AI and Robotics LAb-1

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```
R = rot2(45)
```

```
R = 2×2
    0.5253   -0.8509
    0.8509    0.5253
```

```
R = rot2(45,'deg')
```

```
R = 2×2
    0.7071   -0.7071
    0.7071    0.7071
```

```
R = rotx(45),roty(45),rotz(45)
```

```
R = 3×3
    1.0000         0         0
         0    0.5253   -0.8509
         0    0.8509    0.5253
ans = 3×3
    0.5253         0    0.8509
         0    1.0000         0
   -0.8509         0    0.5253
ans = 3×3
    0.5253   -0.8509         0
    0.8509    0.5253         0
         0         0    1.0000
```

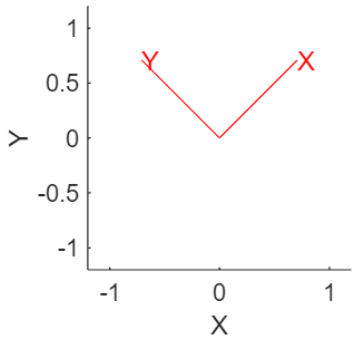
```
R=rotx(45,'deg')
```

```
R = 3×3
    1.0000         0         0
         0    0.7071   -0.7071
         0    0.7071    0.7071
```

```
clf;
clear all;
R = rot2(45,'deg')
```

```
R = 2×2
    0.7071   -0.7071
    0.7071    0.7071
```

```
H=trplot2(R,'color','r')
```

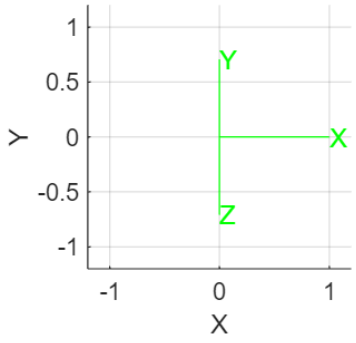



```
H =
  Transform with properties:

    Children: [4×1 Graphics]
     Visible: on
     HitTest: on
      Matrix: [4×4 double]

  Show all properties
```

```
clf;
clear all;
R = rotx(45,'deg')
```

```
R = 3×3
    1.0000         0         0
         0    0.7071   -0.7071
         0    0.7071    0.7071
```

```
trplot(R,'color','g')
```




```
T = transl2(2,3)
```

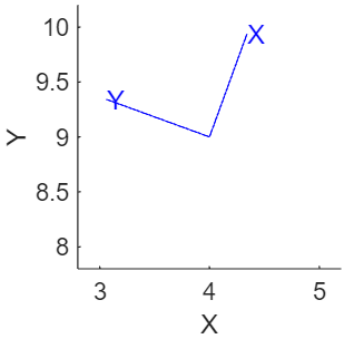
```
T = 3×3
     1     0     2
     0     1     3
     0     0     1
```

```
H = transl2(4,9) * trot2(70,'deg')
```

```
H = 3×3
```

```
    0.3420   -0.9397    4.0000
    0.9397    0.3420    9.0000
         0         0    1.0000
```

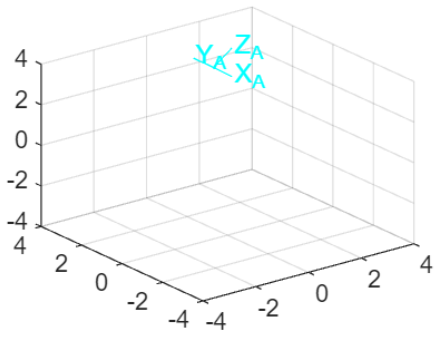
```
clf;
trplot2(H)
```




```
clf;
axis([-4 4 -4 4 -4 4]);
view(3);
grid on;
hold on;
H1 = transl(1,2,3)*troty(45,'deg')
```

```
H1 = 4×4
    0.7071         0    0.7071    1.0000
         0    1.0000         0    2.0000
   -0.7071         0    0.7071    3.0000
         0         0         0    1.0000
```

```
trplot(H1, 'frame', 'A', 'color', 'c');
```



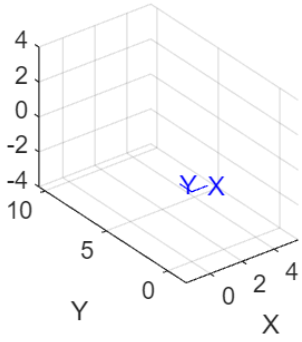

```
clf;
axis([-4 4 -4 4 -4 4]);
view(3);
grid on
H = transl2(4,9)*trot2(70,'deg')
```

```
H = 3×3
    0.3420   -0.9397    4.0000
    0.9397    0.3420    9.0000
         0         0    1.0000
```

```
H1=eye(3)
```

```
H1 = 3×3
     1     0     0
     0     1     0
     0     0     1
```

```
tranimate2(H,H1)
```



Practice Questions

```
theta = 45;
R = trotz(theta, 'deg');
R = R(1:3, 1:3);
RT_R = R' * R;
inverse_R = inv(R);
det_R = det(R);

disp('R'' * R =');
```

```
R' * R =
```

```
disp(RT_R)
```

```
     1     0     0
     0     1     0
     0     0     1
```

```


disp('inv(R) =');
```

```
inv(R) =
```

```
disp(inverse_R)
```

```
    0.7071    0.7071         0
   -0.7071    0.7071         0
         0         0    1.0000
```

```
disp('R'' =');
```

```
R' =
```

```
disp(R')
```

```
    0.7071    0.7071         0
   -0.7071    0.7071         0
         0         0    1.0000
```

