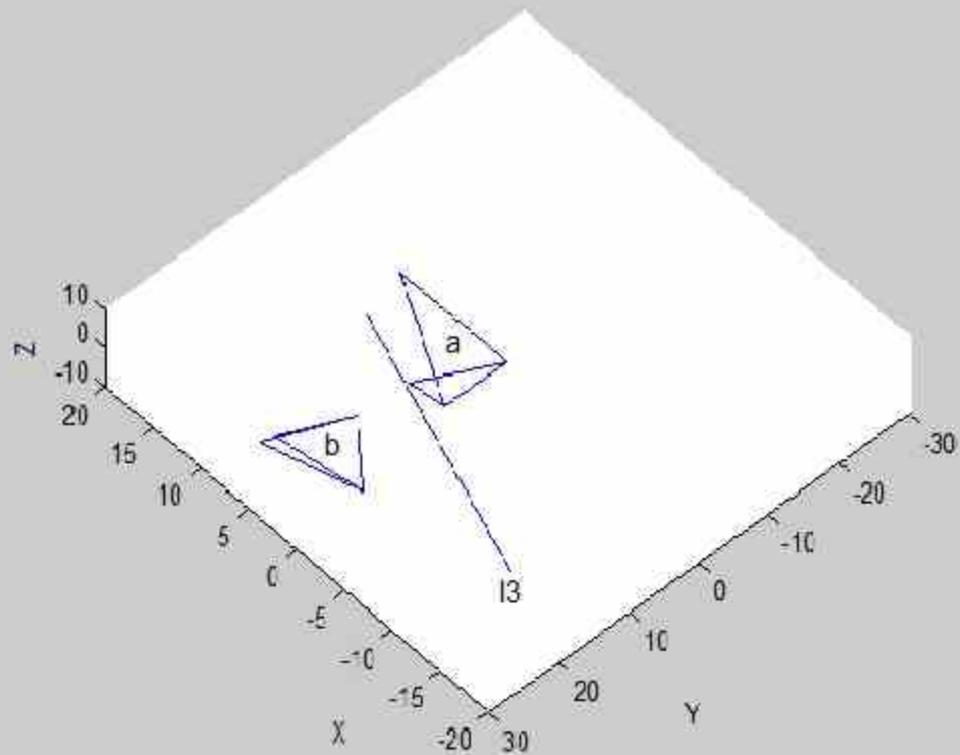
```
-0.4706   0.8824      0      0
-0.8824  -0.4706      0      0 ==> Reverse Step2
      0      0   1.0000      0
      0      0      0      1.0000
```

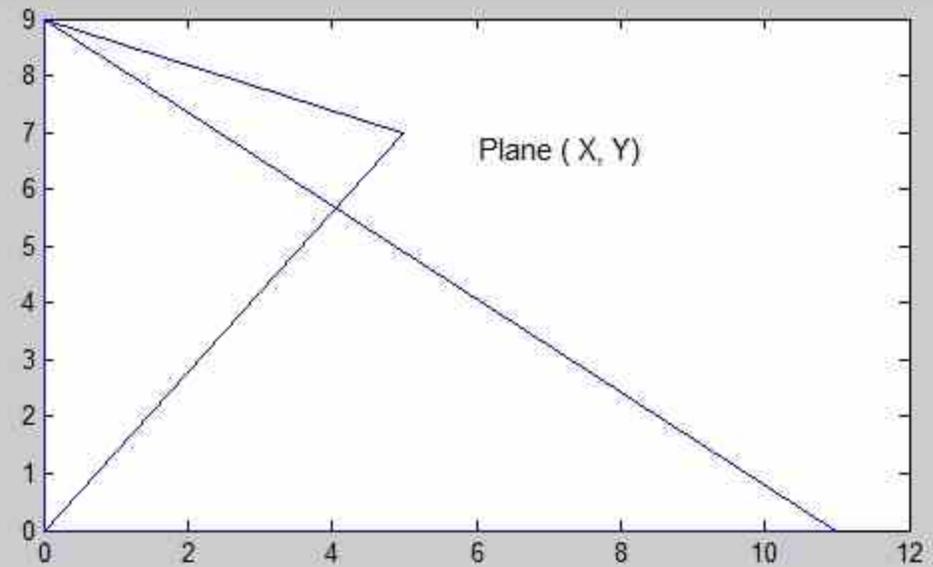
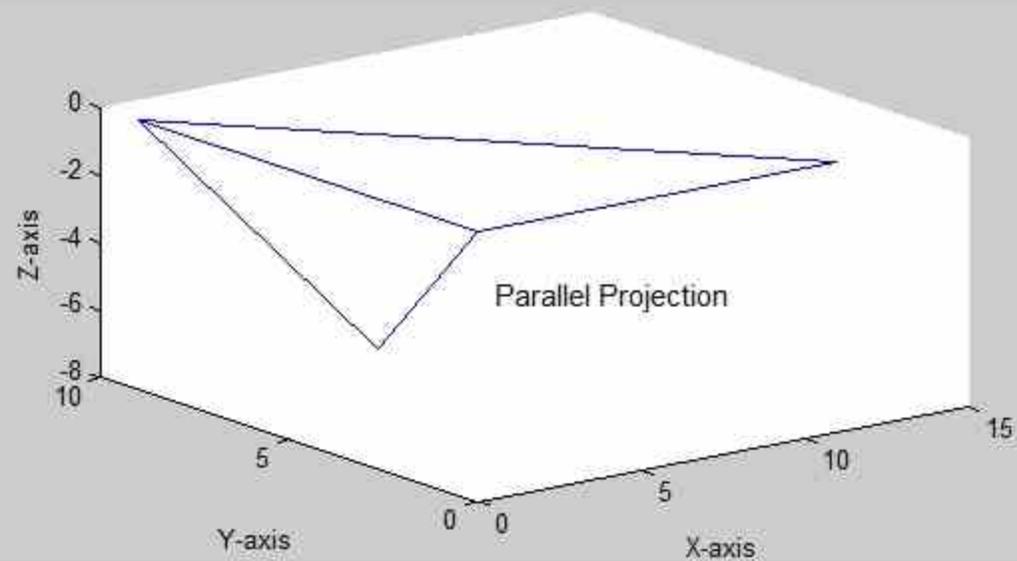
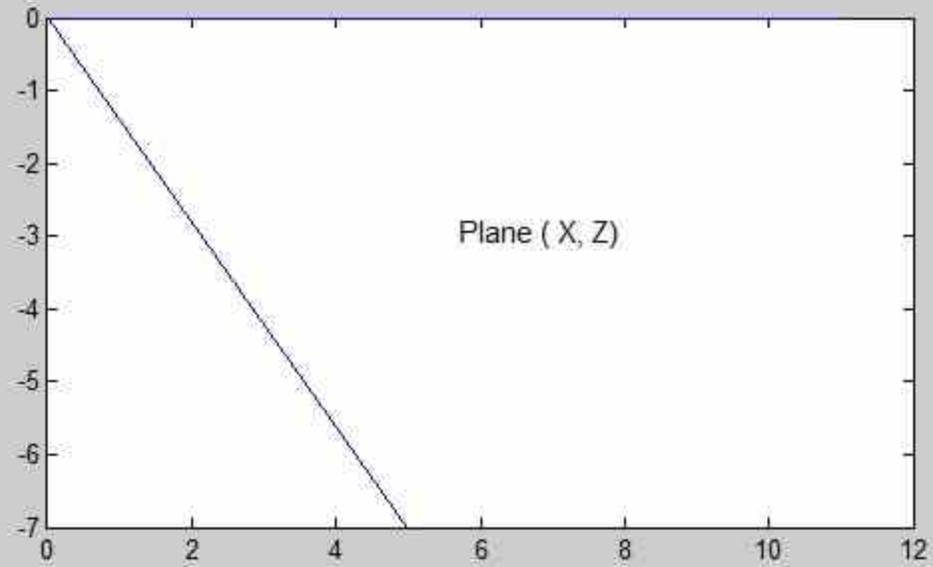
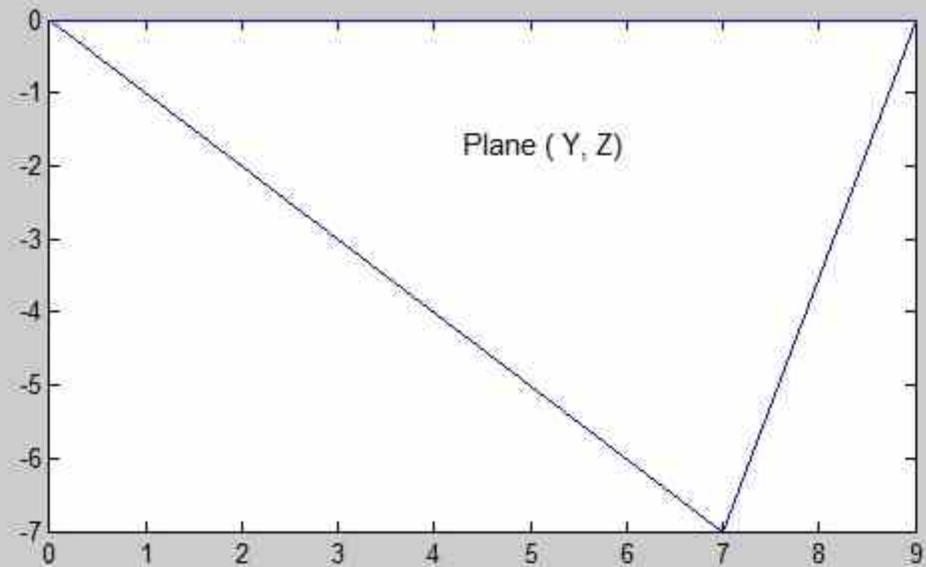
s7 =

```
  1      0      0      0
  0      1      0      0 ==> Reverse Step1
  0      0      1      0
-15     20      3      1
```

