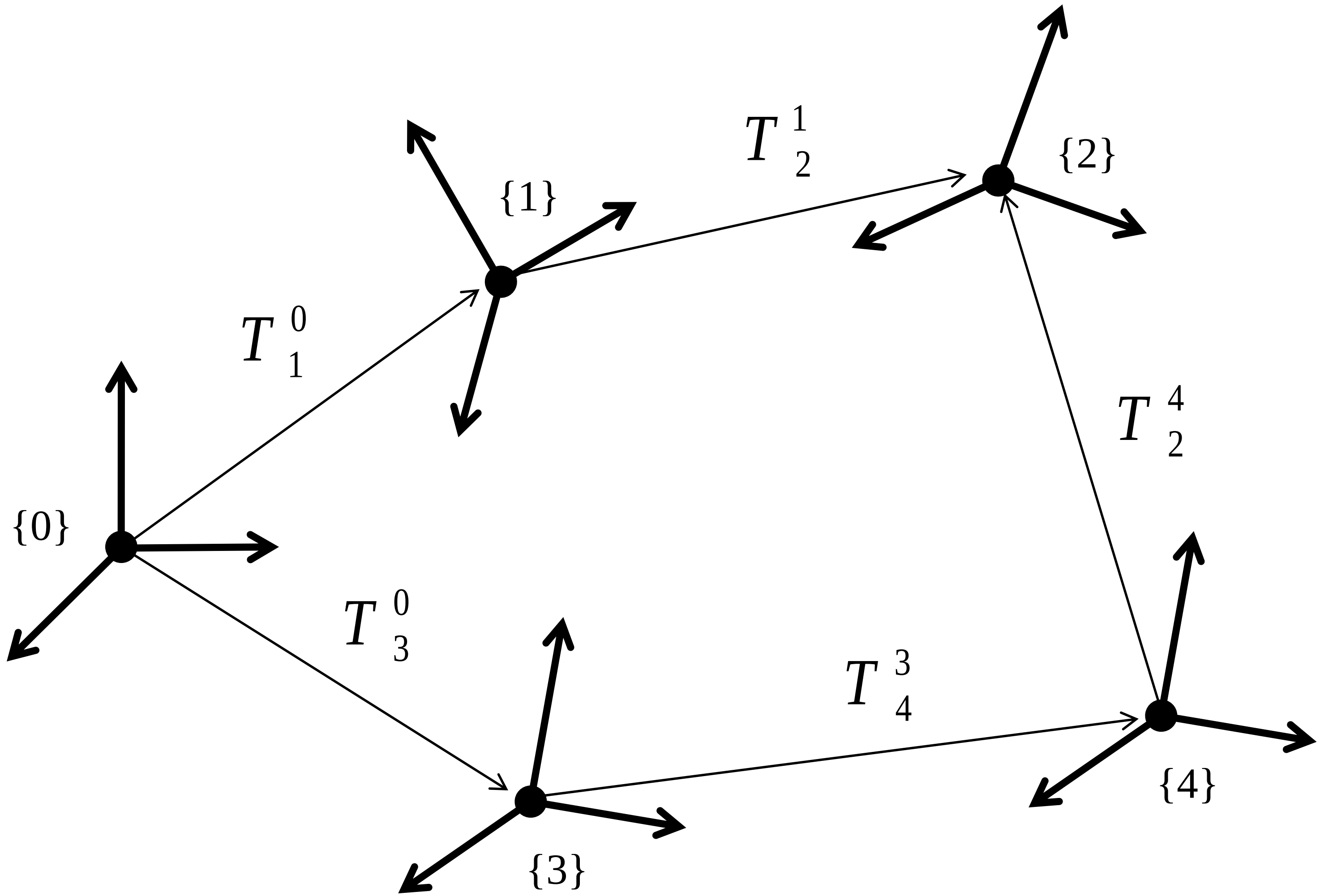
Day 06

Forward Kinematics

Transform Equations



