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%HW 1

problem 1

```
clear; clc;
%part a
syms phi theta psi
R = mrz(psi)*mrx(theta)*mrz(phi)
%part b
phi = 30*pi/180;
theta = 45*pi/180;
psi = -60*pi/180;
R = double(simplify(subs(R)))
%part c
r_xyz = [-5;3;0];
r_XYZ = R'*r_xyz
```

problem 2 (3.3 from book)

```
clear
r_airplane = [0;.5;-2];
R = mry(10*pi/180)*mrz(20*pi/180)*mrz(40*pi/180);
r_earth = R*r_airplane
```

```
r_earth =

    0.6656
   -0.3241
   -1.9240
```

problem 3 (3.4 from book)

```
clear;
e_ba = [-50;20;0];
e_ca = [-50;0;40];
e_bah = e_ba/norm(e_ba);
e_cah = e_ca/norm(e_ca);
```

```

k_hat = cross(e_bah,e_cah);
i_hat = e_bah;
j_hat = cross(k_hat,i_hat);
R = [i_hat';j_hat';k_hat']
r_XYZ = [-50;0;0];
r_xyz = R*r_XYZ

```

```
R =
```

```

-0.9285    0.3714    0
-0.1077   -0.2693    0.6247
 0.2320    0.5800    0.2900

```

```
r_xyz =
```

```

 46.4238
  5.3853
-11.6003

```

problem 4

```

clear;
syms theta
R_rot = mry(theta)*mrz(40*pi/180);
theta_r = double(solve(R_rot(1,1)==cos(49.36*pi/180),theta));
R = mry(theta_r(1))*mrz(40*pi/180)

```

```
R =
```

```

 0.6513    0.5465   -0.5264
-0.6428    0.7660    0
 0.4033    0.3384    0.8502

```

problem 5

```

clear;
theta = atan2(2,3);
r_ac_XYZ = [0;2;1];
r_ac_new_xyz2 = mrz(theta)*r_ac_XYZ;
R = (mry(45*pi/180)*mrz(theta));
r_ac_new_XYZ = R'*r_ac_new_xyz2;
r_oc_new_XYZ = r_ac_new_XYZ+[3;0;0]

```

functions

```

function R = mrz(theta)
    R = [cos(theta), sin(theta), 0;

```

```

        -sin(theta), cos(theta), 0;
        0, 0, 1];
end
function R = mrx(theta)
    R = [1,0,0;
        0,cos(theta), sin(theta);
        0,-sin(theta),cos(theta)];
end
function R = mry(theta)
    R = [cos(theta),0,-sin(theta);
        0,1, 0;
        sin(theta),0,cos(theta)];
end

R =

[ cos(phi)*cos(psi) - cos(theta)*sin(phi)*sin(psi),
  cos(psi)*sin(phi) + cos(phi)*cos(theta)*sin(psi),
  sin(psi)*sin(theta)]
[ -cos(phi)*sin(psi) - cos(psi)*cos(theta)*sin(phi),
  cos(phi)*cos(psi)*cos(theta) - sin(phi)*sin(psi),
  cos(psi)*sin(theta)]
[
                                sin(phi)*sin(theta),
    -cos(phi)*sin(theta),      cos(theta)]

R =

    0.7392    -0.2803    -0.6124
    0.5732     0.7392     0.3536
    0.3536    -0.6124     0.7071

r_XYZ =

    -1.9763
     3.6192
     4.1225

```

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