1.

a) ${}^{L}p_1 - {}^{L}p_2 = P_1P_2 \qquad \sqrt{(x_2-x_1)^2+(y_2-y_1)^2} = 5$

${}^{L}X_B = [0, -1, 0]^T \qquad {}^{L}Z_B = [0, 0, 1]^T \qquad {}^{L}p_B = [9, 15, 3, 1]^T$

${}^{L}Y_B = {}^{L}Z_B \times {}^{L}X_B = [1, 0, 0]^T$

$$ {}^{L}T_B = \begin{bmatrix} 0 & 1 & 0 & 9 \\ -1 & 0 & 0 & 15 \\ 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 1 \end{bmatrix} $$

b) ${}^{L}p_1 = {}^{L}p_B = [9, 15, 3, 1]^T$

${}^{L}X_B = [0, 1, 0]^T$

${}^{L}Z_B = [0, 0, 1]^T$

${}^{L}Y_B = {}^{L}Z_B \times {}^{L}X_B = [-1, 0, 0]^T$

$$ {}^{L}T_B = \begin{bmatrix} 0 & -1 & 0 & 9 \\ 1 & 0 & 0 & 15 \\ 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 1 \end{bmatrix} $$

2.

```
a = [-1.7035 4.8305 8.3666];
ax = a(1);
ay = a(2);
az = a(3);
g = 9.81;
theta_p = asin(-ax/g);
theta_r =  atan2(ay,az);

p_degree = theta_p * (180 / pi);
display(p_degree);
r_degree = theta_r * (180 / pi);
display(r_degree);
y_degree = 0.0;

R0 = rotz(0) * roty(theta_p) *rotx(theta_r);
```

```
R = R0;
R3 = eye(3);
omega_imu = [0.7 0.8 0];
for i = 1:5
    R = R + R * 0.060 *skew(omega_imu);
    R = R * R3;
    R_det = det(R);
     if i == 5
        R1 = trnorm(R);
        R1_det = det(R1);
    end
end

display(R0);
display(R);
display(R1);
display(R_det);
display(R1_det);
```

a)

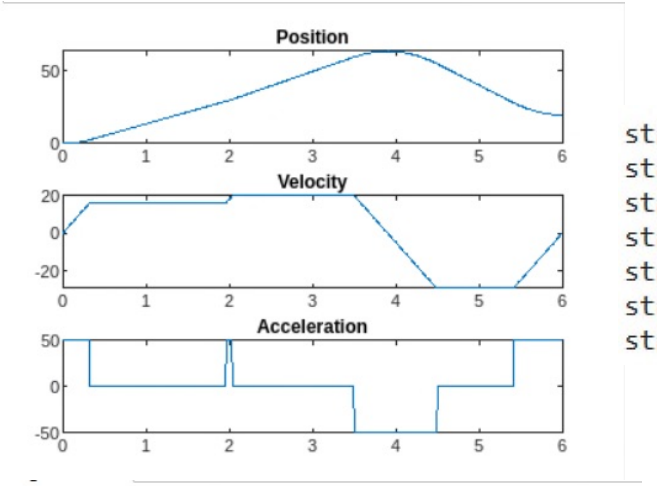
```
p_degree =

   10.0001


r_degree =

   30.0002


R0 =

    0.9848    0.0868    0.1504
         0    0.8660   -0.5000
   -0.1736    0.4924    0.8529
```

b).

```
R =

    0.9281    0.1364    0.3606
    0.1364    0.7466   -0.6601
   -0.3628    0.6579    0.6743


R1 =

    0.9242    0.1358    0.3570
    0.1431    0.7433   -0.6534
   -0.3541    0.6550    0.6675


R_det =

    1.0205


R1_det =

     1
```

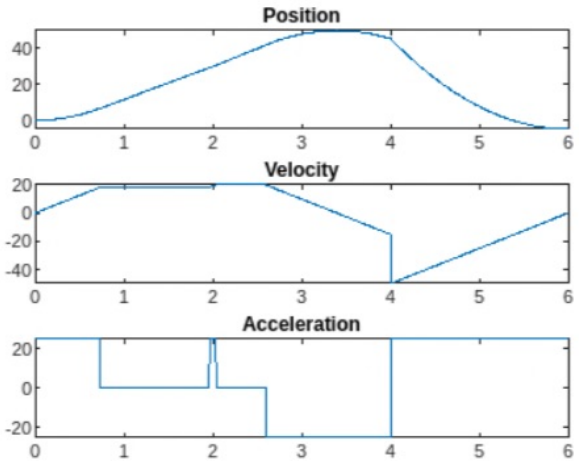
3.

a)




```
stage range: 0.00 seconds to 0.33 seconds
stage range: 0.33 seconds to 1.97 seconds
stage range: 1.97 seconds to 2.04 seconds
stage range: 2.04 seconds to 3.51 seconds
stage range: 3.51 seconds to 4.50 seconds
stage range: 4.50 seconds to 5.42 seconds
stage range: 5.42 seconds to 6.01 seconds
```

b)




```
stage range: 0.00 seconds to 0.74 seconds
stage range: 0.74 seconds to 1.97 seconds
stage range: 1.97 seconds to 2.04 seconds
stage range: 2.04 seconds to 2.61 seconds
stage range: 2.61 seconds to 5.41 seconds
stage range: 5.41 seconds to 5.41 seconds
stage range: 5.41 seconds to 7.41 seconds
```

If I set the theta_acc to 25, you can see it has a sudden change from -25 to 25 in the acceleration image which influences the velocity. I consider the change affects the result of the T34. So it makes the last linear segment equals to zero. What's more The trajectory becomes more smooth by decreasing the declereation.