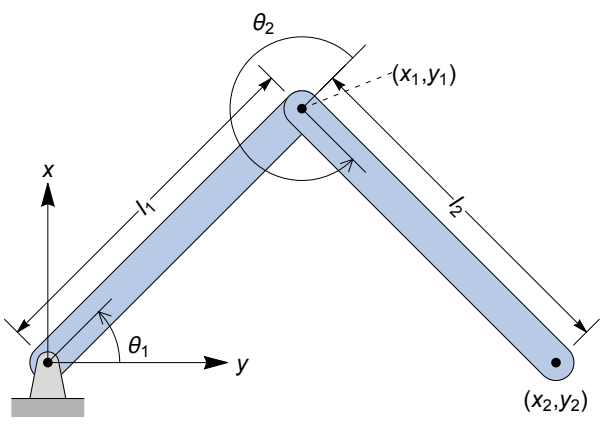
Two-Link Planar Robotic Arm

The two-link planar robotic arm is a frictionless, constrained mechanical system. The system consists of two links attached to each other through a joint, such that one end of the first link is held fixed, while the trajectory at the end of the second link is specified. The following figure shows a schematic of the system.



Composite Motion

The motion of this simple arm is comprised of two linked motions:

- Rotary motion of first arm l_1 around a fixed joint
- Rotary motion of second arm l_2 around the joint at the free end of arm l_1

θ_1

θ_1 is angular measure of motion of first arm l_1 around an anchored joint.

θ_2

θ_2 is angular measure of motion of second arm l_2 around the linked joint.

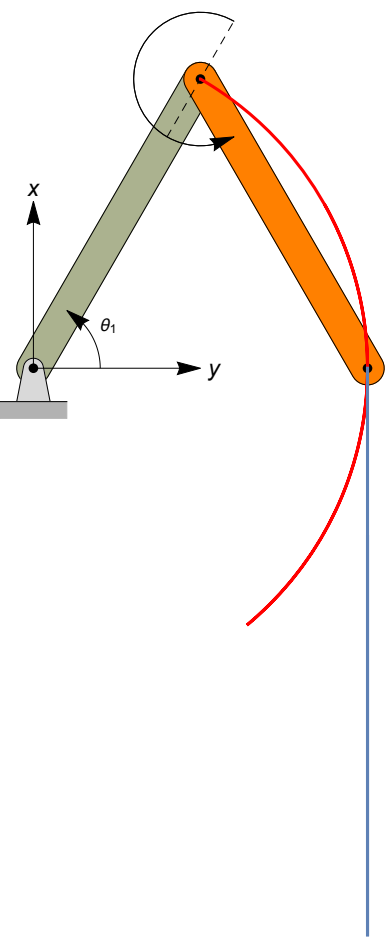
Note: the Linked Joint is not fixed and moves along an arc of a circle aroud the anchored joint.

$\theta_1(t)$ stands for angle θ_1 as function of time i.e. given a value time t, $\theta_1(t)$ is the value for angle θ_1 at time t.

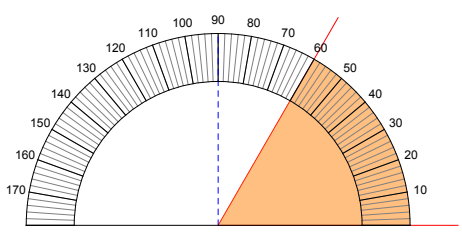
Example

$l_1=1$
$l_2=1$

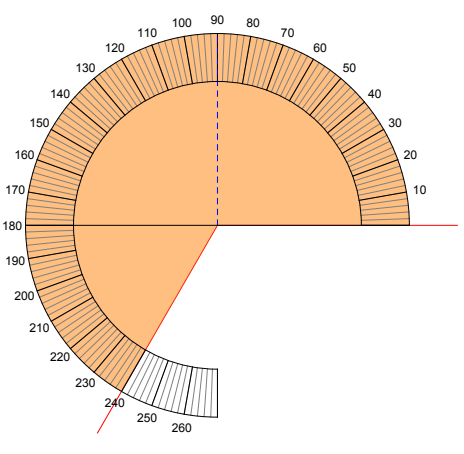
Initial configuration:
$t=0$
$\theta_1(0)=60.,\ \theta_2(0)=240.$



$\theta_1 \approx 60^\circ$

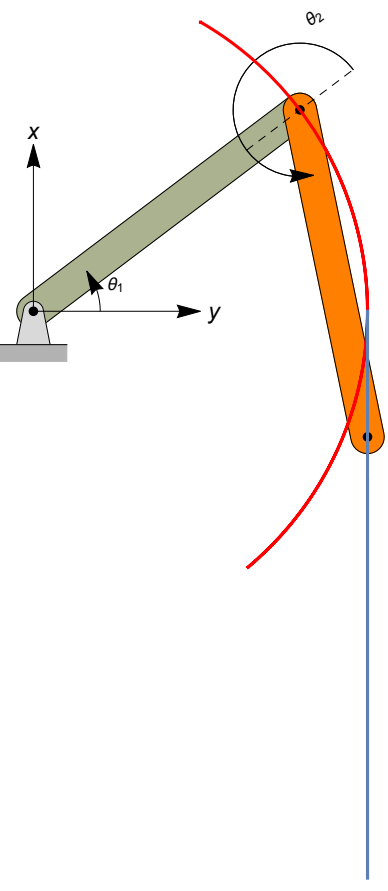


$\theta_2 \approx 240^\circ$

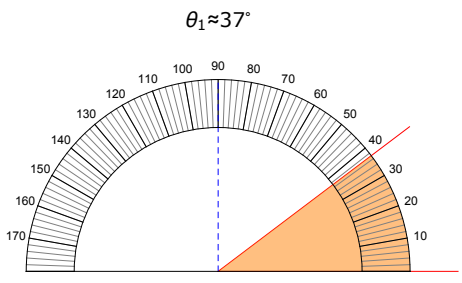


Blue curve is the constraint imposed on second arm's path.
Red curve is **always** an arc of radius $l_1=1$ for first arm's path.

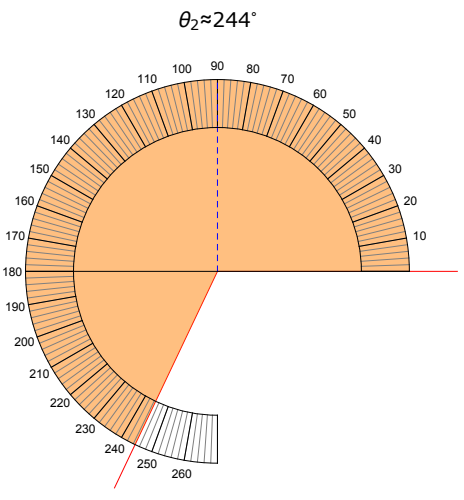
At later time:
$t=0.3$
$\theta_1(0.3)=37.0904,\ \theta_2(0.3)=244.582$



$\theta_1 \approx 37^\circ$



$\theta_2 \approx 244^\circ$



Composite Two Rotations

The motion of the entire arm is actually Two rotations!

θ_1 and θ_2 actually specify a particular configuration of the two arms. In other words if we know θ_1 and θ_2 then when know were each arm is.