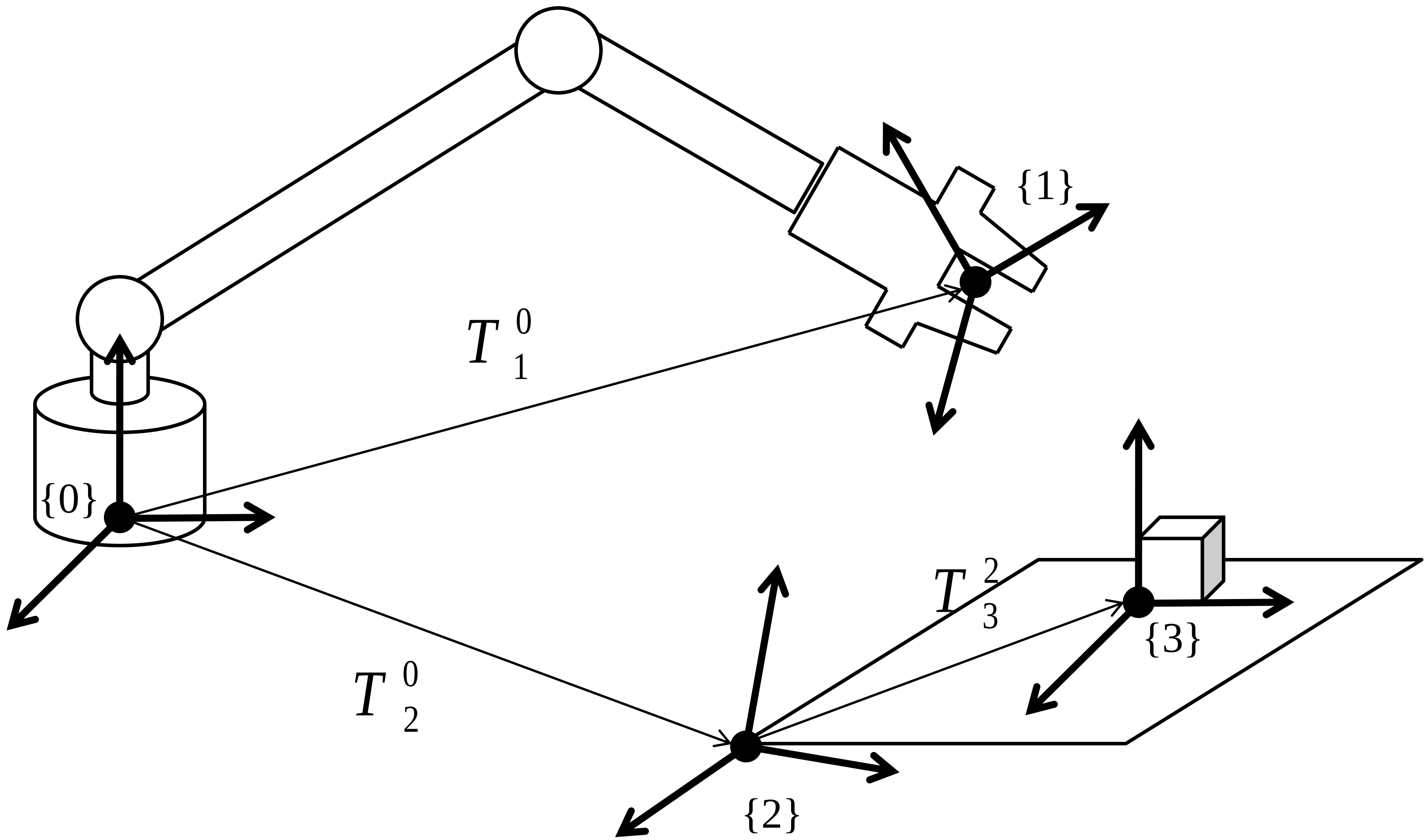
Transform Equations

- give expressions for:

