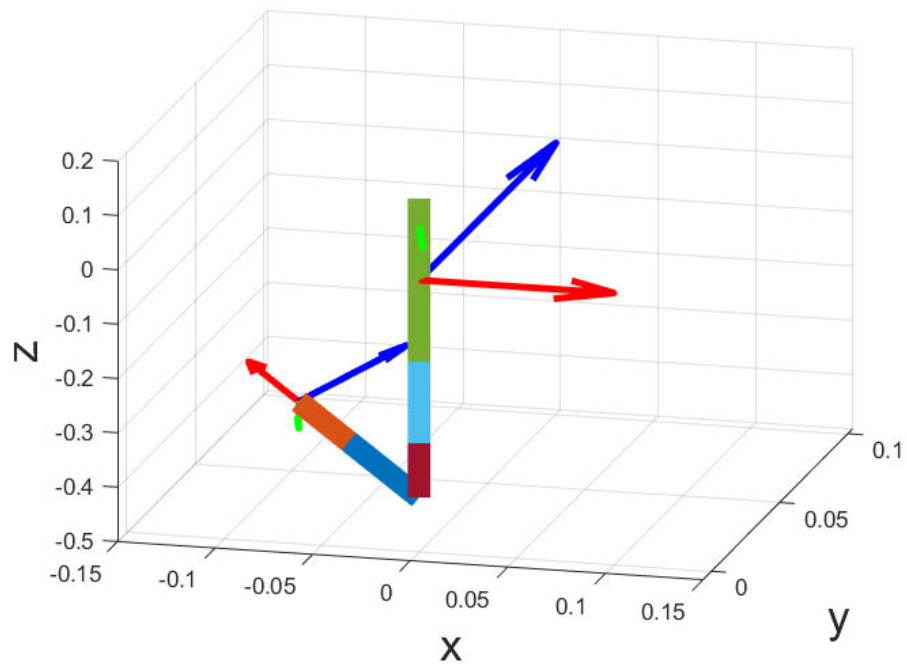
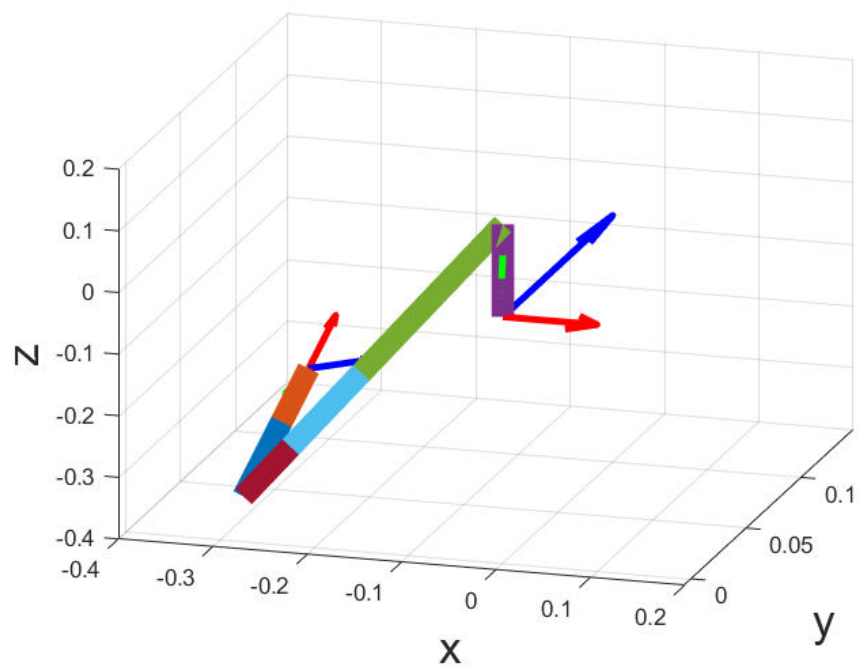


Ryan Dewsnap
32000408
CS403 HW4

1.a.



b.