```
disp('det(R) =');
```

```
det(R) =
```

```
disp(det_R)
```

```
     1
```

```
X=rotx(90);
```

```
X = 3×3
    1.0000         0         0
         0   -0.4481   -0.8940
         0    0.8940   -0.4481
```

```
XY=X*roty(0);
```

```
XY = 3×3
    1.0000         0         0
         0   -0.4481   -0.8940
         0    0.8940   -0.4481
```

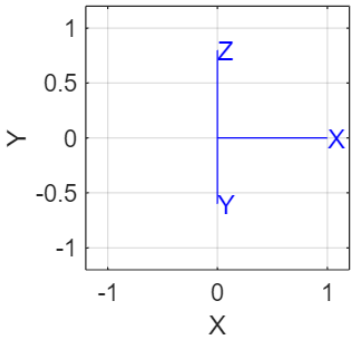
```
XYX = XY*rotx(90);
```

```
XYX = 3×3
    1.0000         0         0
         0   -0.5985    0.8012
         0   -0.8012   -0.5985
```

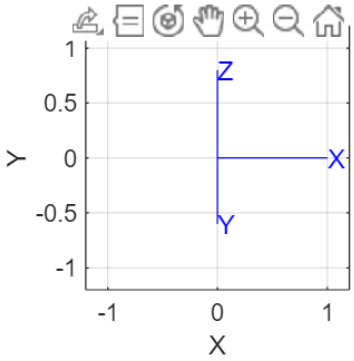
```
compareX = rotx(180)
```

```
compareX = 3×3
    1.0000         0         0
         0   -0.5985    0.8012
         0   -0.8012   -0.5985
```

```
trplot(XYX)
```

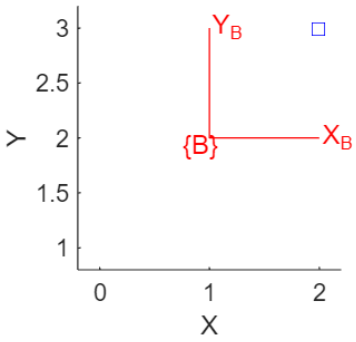



```
trplot(rotx(180))
```



LAB SHEET - 2

```
clear all;
clf;
clc;
B = transl2(1,2);
Ap=[2;3];
trplot2(B,'frame','B','color','r')
hold on
plot_point(Ap)
```




```
Pb = inv(B)*[Ap;1]
```

```
Pb = 3×1
```

```
     1
     1
     1
```

```
h2e(Pb)
```

```
ans = 2×1
     1
     1
```

```
Pb = h2e(inv(B)*e2h(Ap))
```

```
Pb = 2×1
     1
     1
```

```
syms theta
R = rot2(theta)
```

```
R =
```

$$\begin{pmatrix} \cos(\theta) & -\sin(\theta) \\ \sin(\theta) & \cos(\theta) \end{pmatrix}$$

```
simplify(R*R)
```

```
ans =
```

$$\begin{pmatrix} \cos(2\,\theta) & -\sin(2\,\theta) \\ \sin(2\,\theta) & \cos(2\,\theta) \end{pmatrix}$$

```
R = eul2r(0.1,0.2,0.3)
```

```
R = 3×3
    0.9021   -0.3836    0.1977
    0.3875    0.9216    0.0198
   -0.1898    0.0587    0.9801
```

```
EU = eul2r(0.1,-0.2,0.3)
```

```
EU = 3×3
    0.9021   -0.3836   -0.1977
    0.3875    0.9216   -0.0198
    0.1898   -0.0587    0.9801
```

```
EU2 = eul2tr(EU)
```

```
EU2 = 4×4
    0.9021   -0.3836    0.1977         0
    0.3875    0.9216    0.0198         0
   -0.1898    0.0587    0.9801         0
         0         0         0    1.0000
```

```
R1 = eul2r(EU)
```

```
R1 = 3×3
    0.9021   -0.3836    0.1977
    0.3875    0.9216    0.0198
   -0.1898    0.0587    0.9801
```

PRACTICE QUESTION

```
H = eul2r(1,4,8)
```

```
H = 3×3
   -0.7811    0.4718   -0.4089
    0.6146    0.4656   -0.6368
   -0.1101   -0.7487   -0.6536
```

```
H = H* rotx(45,'deg')*roty(70,'deg')*rotz(30,'deg')
```

```
H = 3×3
    0.2977   -0.1205   -0.9470
    0.7558   -0.5762    0.3109
   -0.5832   -0.8084   -0.0805
```

```
eulerAngles = eul2tr(H)
```

```
eulerAngles =
eulerAngles(:,:,1) =

    0.7924    0.5990   -0.1149         0
   -0.6059    0.7948   -0.0353         0
    0.0702    0.0976    0.9928         0
         0         0         0    1.0000


eulerAngles(:,:,2) =

    0.3711   -0.8397   -0.3965         0
    0.7702    0.5169   -0.3737         0
    0.5187   -0.1667    0.8385         0
         0         0         0    1.0000


eulerAngles(:,:,3) =

    0.5304    0.5952   -0.6036         0
   -0.4462    0.8014    0.3982         0
    0.7208    0.0581    0.6907         0
         0         0         0    1.0000
```

```
AngelVector = tr2angvec(H)
```

```
AngelVector = 2.3179
```

```
RPY = tr2rpy(H)
```

```
RPY = 1×3
   -1.6700    0.6226    1.1956
```