Command Window

```
fx >> plot3(l3(:,1),l3(:,2),l3(:,3))  
plot3(a(:,1),a(:,2),a(:,3))  
b=a*s1*s2*s3*s4*s5*s6*s7  
plot3(b(:,1),b(:,2),b(:,3))
```





a =

```

0     0     0
0     9     0
11    0     0
0     0     0
5     7    -7
0     9     0
    
```

b = [Xi+Ux*xP , Yi+Ux*yP , Zi+Ux*zP

bx = 3D represent

dop = ==> (xP, yP, zP)

```

-5     9     11
    
```

```

0     0     0
0     9.0000     0
0    19.8000    24.2000
0     0     0
0    16.0000     4.0000
0     9.0000     0
    
```

ux = ==> Ux = -Xi / xP

```

0
0
2.2000
0
1.0000
0
    
```

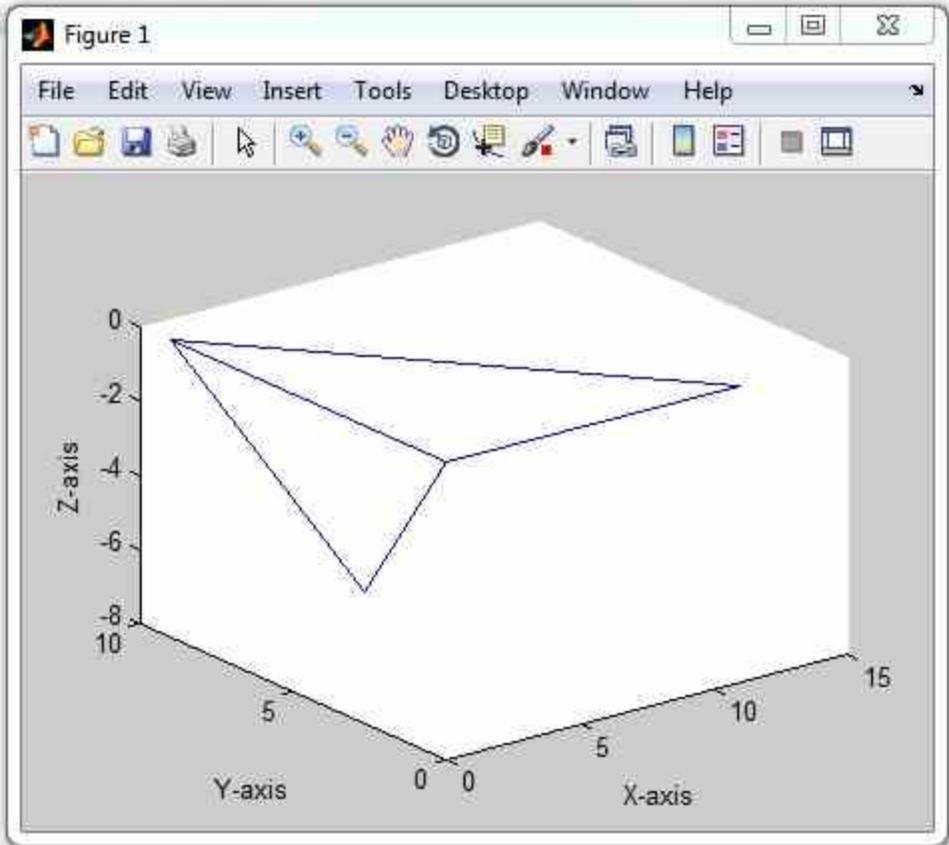
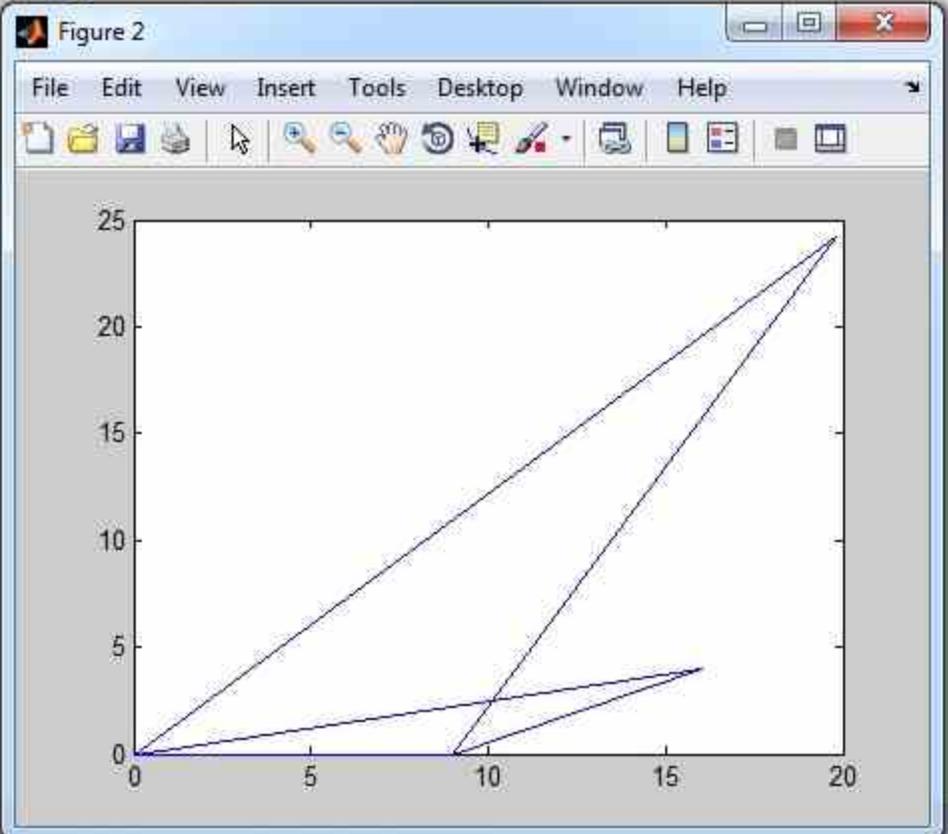
bx = 2D represent

```

0     0
9.0000     0
19.8000    24.2000
0     0
16.0000     4.0000
9.0000     0
    
```

