

# Task-1

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## Task 1: Position of Elbow Joint and End-Effector

Let's consider: A planar robotic arm setting with two rigid links of equal length

$$l_1 = l_2 = 1,$$

connected by two revolute joints. The base of the arm is fixed at the origin

$$O = (0, 0),$$

and the configuration of the arm is described by the joint angles  $q_1$  and  $q_2$ .

### q1- Elbow Joint Position

Coordinates of the elbow joint  $E = (x_e, y_e)$  are given by

$$y_e = l_1 \sin(q_1) = \sin(q_1).$$

### q2- End-Effector Position

The end-effector is located at the end of the second link. Its position depends on both joint angles  $q_1$  and  $q_2$ .

The total orientation of the second link relative to the base frame is  $(q_1 + q_2)$ . Coordinates of the end-effector  $EF = (x, y)$  are (already given in the question)

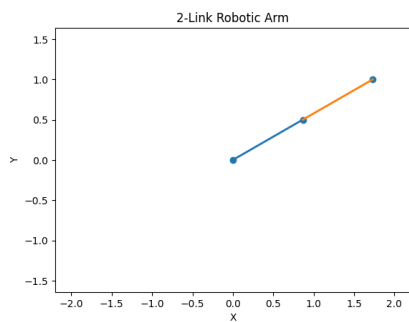
$$x = \cos(q_1) + \cos(q_1 + q_2),$$

$$y = \sin(q_1) + \sin(q_1 + q_2).$$

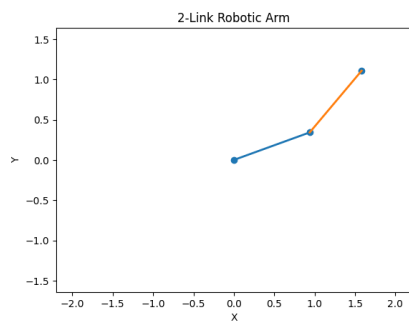
## Task 2: 2-link Robotic Arm

The Python Notebook below is used for visualization of the 2-link Robotic Arm.

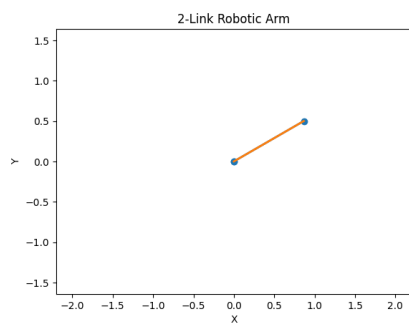
<https://colab.research.google.com/drive/1Z5uchI12ffo7qhLly3DEg3418xRE32m1?usp=sharing>



(a) Straight Arm



(b) Bent Arm



(c) Folded Arm

Figure 1: Different configurations of the robotic arm