$$T_2^0$$

$$T_4^3$$

Transform Equations



Transform Equations

- how can you find

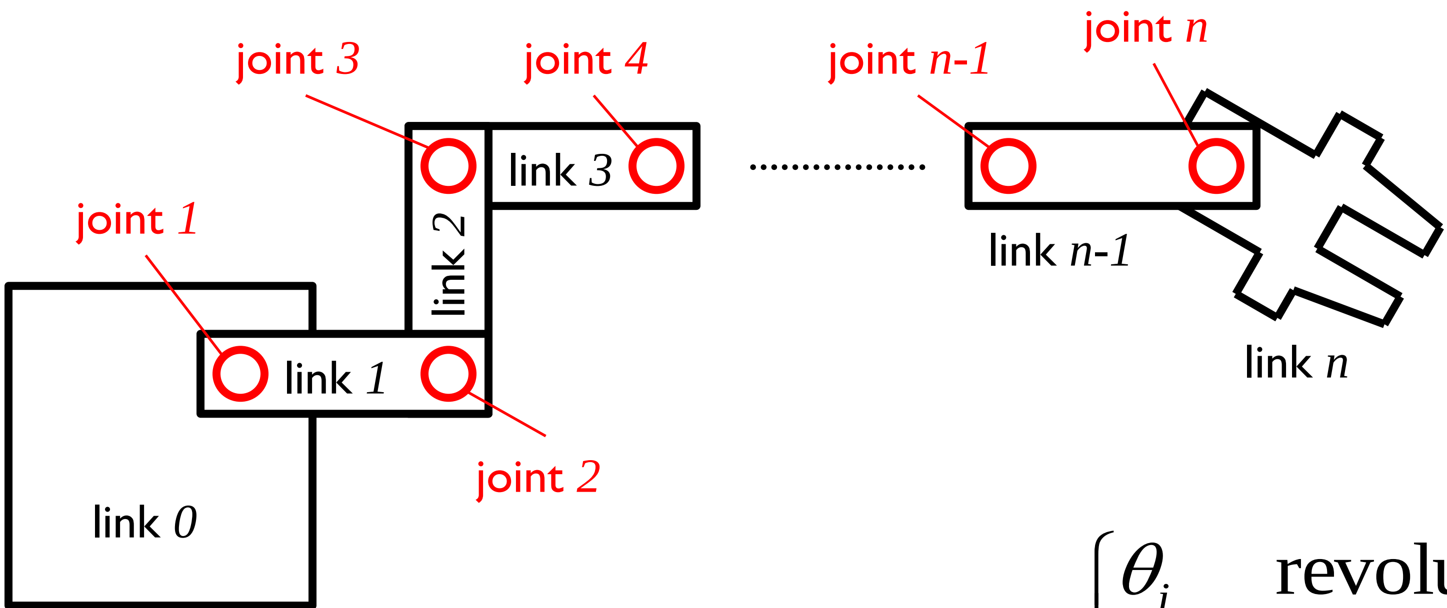
$$T_1^0$$

$$T_2^0$$

$$T_3^2$$

$$T_3^1$$

Links and Joints

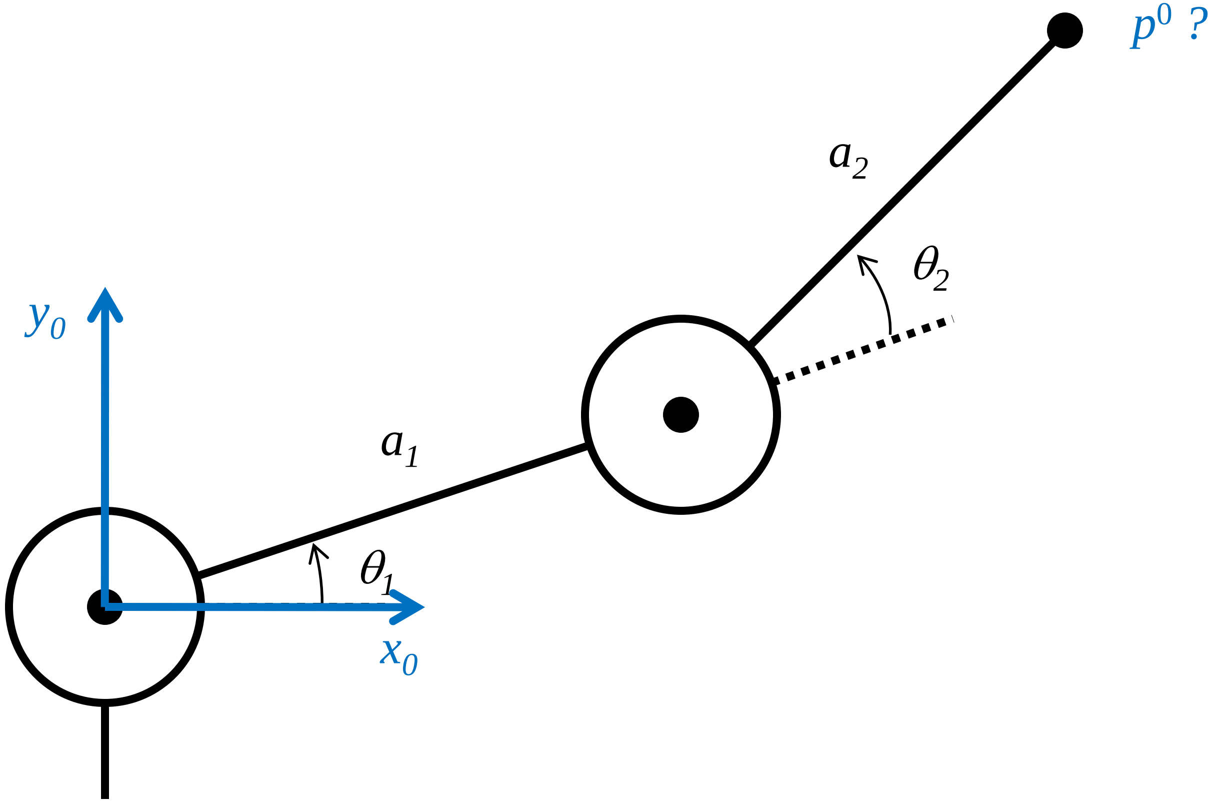


$$q_i = \begin{cases} \theta_i & \text{revolute} \\ d_i & \text{prismatic} \end{cases}$$

- n joints, $n + 1$ links
- link 0 is fixed (the base)
- joint i connects link $i - 1$ to link i
  - link i moves when joint i is actuated