Command Window

```
fx >> a= [0 0 0; 0 9 0; 11 0 0; 0 0 0; 5 7 -7; 0 9 0]  
dop=[ -5 9 11]  
% Projection-->X_axis  
ux= -a(:,1)/dop(1)  
bx=[a(:,1)+ux*dop(1), a(:,2)+ux*dop(2), a(:,3)+ux*dop(3)]  
bx(:,1)=[]
```



a =

0	0	0
0	9	0
11	0	0
0	0	0
5	7	-7
0	9	0

====>>

uy = ==> Uyi = -Yi / yp

0
-1.0000
0
0
-0.7778
-1.0000

=====>>>

by =

0	0
5.0000	-11.0000
11.0000	0
0	0
8.8889	-15.5556
5.0000	-11.0000

dop =

-5	9	11
xP	yP	zP

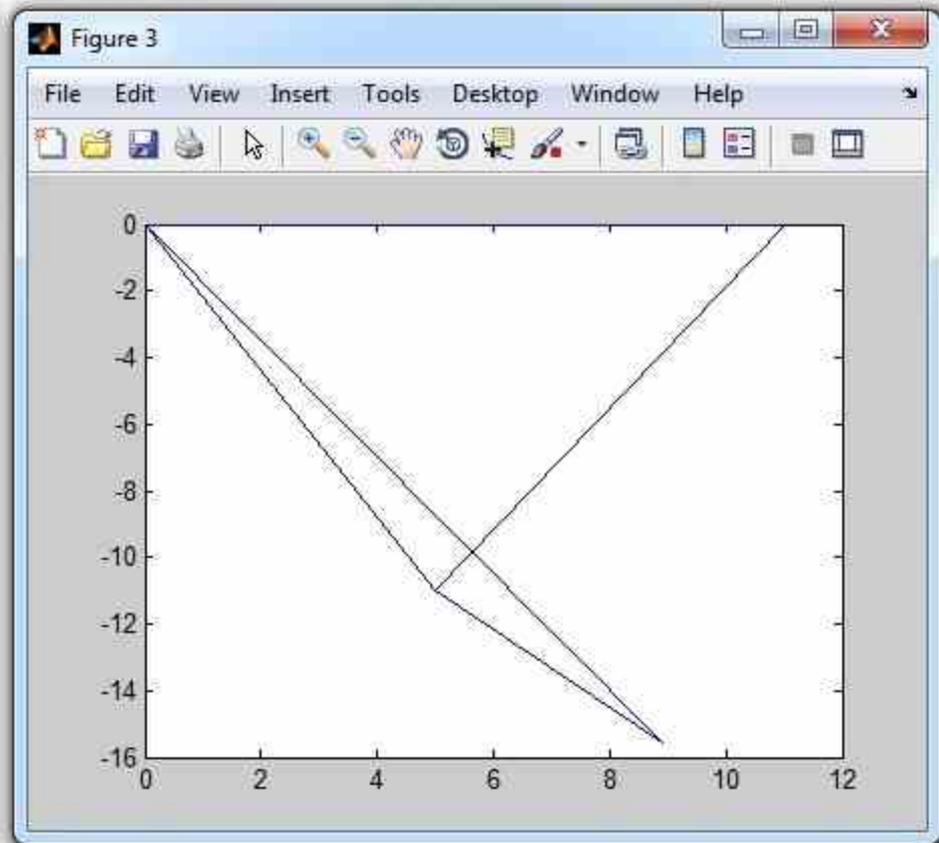
by = [Xi + Uyi * xP , Yi + Uyi * yP , Zi + Uyi * zP]

0	0	0
5.0000	0	-11.0000
11.0000	0	0
0	0	0
8.8889	0	-15.5556
5.0000	0	-11.0000

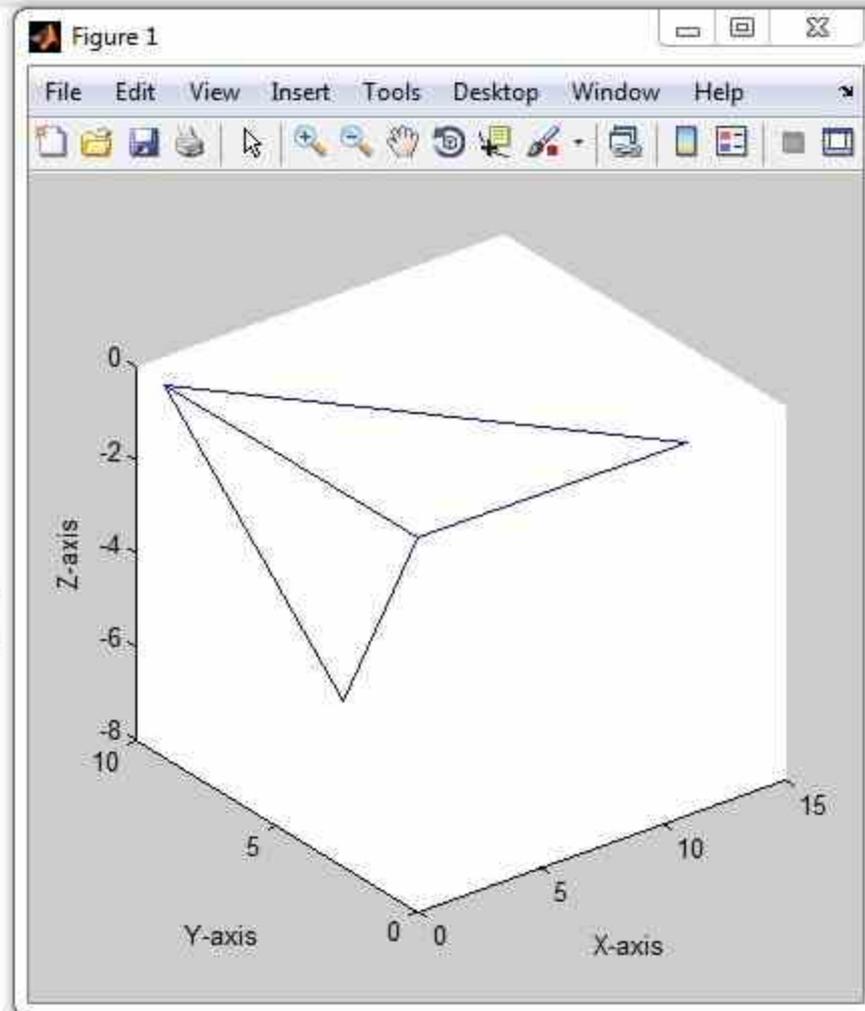
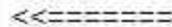


