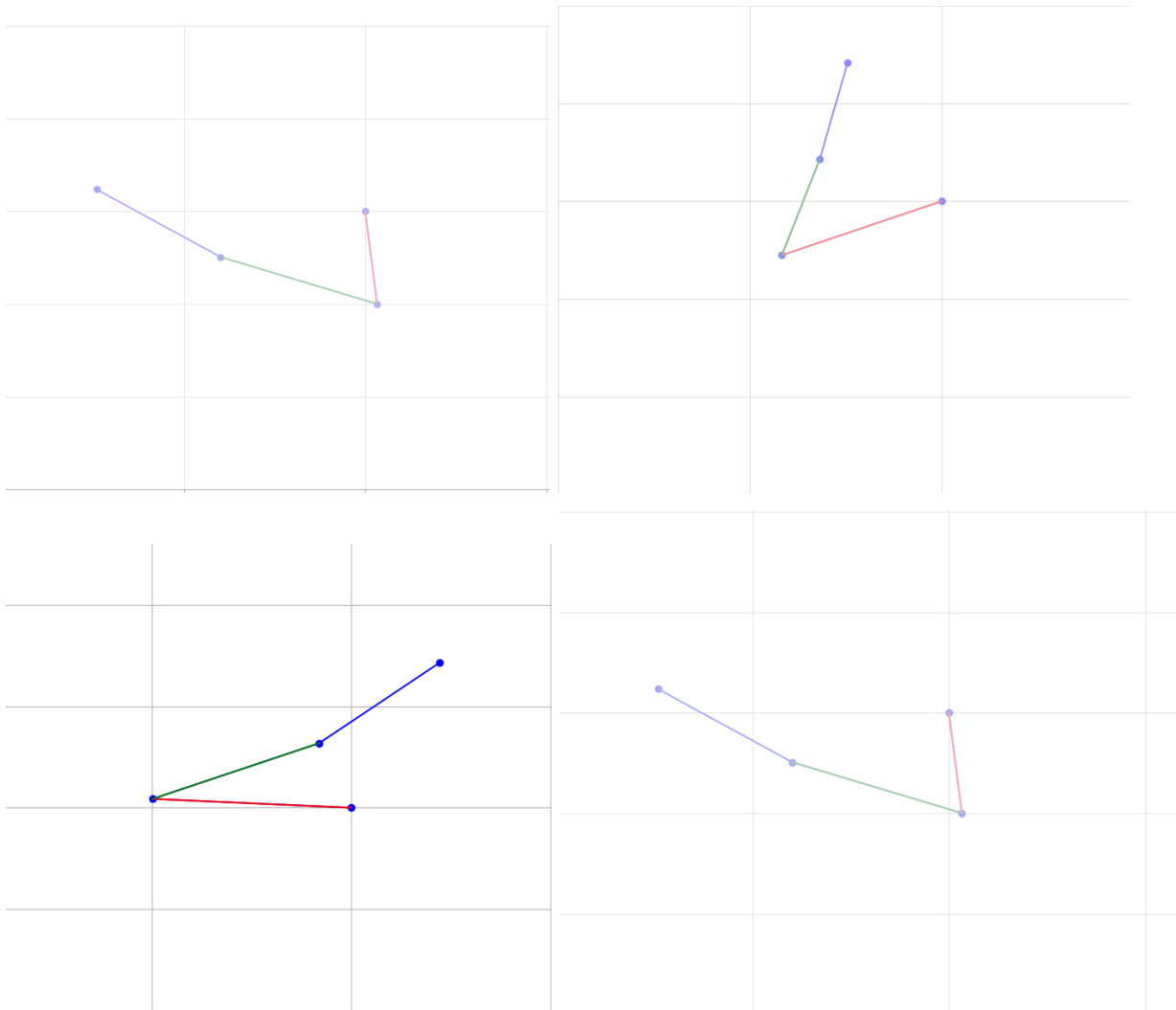# Assignment 6

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Q.1 Tried Numerical solver approach. However, there are some issues with the solution. Since there are 2 or more solutions for a given End Effector [X,Y], the solver does not give interpolated solutions. So the circle tracing isn't smooth. **Code is attached.**

Q2. I have used an example of 3R Puma robot's kinematic analysis from the paper[1]. Kinematic Analysis is taken directly from the paper. Link lengths are 0.25m each.

Forward Kinematics: -

```
x = (L2*np.cos(theta2)+L3*np.cos(theta2+theta3))*np.sin(theta1)
y = (L2*np.cos(theta2)+L3*np.cos(theta2+theta3))*np.cos(theta1)
z = L2*np.sin(theta2)+L3*np.sin(theta2+theta3) +L1
```


Inverse Kinematics:-

```
    theta1 = np.arctan2(y, x)
    r = np.sqrt(x**2 + y**2)
    D = np.sqrt((z-L1)**2 + r**2)
    theta3 = np.arccos((-L2**2 -L3**2 +D**2)/(2*L2*L3))
    theta2 = np.arctan2(r,z-L1) - np.arctan2(L2+L3*np.cos(theta3),
L3*np.sin(theta3))
```

All the four points ABCD lies in the workspace of the robot.