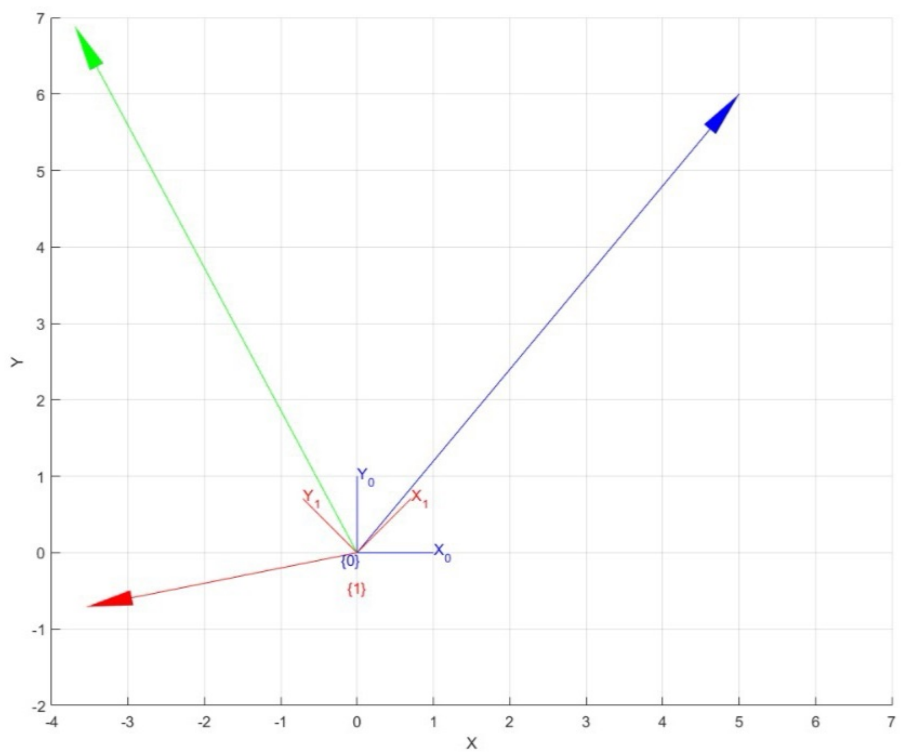
Answer Sheet

Index No: 210293K

1. MATLAB code for 3.1 ~ 3.5.

```
figure;
trplot2(eye(3), 'frame', '0');
hold on;
axis([-4 7 -2 7]);
grid on;

p = [5; 6];
plot_arrow([0, 0], [p(1), p(2)], 'b');

theta = deg2rad(45);
R = rot2(theta);
trplot2(R, 'frame', '1', 'color', 'r');

p_in_frame1 = R' * p;
plot(p_in_frame1(1), p_in_frame1(2), 'ro');
disp(p_in_frame1)

q = [-3; 2];
origin_frame1 = R * [0; 0];
plot_arrow(origin_frame1, origin_frame1 + R * q, 'r');

theta_68 = deg2rad(68);
R_68 = rot2(theta_68);
r = R_68 * p;

plot_arrow([0, 0], [r(1), r(2)], 'g');

hold off;
```

2. Final output MATLAB figure for the operations in 3.1 ~ 3.5.



3. p^1 for 3.3:

$$\begin{matrix} 7.7782 \\ 0.7071 \end{matrix}$$

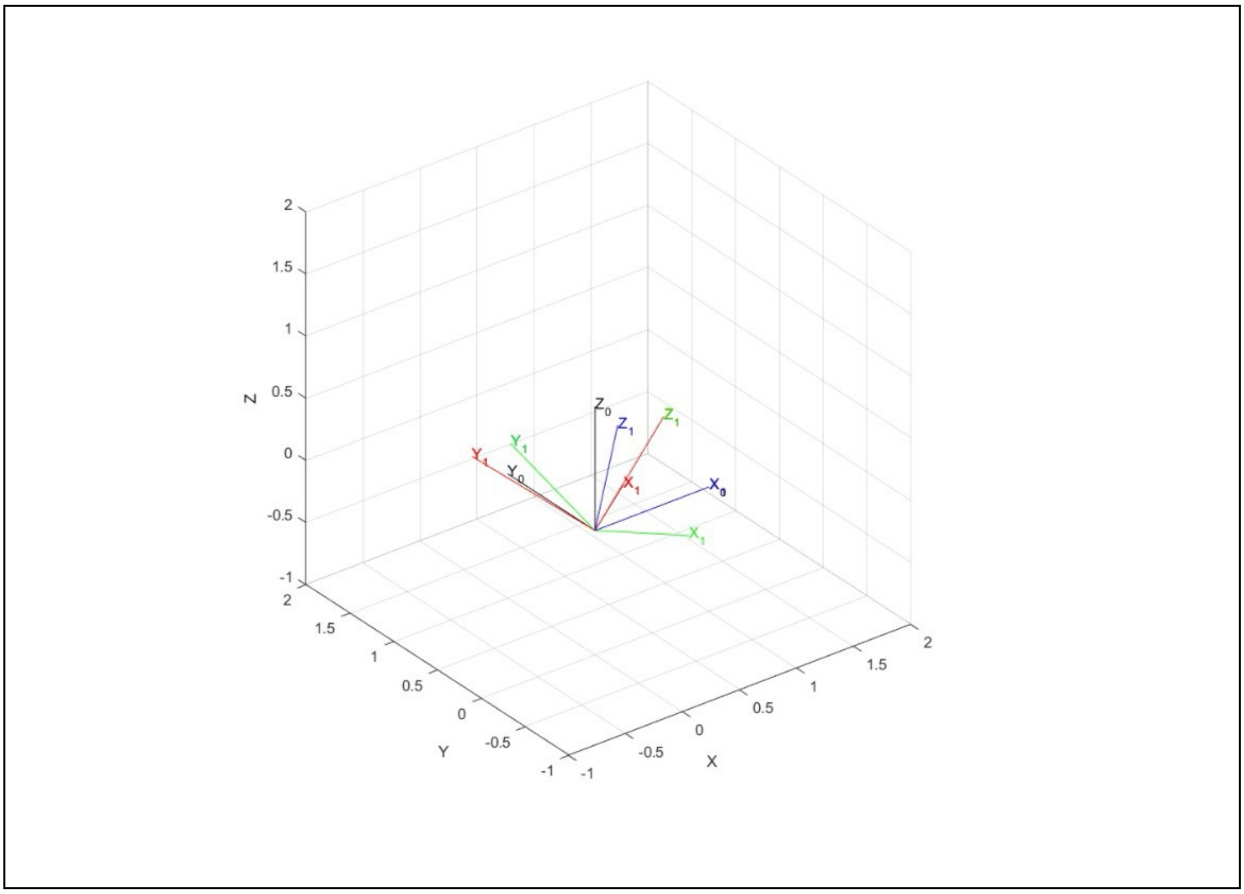
4. R_1^0 for 3.7.

$$\begin{matrix} 0.7424 & -0.5198 & 0.4226 \\ 0.6436 & 0.7285 & -0.2346 \\ -0.1859 & 0.4462 & 0.8754 \end{matrix}$$

5. MATLAB code for 3.6 ~ 3.9.

```
figure;
trplot(eye(3), 'frame', '0', 'color', 'k');
hold on;
axis([-1 2 -1 2 -1 2]);
grid on;

R_x = rotx(15, 'deg');
R_y = roty(25, 'deg');
R_z = rotz(35, 'deg');

R_10 = R_x * R_y * R_z; % Final rotation matrix R_10
disp('R in 3.7');
disp(R_10);

tranimate(eye(3), R_x, 'color', 'b', 'frame', '1'); % Rotate about X-axis
hold on;
tranimate(R_x, R_x * R_y, 'color', 'g', 'frame', '1'); % Rotate about Y-axis
tranimate(R_x * R_y, R_10, 'color', 'r', 'frame', '1'); % Rotate about Z-axis

trplot(R_10, 'frame', '1', 'color', 'r');
axis([-1 2 -1 2 -1 2]);
grid on;

R_given = [
   0.8138 0.0400 0.5798;
   0.2962 0.8298 -0.4730;
   -0.5000 0.5567 0.6634
];

rpy_angles = tr2rpy(R_given, 'deg'); % Obtain roll, pitch, yaw in degrees
disp('Roll-Pitch-Yaw Angles (in degrees):');
disp(rpy_angles);

R_confirmed = rpy2r(rpy_angles(1), rpy_angles(2), rpy_angles(3), 'deg');
disp('Reconstructed Rotation Matrix:');
disp(R_confirmed);
```

6. Final output MATLAB figure for the operations in 3.6 ~ 3.9.



7. Default roll-pitch-yaw angle definition for the toolbox.

Roll : Rotation about the X-axis
Pitch : Rotation about the Y-axis
Yaw : Rotation about the Z-axis

8. For 3.9,
ψ: 40.0021 θ: 29.9999 φ: 20.0001

```
R in 3.7
    0.7424   -0.5198    0.4226
    0.6436    0.7285   -0.2346
   -0.1859    0.4462    0.8754

Roll-Pitch-Yaw Angles (in degrees):
   40.0021   29.9999   20.0001

Reconstructed Rotation Matrix:
    0.8138    0.0400    0.5798
    0.2962    0.8298   -0.4731
   -0.5000    0.5567    0.6634
```