Projection Y-axis

```
fx >> % Projection-->Y_axis
uy= -a(:,2)/dop(2)
by=[a(:,1)+uy*dop(1), a(:,2)+uy*dop(2), a(:,3)+uy*dop(3)]
by(:,2)=[]
```



Projection-Y



a =

0	0	0
0	9	0
11	0	0
0	0	0
5	7	-7
0	9	0

Finally, Projection-Z_axis

bz =

	0	0
	0	9.0000
11.0000		0
	0	0
1.8182	12.7273	
	0	9.0000

dop =

xP	yP	zP
-5	9	11

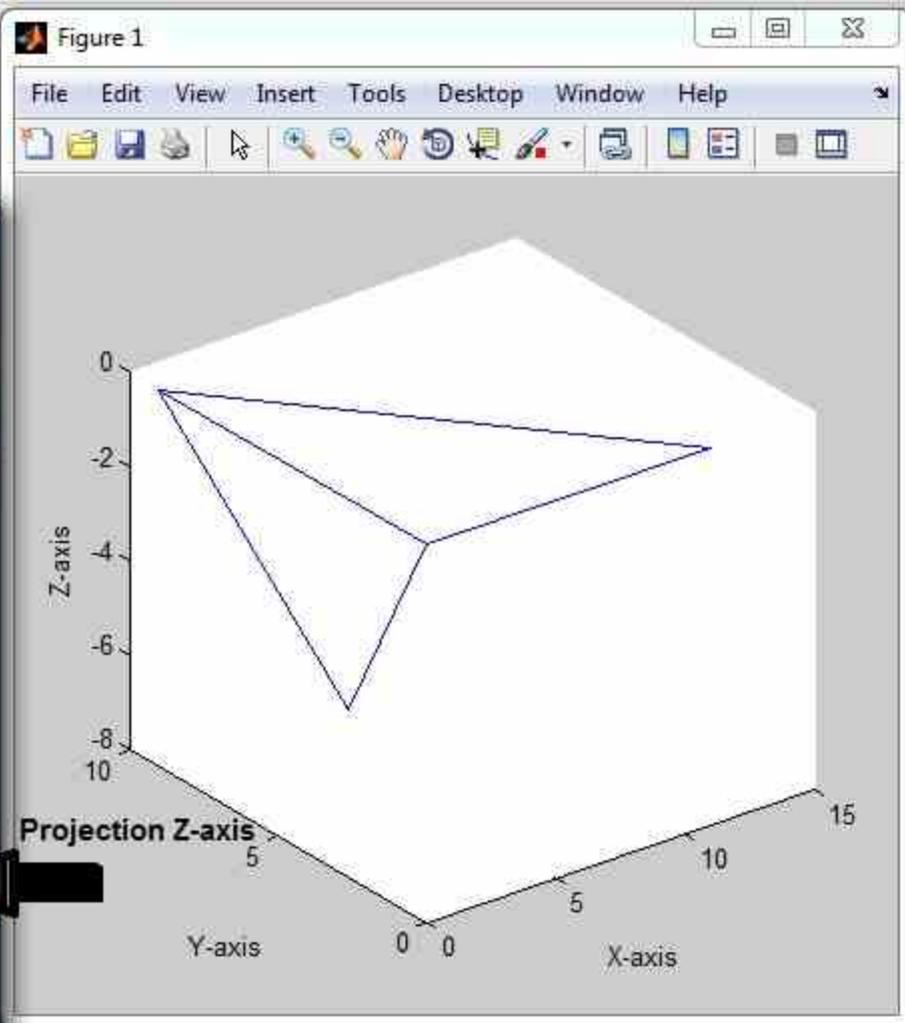
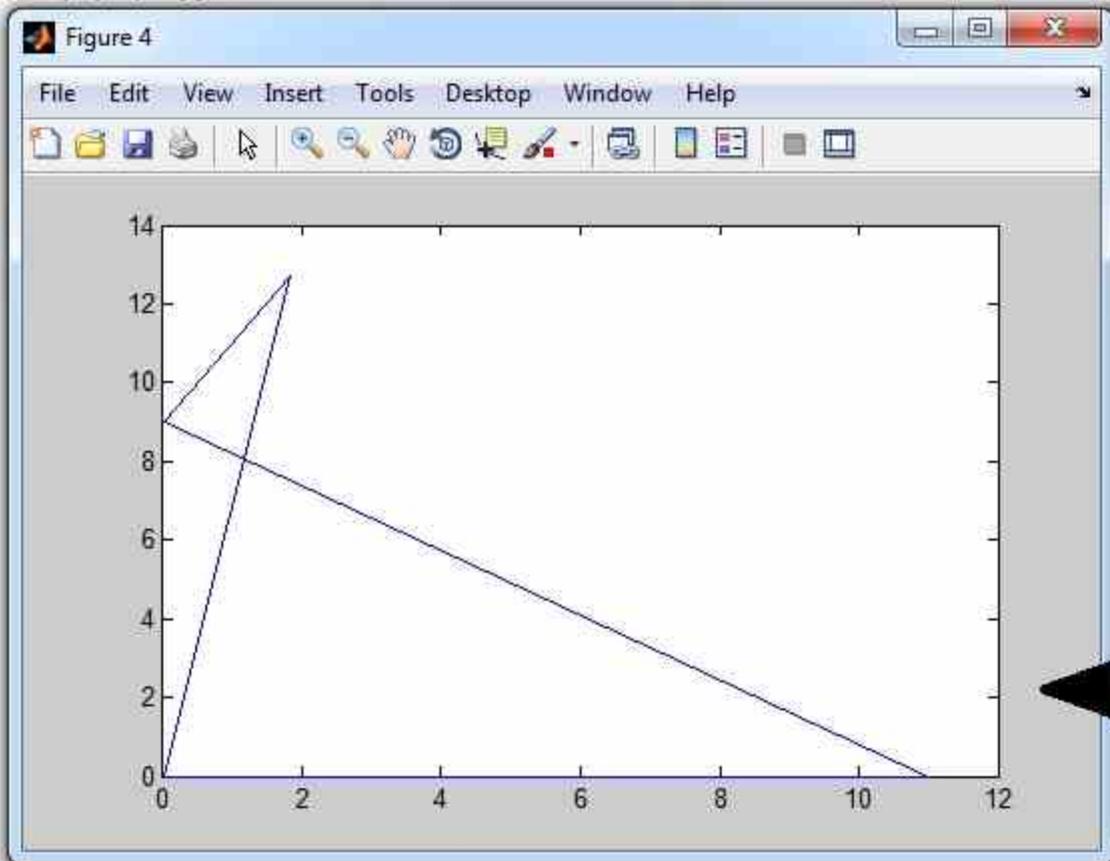
uz = ==> Uiz= -Zi / zP

0
0
0
0
0.6364
0

bz = [Xi + Uiz * xP , Yi + Uiz * yP , Zi + Uiz * zP]