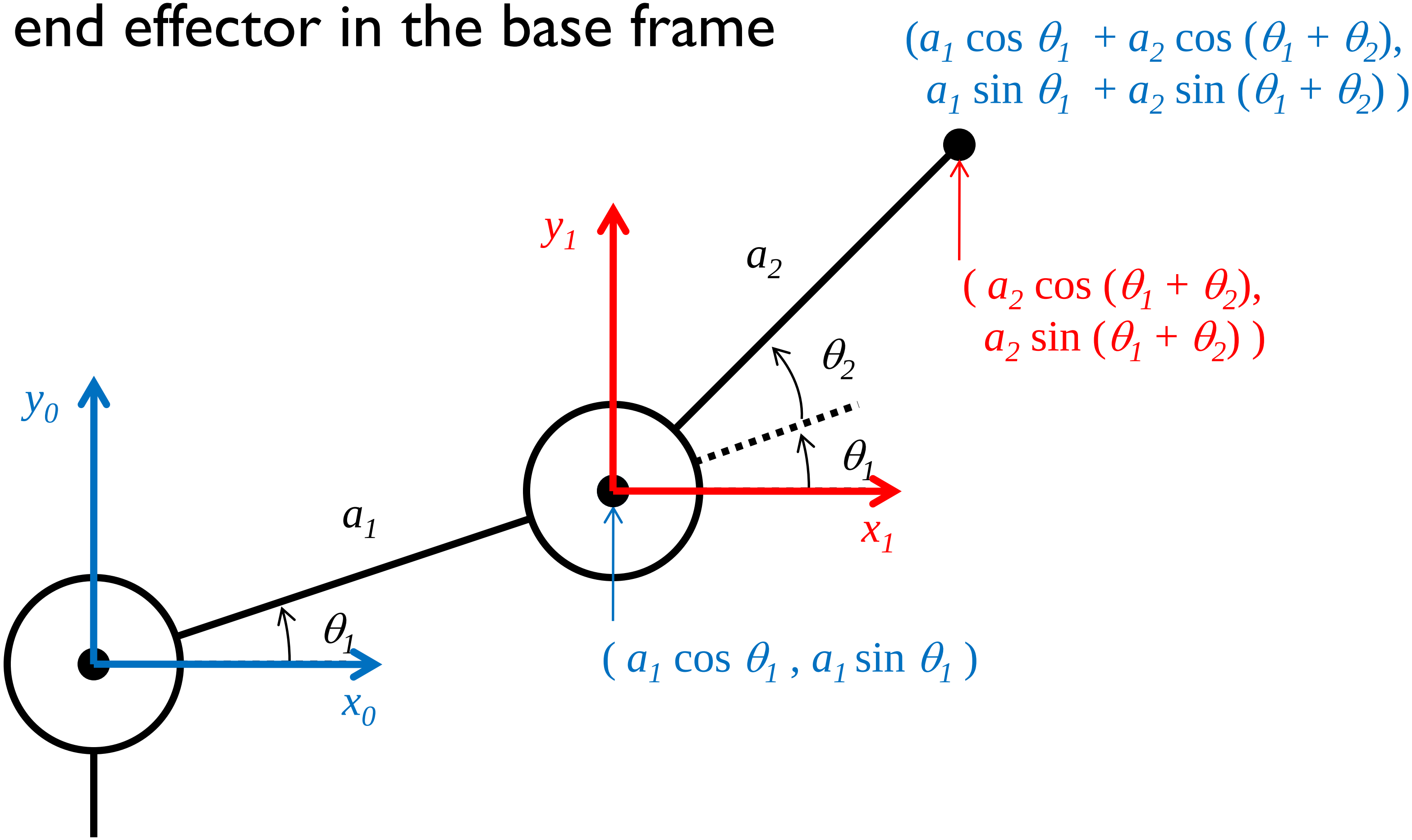
Forward Kinematics

- given the joint variables and dimensions of the links what is the position and orientation of the end effector?



Forward Kinematics

- because the base frame and frame *1* have the same orientation, we can sum the coordinates to find the position of the end effector in the base frame



