intro -

visualizing the reachable 3-degree of freedom

=) Revolute joints

=) joint angles

=) segment lengths

$l_1 = 0.5$

$l_2 = 0.3$

$l_3 = 0.2$

$\theta_1 \in \left[-\dfrac{\pi}{3}, \dfrac{\pi}{3} \right]$

$\theta_2 \in \left[-\dfrac{2\pi}{3}, \dfrac{2\pi}{3} \right]$

$\theta_3 = \left[-\dfrac{\pi}{2}, \dfrac{\pi}{2} \right]$

Angle limits in radians $= \begin{pmatrix} -\dfrac{\pi}{3} & \dfrac{\pi}{3} \\ -\dfrac{2\pi}{3} & \dfrac{2\pi}{3} \end{pmatrix}$

$$\left\{ -\frac{\pi}{2} \quad \frac{\pi}{2} \right\}$$

draw_arc $(x, y, r, /\theta \text{ (strat)}, \theta \text{ (end)})$

workspace :-

$x = l_1 \cos\theta_1 + l_2 (\cos(\theta_1 + \theta_2)) + l_3 \cos(\theta_1 + \theta_2 + \theta_3)$

$y = l_1 \sin\theta_1 + l_2 \sin(\theta_1 + \theta_2) + l_3 \sin(\theta_1 + \theta_2 + \theta_3)$

visualize _ workspace (segment lengths)
$\Rightarrow$ reach positions