	0	0	0
	0	9.0000	0
11.0000		0	0
	0	0	0
1.8182	12.7273		0
	0	9.0000	0

```
fx >> % Projection-->Z_axis
uz= -a(:,3)/dop(3)
bz=[a(:,1)+uz*dop(1), a(:,2)+uz*dop(2), a(:,3)+uz*dop(3)]
bz(:,3)=[]
```



```
>> clear all clc
```

```
f=[-5 8 0;7 -9 11;1 4 -6], cop = [-3, 2, -7]
```

```
df=[f(:,1)-cop(1), f(:,2)-cop(2), f(:,3)-cop(3)]
```

```
% Projection X-axis
```

```
hx=f;
```

```
for i=1 :length(df)
```

```
ux= -cop(1)/df(i,1)
```

```
hx(i,1)=df(i,1)*ux+cop(1);
```

```
hx(i,2)=df(i,2)*ux+cop(2);
```

```
hx(i,3)=df(i,3)*ux+cop(3);
```

```
end
```

```
hx(:,1)=[]
```

```
% Projection Y-axis
```

```
hy=f;
```

```
for i=1 :length(df)
```

```
uy= -cop(2)/df(i,2)
```

```
hy(i,1)=df(i,1)*uy+cop(1);
```

```
hy(i,2)=df(i,2)*uy+cop(2);
```

```
hy(i,3)=df(i,3)*uy+cop(3);
```

```
end
```

```
hy(:,2)=[]
```

```
>> % Projection Z-axis
```

```
hz=f;
```

```
for i=1 :length(df)
```

```
uz= -cop(3)/df(i,3)
```

```
hz(i,1)=df(i,1)*uz+cop(1);
```

```
hz(i,2)=df(i,2)*uz+cop(2);
```

```
hz(i,3)=df(i,3)*uz+cop(3);
```

```
end
```

```
hz(:,3)=[]
```

```
hold on
```

```
xlabel('X-axis'), ylabel('Y-axis'), zlabel('Z-axis')
```

```
figure(1), plot3(f(:,1), f(:,2), f(:,3)), view(3)
```

```
figure(2), plot(hx(:,1), hx(:,2)), view(2)
```

```
figure(3), plot(hy(:,1), hy(:,2)), view(2)
```

```
figure(4), plot(hz(:,1), hz(:,2)), view(2)
```

```
f =
```

```
-5    8    0
 7   -9   11
 1    4   -6
```

```
cop =
```

```
-3    2   -7
```

```
df =
```

```
-2    6    7
 10  -11   18
 4    2    1
```

X is remove

$$U1x = 3 / -2 = -1.5$$

$$U2x = 3 / 10 = 0.3$$

$$U3x = 3 / 4 = 0.75$$

Y is remove

$$U1y = -2 / 6 = -1 / 3$$

$$U2y = -2 / 11$$

$$U3y = -2 / 2 = -1$$

Z is remove

$$U1z = 7 / 7 = 1$$

$$U2z = 7 / 18$$

$$U3z = 7 / 1 = 7$$



```
hx =
      0   -7.0000  -17.5000
      0   -1.3000   -1.6000
      0    3.5000   -6.2500

hx =
-7.0000  -17.5000
-1.3000  -1.6000
 3.5000  -6.2500
```

Note : Oblique Projection (H.W) { leave on student}

```
1 - clear all;clc
2 - start=input('Start as [x1 y1 z1]= ');
3 - finish=input('Finish as [x2 y2 z2]= ');
4 - x1=start(1);y1=start(2);z1=start(3);
5 - x2=finish(1);y2=finish(2);z2=finish(3);
6 - hold on,xlabel('X');ylabel('Y');zlabel('Z');view(3)
7 - for t=0 :0.005:1
8 -     x=(x2-x1)*t+x1;
9 -     y=(y2-y1)*t+y1;
10 -    z=(z2-z1)*t+z1;
11 -    plot3(x,y,z,'rs')
12 - end
```

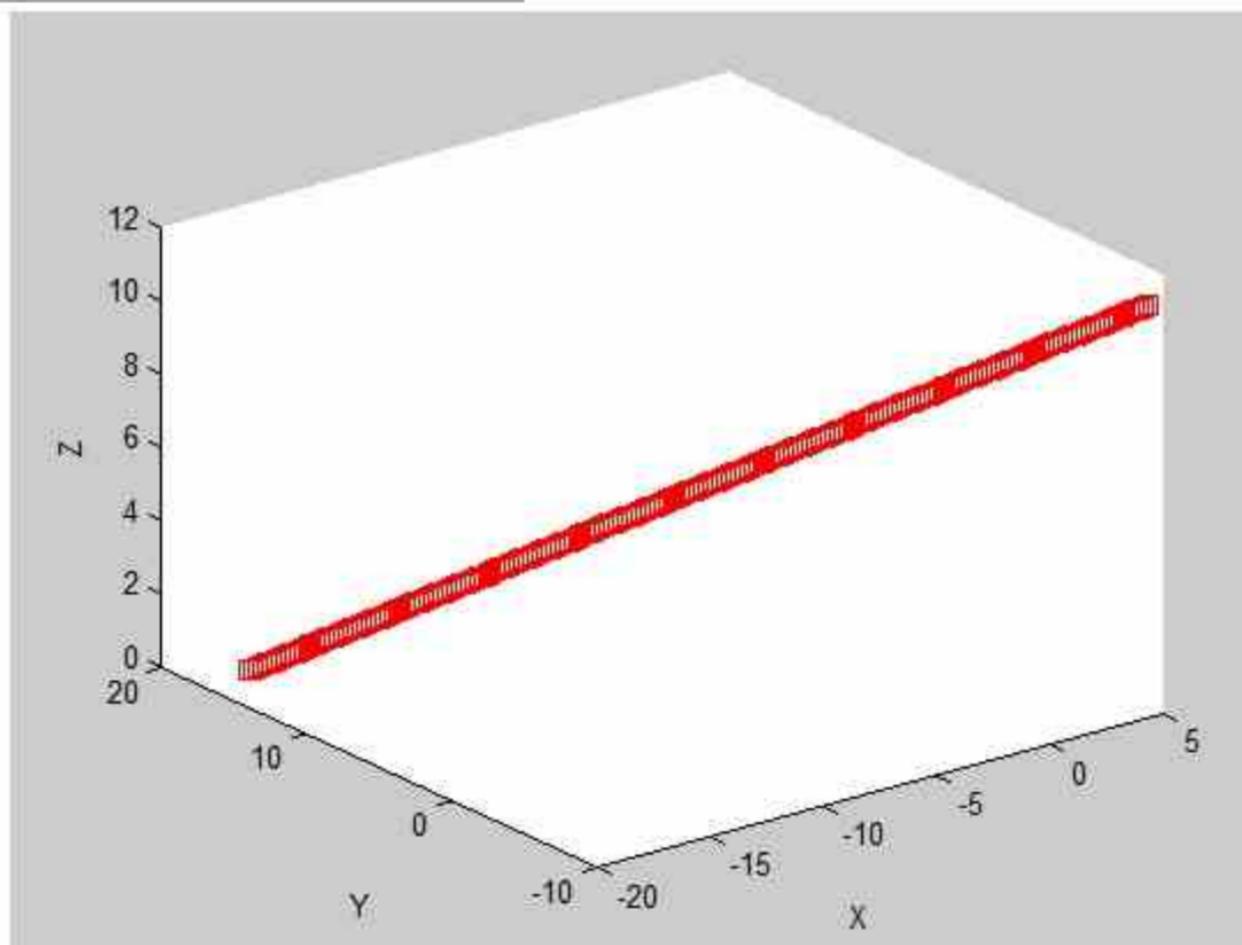


Command Window

```
Start as [x1 y1 z1]= [5 -9 11]
Finish as [x2 y2 z2]= [-20 14 1]
```

```
fx>> |
```