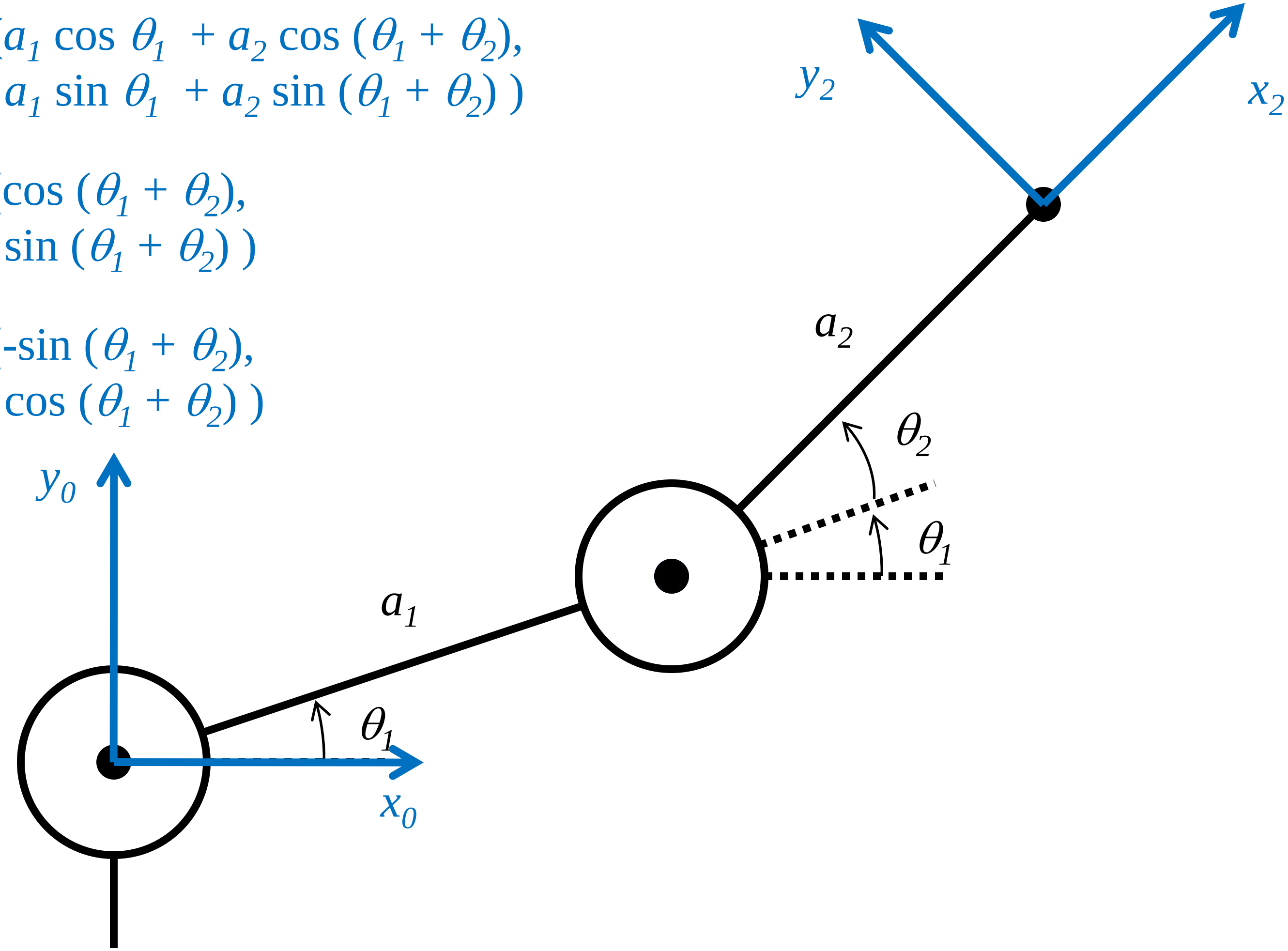
Forward Kinematics

- from Day 02

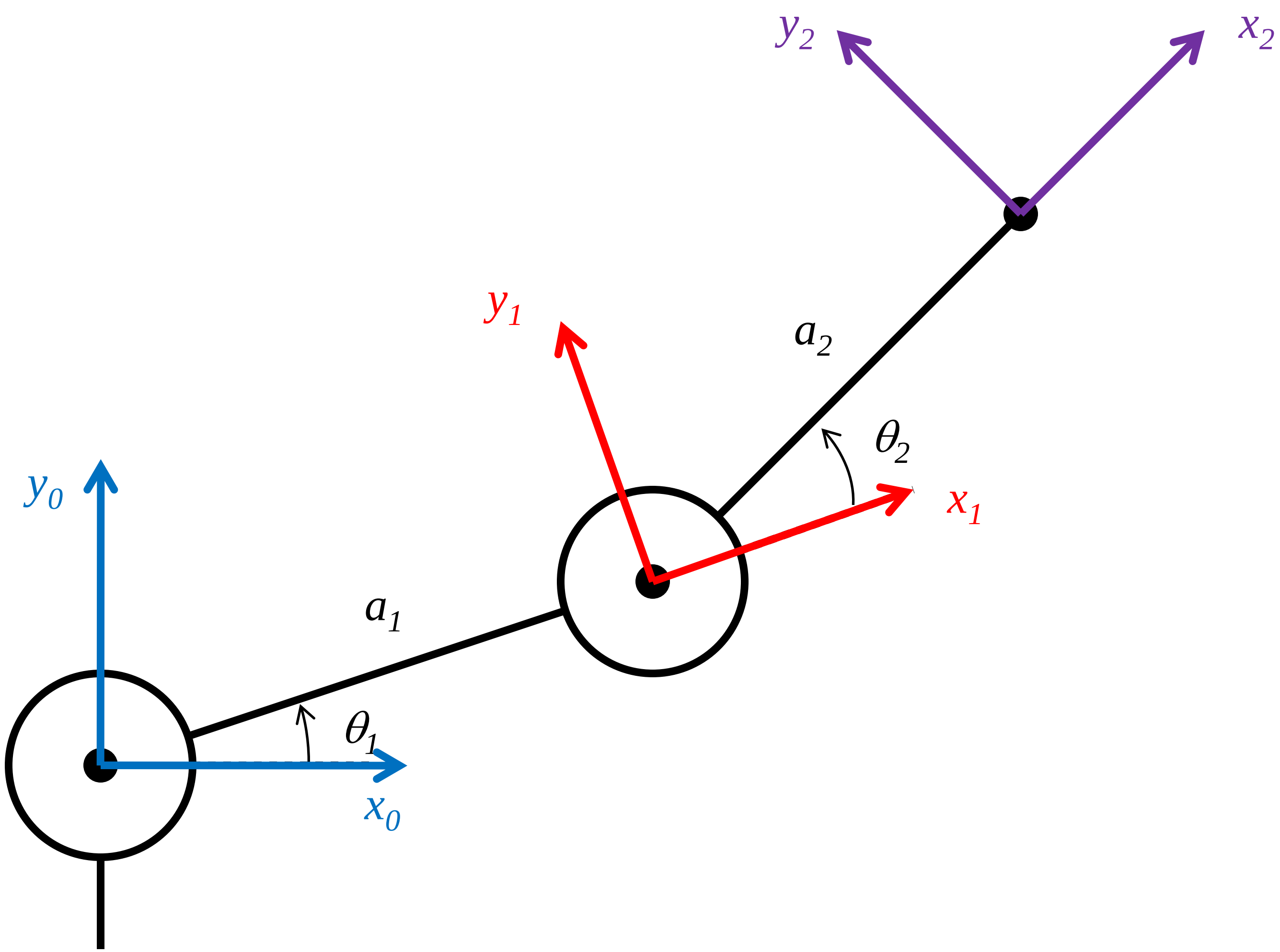
$$p^0 = (a_1 \cos\,\theta_1 \; + a_2 \cos\,(\theta_1 + \theta_2),$$
$$a_1 \sin\,\theta_1 \; + a_2 \sin\,(\theta_1 + \theta_2)\;)$$

$$x_2 = (\cos\,(\theta_1 + \theta_2),$$
$$\sin\,(\theta_1 + \theta_2)\;)$$

$$y_2 = (-\sin\,(\theta_1 + \theta_2),$$
$$\cos\,(\theta_1 + \theta_2)\;)$$



Frames



Forward Kinematics

- using transformation matrices

$$T_1^0 = R_{z,\theta_1} D_{x,a_1}$$

$$T_2^1 = R_{z,\theta_2} D_{x,a_2}$$

$$T_2^0 = T_1^0 T_2^1$$