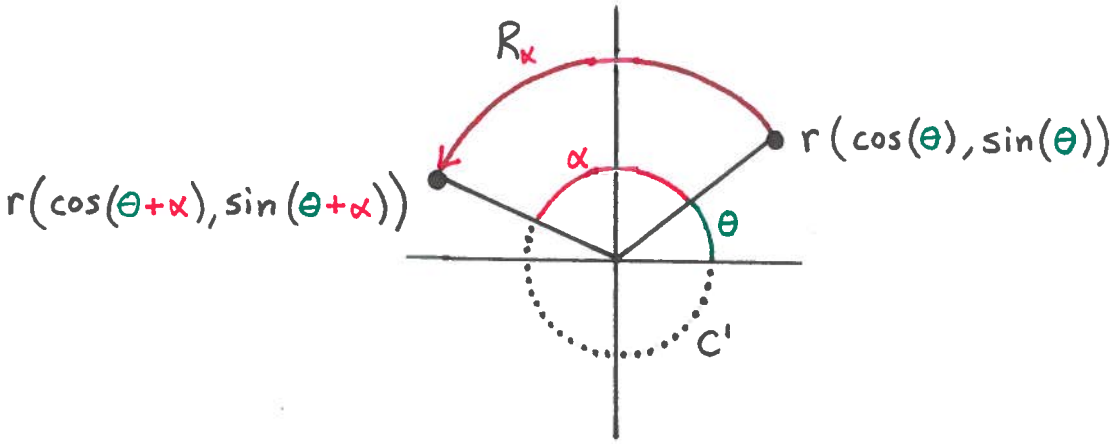
Rotation

Rotation in polar coordinates

$R_\alpha : \mathbb{R}^2 \to \mathbb{R}^2$ "rotation by angle α"

$$R_\alpha\left(r(\cos(\theta), \sin(\theta))\right) = r\left(\cos(\theta+\alpha), \sin(\theta+\alpha)\right)$$



① Find $R_{17}\left(10(\cos(4), \sin(4))\right)$

② Find $R_5\left(2(\cos(3), \sin(3))\right)$

Rotation in Cartesian coordinates

$$R_\alpha = \begin{pmatrix} \cos(\alpha) & -\sin(\alpha) \\ \sin(\alpha) & \cos(\alpha) \end{pmatrix}$$

"rotation by angle α"

③ What's $\cos\left(\frac{\pi}{4}\right)$?

④ What's $\sin\left(\frac{\pi}{4}\right)$?

⑤ What's the matrix $R_{\frac{\pi}{4}}$?

⑥ What's the result of rotating the point $(2,3)$ by angle $\pi/4$?
(That is, find $R_{\pi/4}(2,3)$.)

⑦ Find $R_{\pi/4}(x,y)$.

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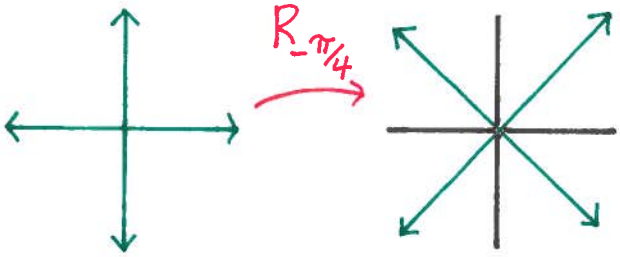
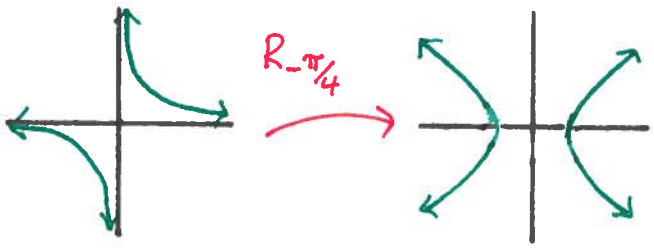
⑧ Find an equation for the conic $xy=0$ rotated by $-\pi/4$.



$xy=0$

⑨ Find an equation for the conic $xy=\frac{1}{2}$ rotated by $-\pi/4$.



$xy=\frac{1}{2}$