Apply==>>>

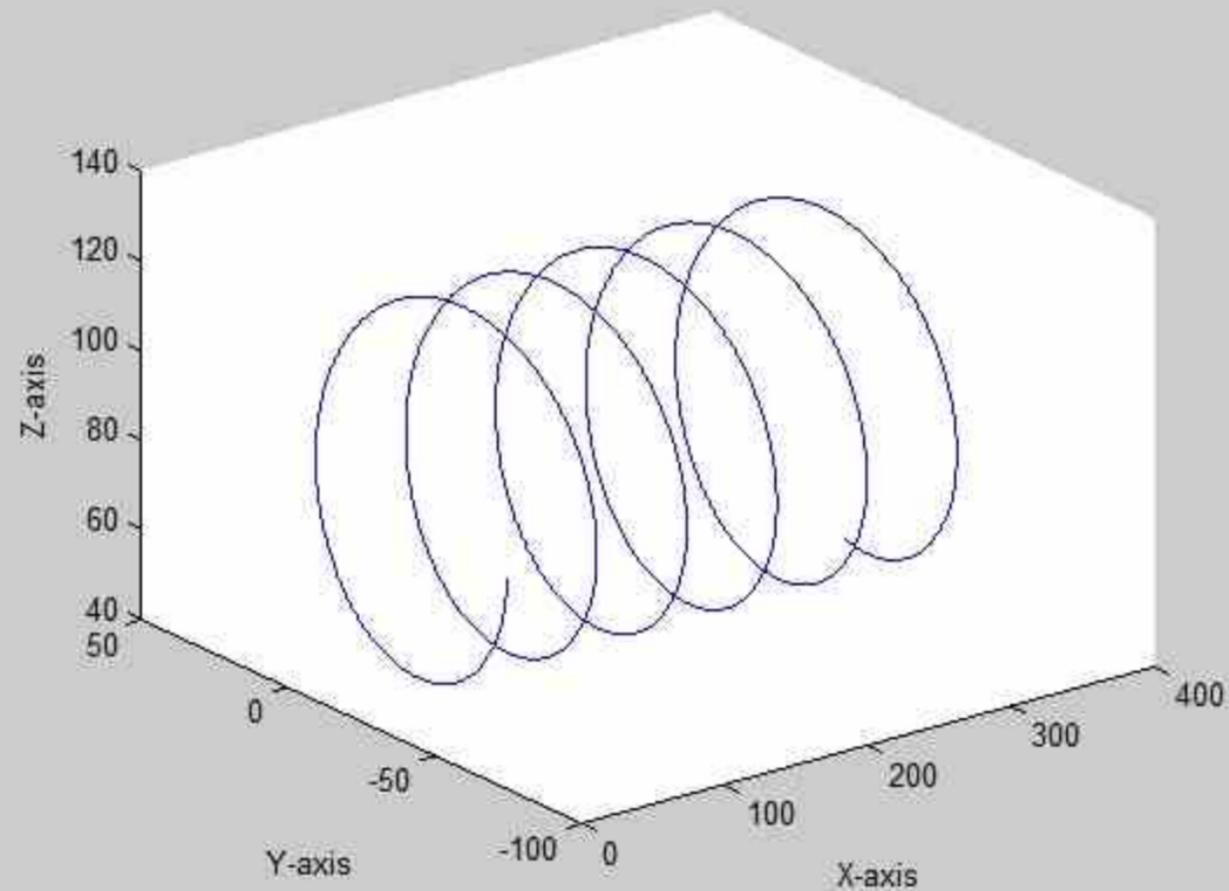


```
1 - clear all;clc
2 - h=input('Helix on X-axis [Xc, yc, Zc, raduis, placement]=');
3 - r=h(4); p=h(5);
4 - t= -3:0.01:30;
5 - xc=h(1);yc=h(2);zc=h(3);
6 - x=xc+p*t;
7 - y=yc+r*cos(t);
8 - z=zc+r*sin(t);
9 - plot3(x,y,z);
10 - xlabel('X-axis');ylabel('Y-axis');zlabel('Z-axis');
```

Command Window

```
Helix on X-axis [Xc, yc, Zc, raduis, placement]=[40 -30 90 40 10]
```