2.a Solving end effector for
q =

0	1.5708	0	0.5236	1.5708	0
---	--------	---	--------	--------	---

end_effector_SE3 =

-0.8660	0.5000	0.0000	-0.1039
0.5000	0.8660	-0.0000	0.0600
-0.0000	0.0000	-1.0000	-0.4000
0	0	0	1.0000

b.
Solving end effector for
q =

0	1.0472	0.7854	1.0472	1.5708	0
---	--------	--------	--------	--------	---

end_effector_SE3 =

-0.4830	0.8365	-0.2588	0.0273
0.8660	0.5000	-0.0000	0.1039
0.1294	-0.2241	-0.9659	-0.3358
0	0	0	1.0000

```
1 % Ryan Dewsnap
2 % 32000408
3 % CS403 Homework 4
4
5 clear all
6 close all
7 clc
8
9 addpath('C:/Matlab/matlab_utils')
10
11 fprintf('Ryan Dewsnap\n32000408\nCS403 HW#4\n\n')
12
13 clf;
14
15 drawCoordinate3DScale(eye(3), zeros(3,1), 0.1); % draw global frame
16
17 q = deg2rad([0 60 45 60 90 0]); % convert degrees to
radian for easy input
18
19 T00 = SE3(eul2matrix([0, 0, 0]), [0; 0; 0]); % calculate SE3 matrices
20 T01 = SE3(eul2matrix([q(1), q(2), 0]), [0; 0; 0.15]);
21 T12 = SE3(eul2matrix([0, q(3), 0]), [0.30; 0; 0]);
22 T23 = SE3(eul2matrix([0, 0, q(4)]), [0.15; 0; 0]);
23 T34 = SE3(eul2matrix([0, q(5), 0]), [0.10; 0; 0]);
24 T45 = SE3(eul2matrix([0, 0, q(6)]), [0.07; 0; 0]);
25 T56 = SE3(eul2matrix([0, 0, 0]), [0.05; 0; 0]);
26
27 T02 = T01*T12; % calculate SE3 matrices
relative to global
28 T03 = T02*T23;
29 T04 = T03*T34;
30 T05 = T04*T45;
31 T06 = T05*T56;
32
33 drawLine3D(T00(1:3,4), T01(1:3,4)); % draw lines, taking XYZ
position from SE3
34 drawLine3D(T01(1:3,4), T02(1:3,4));
35 drawLine3D(T02(1:3,4), T03(1:3,4));
36 drawLine3D(T03(1:3,4), T04(1:3,4));
37 drawLine3D(T04(1:3,4), T05(1:3,4));
38 drawLine3D(T05(1:3,4), T06(1:3,4));
39
40 drawCoordinate3DScale(T06(1:3,1:3), T06(1:3,4), 0.05); % draw end effector frame
41
42 fprintf('Solving end effector for');
43 q
44 end_effector_SE3 = T06
45
46 grid on
```

```
47 view(60, 30);
48
49 xlabel('x', 'fontsize',20);
50 ylabel('y', 'fontsize',20);
51 zlabel('z', 'fontsize',20);
52
53 % functions
54
55 function x = SE3(R, t)
56     row3 = [0 0 0 1];
57     x = [R t; row3];
58 end
59
60 function matrix = eul2matrix(eul)
61     s = sin(eul);
62     c = cos(eul);
63
64     matrix = zeros(3,3);
65
66     matrix(1,1) = c(2)*c(1);    % build ZYX matrix from identities
67     matrix(1,2) = s(2)*s(3)*c(1) - s(1)*c(3);
68     matrix(1,3) = s(2)*c(3)*c(1) + s(1)*s(3);
69     matrix(2,1) = c(2)*s(1);
70     matrix(2,2) = s(1)*s(2)*s(3) + c(1)*c(3);
71     matrix(2,3) = s(1)*s(2)*c(3) - c(1)*s(3);
72     matrix(3,1) = -s(2);
73     matrix(3,2) = c(2)*s(3);
74     matrix(3,3) = c(2)*c(3);
75 end
76
77
```