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# Homework 2

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## 2a

```
v_e = [10 0 0]'; % units
R_i_e = rotx(deg2rad(13))*roty(deg2rad(15))*rotz(deg2rad(10));

v_i = R_i_e \ v_e %

v_i =

    9.9998
   -0.0305
    0.0457
```

## 2b

```
function euler321_angles_dot = rotational_kinematics(t,
    euler321_angles, omega_iee)

psi_yaw = euler321_angles(1);
theta_pitch = euler321_angles(2);
phi_roll = euler321_angles(3);

H_321 = [-sin(theta_pitch) 0 1;
    sin(phi_roll)*cos(theta_pitch) cos(phi_roll) 0;
    cos(phi_roll)*cos(theta_pitch) -sin(phi_roll) 0];

euler321_angles_dot = H_321 \ omega_iee;
end

clear all; close all; clc;

%initial conditions
```

```
euler321_angles_initial = [10; 15; 13] * pi/180; %radians
time_span = [0 2]; %seconds
omega_iee = [2; 0; 0] * pi/180; %radians/second

%solve ODE
[t_sim, euler321_angles_sim] = ...
ode45(@(t, y)rotational_kinematics(t, y, omega_iee), time_span,
    euler321_angles_initial);

%initial conditions same as last ones
euler321_angles_initial = euler321_angles_sim(end, :); %rad
time_span = [2 5]; %s
omega_iee = [1; 3; 0] * pi/180; %rad/s

%solve ODE
[t_sim_2, euler321_angles_sim_2] = ...
ode45(@(t, y)rotational_kinematics(t, y, omega_iee), time_span,
    euler321_angles_initial);

%initial conditions same as last ones
euler321_angles_initial = euler321_angles_sim_2(end, :); %rad
time_span = [5 8]; %s
omega_iee = [0; 0; 1] * pi/180; %rad/s

%solve ODE
[t_sim_3, euler321_angles_sim_3] = ...
ode45(@(t, y)rotational_kinematics(t, y, omega_iee), time_span,
    euler321_angles_initial);

%initial conditions same as last ones
euler321_angles_initial = euler321_angles_sim_3(end, :); %rad
time_span = [8 10]; %s
omega_iee = [1; 4; 3] * pi/180; %rad/s

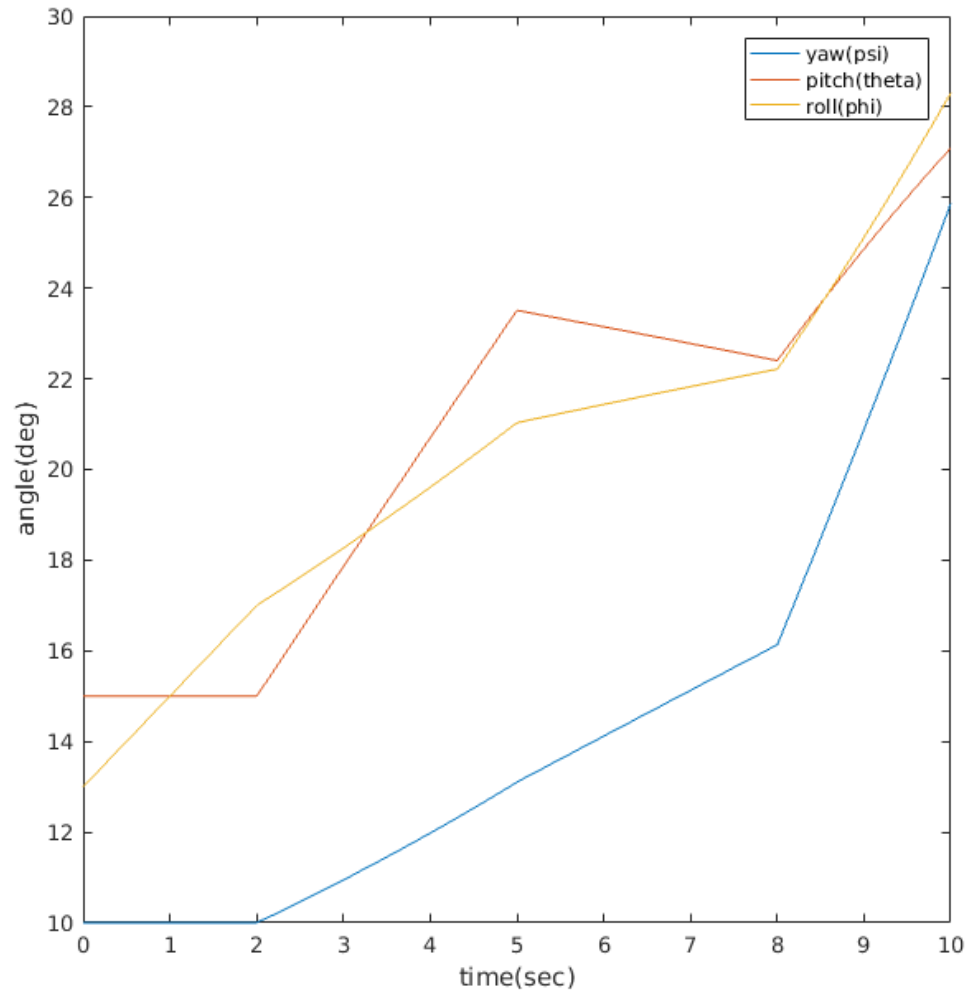
%solve ODE
[t_sim_4, euler321_angles_sim_4] = ...
ode45(@(t, y)rotational_kinematics(t, y, omega_iee), time_span,
    euler321_angles_initial);

euler321_angles_degrees_1 = euler321_angles_sim * 180/pi;
euler321_angles_degrees_2 = euler321_angles_sim_2 * 180/pi;
euler321_angles_degrees_3 = euler321_angles_sim_3 * 180/pi;
euler321_angles_degrees_4 = euler321_angles_sim_4 * 180/pi;

time = [t_sim; t_sim_2; t_sim_3; t_sim_4];
euler321_angles_degrees = [euler321_angles_degrees_1;
    euler321_angles_degrees_2; euler321_angles_degrees_3;
    euler321_angles_degrees_4];

plot(time, euler321_angles_degrees)

xlabel('time(sec)')
ylabel('angle(deg)')
legend('yaw(psi)', 'pitch(theta)', 'roll(phi)')
```



**3a**

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