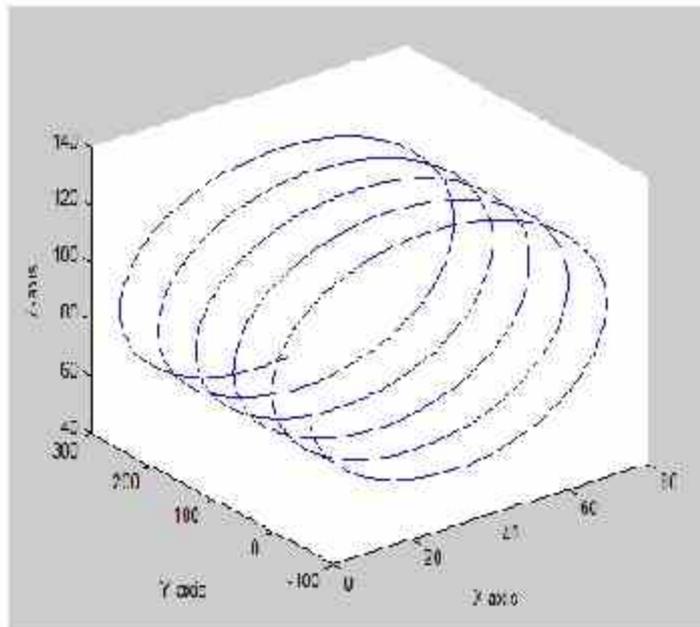
```
fx >>
```



```

clear all;clc
h=input('Helix on Y-axis [Xc, yc, Zc, raduis, placement]=');
r=h(4); p=h(5);
t= -3:0.01:30;
xc=h(1);yc=h(2);zc=h(3);
x=xc+r*cos(t);
y=yc+p*t;
z=zc+r*sin(t);
plot3(x,y,z);
xlabel('X-axis');ylabel('Y-axis');zlabel('Z-axis');

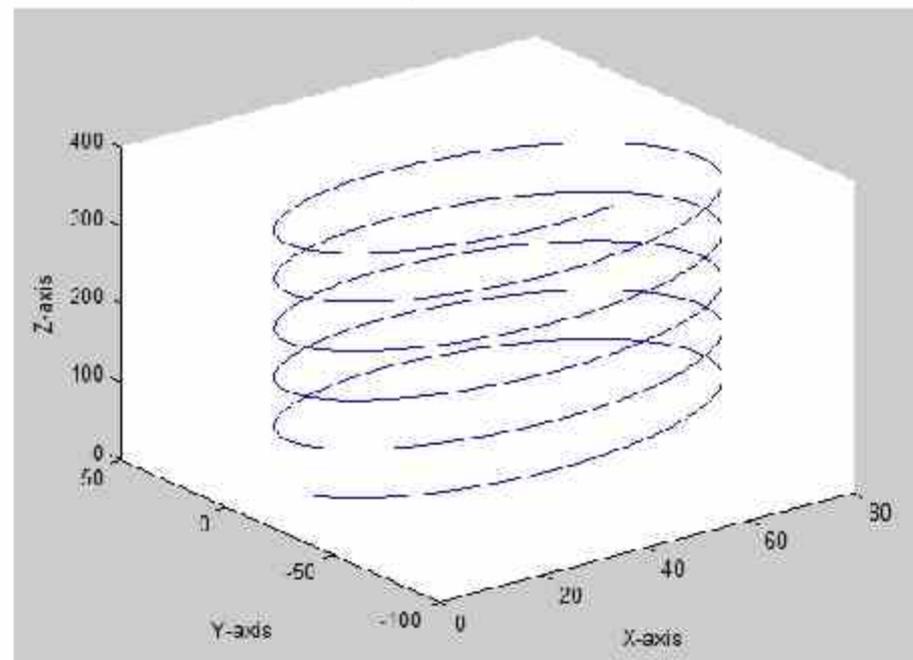
```



```

clear all;clc
h=input('Helix on Z-axis [Xc, yc, Zc, raduis, placement]=');
r=h(4); p=h(5);
t= -3:0.01:30;
xc=h(1);yc=h(2);zc=h(3);
x=xc+r*cos(t);
y=yc+r*sin(t);
z=zc+p*t;
plot3(x,y,z);
xlabel('X-axis');ylabel('Y-axis');zlabel('Z-axis');

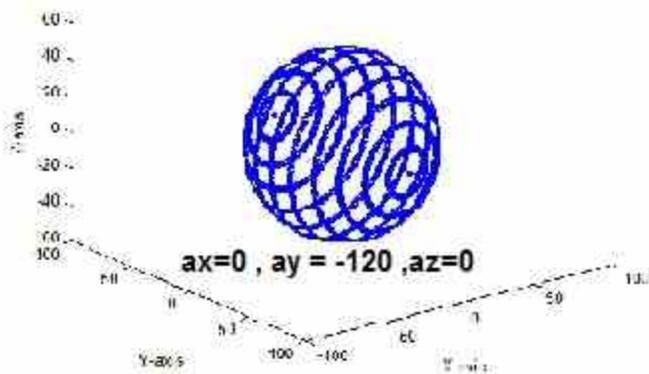
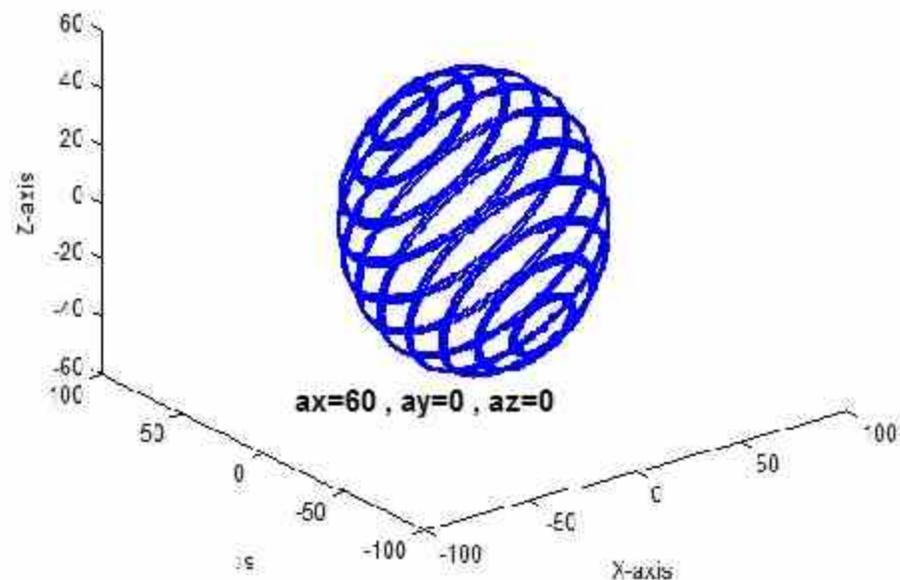
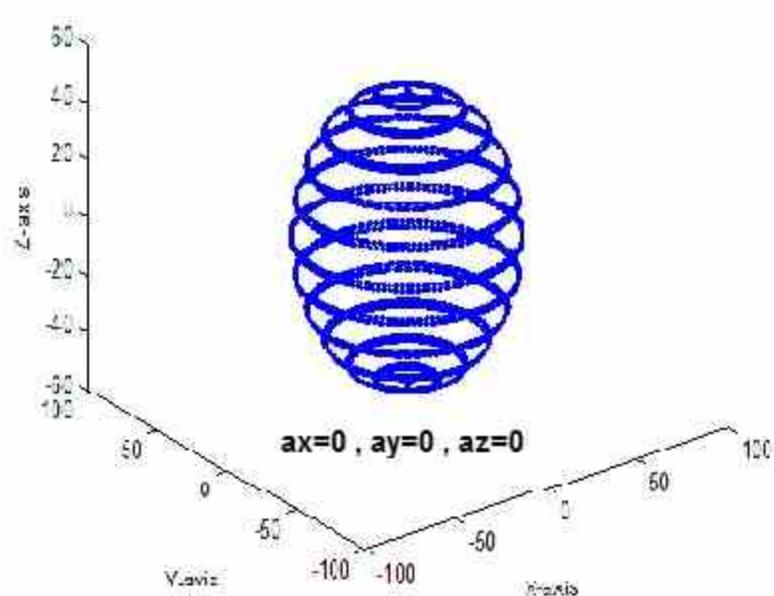
```



```

1 - clear all;clc;
2 - m=1;n=15;r=51;
3 - ax=input('Rotate in x-axis= ');
4 - ay=input('Rotate in y-axis= ');
5 - az=input('Rotate in z-axis= ');
6 - hold on
7
8 - for i=1:m:360
9 -     for j=1:n:360
10 -        x=r*sind(j)*sind(i);
11 -        y=r*sind(j)*cosd(i);
12 -        z=r*cosd(j);
13
14 -        x1=x*cosd(az)-y*sind(az);
15 -        y1=y*cosd(az)+x*sind(az);
16
17 -        z1=z*cosd(ax)-y1*sind(ax);
18 -        y2=y1*cosd(ax)+z*sind(ax);
19
20 -        x2=x1*cosd(ay)-z1*sind(ay);
21 -        z2=z1*cosd(ay)+x1*sind(ay);
22
23 -        plot3(x2,y2,z2);
24
25 -     end
26 - end
27 - xlabel('X-axis');ylabel('Y-axis');zlabel('Z-axis')
28 - view(3);

```



```

%X1=input('x1=');Y1=input('y1=') ;
%X2=input('x2=');Y2=input('y2=');
%X3=input('x3=');Y3=input('y3=');
%X4=input('x4=');Y4= input('y4=');
X1=80;Y1=120;X2=-160;Y2=50;
X3=-20;Y3=-90;X4=70;Y4=-30;

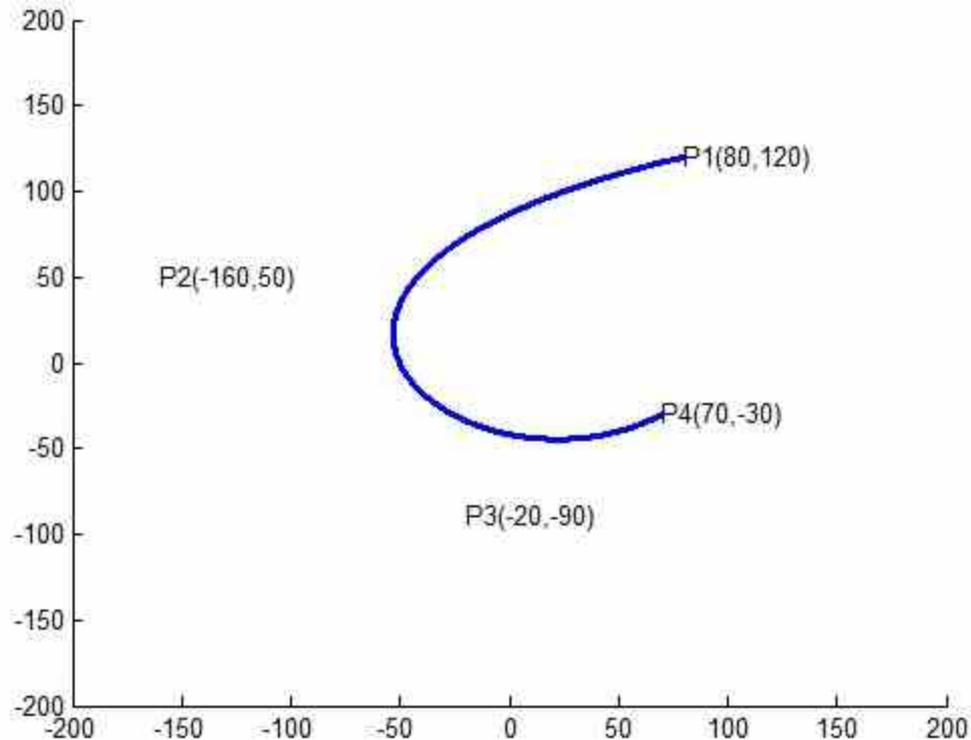
hold on

text(X1,Y1,sprintf('P1(%d,%d)',X1,Y1));
text(X2,Y2,sprintf('P2(%d,%d)',X2,Y2));
text(X3,Y3,sprintf('P3(%d,%d)',X3,Y3));
text(X4,Y4,sprintf('P4(%d,%d)',X4,Y4));

xlim([-200 200]);ylim([-200 200]);

for t = 0 :0.0001: 1
    x = (1 - t) ^ 3 * X1 + 3 * (1 - t) ^ 2 * t * X2 + 3 * (1 - t) * t ^ 2 * X3 + (t ^ 3) * X4;
    y = (1 - t) ^ 3 * Y1 + 3 * (1 - t) ^ 2 * t * Y2 + 3 * (1 - t) * t ^ 2 * Y3 + (t ^ 3) * Y4;
    plot(x, y)
end

```



```

%X1=input('x1=');Y1=input('y1=');
%X2=input('x2=');Y2=input('y2=');
%X3=input('x3=');Y3=input('y3=');
%X4=input('x4=');Y4=input('y4=');
X2=80;Y2=120;X1=-160;Y1=50;
X3=-20;Y3=-90;X4=70;Y4=-30;

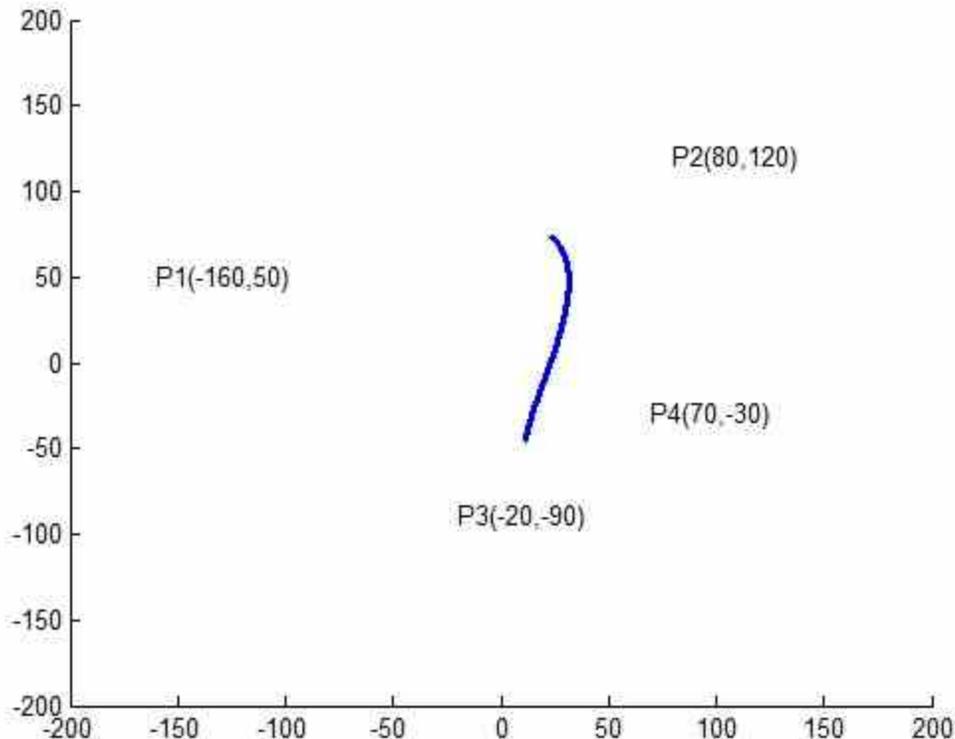
hold on

text(X1,Y1,sprintf('P1(%d,%d)',X1,Y1));
text(X2,Y2,sprintf('P2(%d,%d)',X2,Y2));
text(X3,Y3,sprintf('P3(%d,%d)',X3,Y3));
text(X4,Y4,sprintf('P4(%d,%d)',X4,Y4));

xlim([-200 200]);ylim([-200 200]);

for t = 0 : 0.0001 : 1
    x = ((1-t)^3*X1 + (3*t^3 - 6*t^2 + 4)*X2 + (-3*t^3 + 3*t^2 + 3*t + 1)*X3 + t^3*X4)/6;
    y = ((1-t)^3*Y1 + (3*t^3 - 6*t^2 + 4)*Y2 + (-3*t^3 + 3*t^2 + 3*t + 1)*Y3 + t^3*Y4)/6;
    plot(x, y)
end

```



```

EDITOR PUBLISH VIEW
3 - for v=1:length(p)
4 -     st= sprintf('P%d(%d,%d)',v,p(v,1),p(v,2));
5 -     text(p(v,1),p(v,2),st);
6 - end
7 - dx=zeros(length(p),1);dy=zeros(length(p),1);%DX1..DXn,DY1..DYN
8
9 - ax=zeros(length(p)-1,1);bx=zeros(length(p)-1,1);%a1..a(n-1),b1..b(n-1)
10 - cx=zeros(length(p)-1,1);ex=zeros(length(p)-1,1);%c1..c(n-1),e1..e(n-1)for X-axis
11
12 - ay=zeros(length(p)-1,1);by=zeros(length(p)-1,1);%a1..a(n-1),b1..b(n-1)
13 - cy=zeros(length(p)-1,1);ey=zeros(length(p)-1,1);%c1..c(n-1),e1..e(n-1)for Y-axis
14
15 - hold on
16 - %step 1: ' find Dx and Dy all points
dx(1) = 0; dx(length(p)) = 0;
dy(1) = 0; dy(length(p)) = 0;
    for i = 2 :length(p)-1
        dx(i) = ((p(i + 1,1) - p(i,1)) - (p(i,1) - p(i - 1,1))) * (3 / 2);
        dy(i) = ((p(i + 1,2) - p(i,2)) - (p(i,2) - p(i - 1,2))) * (3 / 2);
    end
%step 2: ' find a,b,c,e for x in all points
for j = 1 :length(p)-1
    ax(j) = (dx(j + 1) - dx(j)) / 6.0; bx(j)=dx(j)/2;
    cx(j) = (p(j + 1,1) - p(j,1)) - ax(j)-bx(j); ex(j)=p(j,1);
        % 'find a,b,c,e for y for all points
    ay(j) = (dy(j + 1) - dy(j)) / 6.0 ; by(j)=dy(j)/2;
    cy(j) = ((p(j + 1,2) - p(j,2))) - ay(j)-by(j) ; ey(j) = p(j,2);
end
%step 3 apply equ. (1)
for s = 1 :length(p)-1
    for T = 0 :0.001: 1
        xp = (T ^ 3) * ax(s) + (T ^ 2) * bx(s) + (T) * cx(s) + ex(s);
        yp = (T ^ 3) * ay(s) + (T ^ 2) * by(s) + (T) * cy(s) + ey(s);
        plot (xp, yp) % draw Curve points
    end
end
end

```

