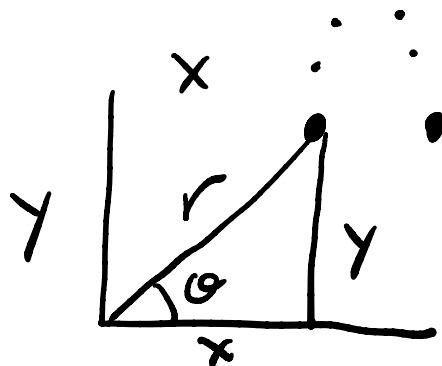
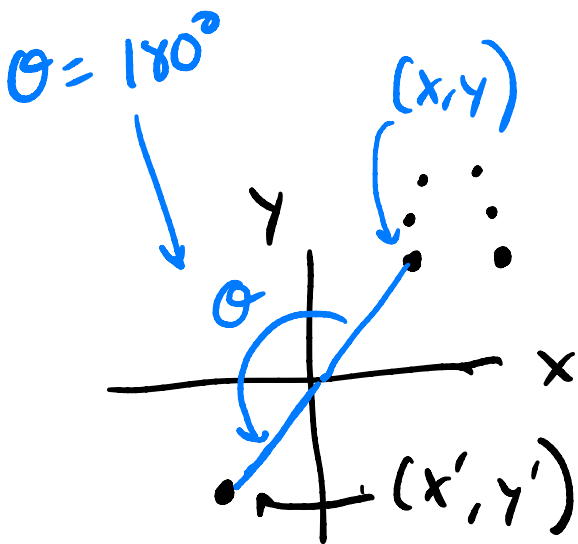
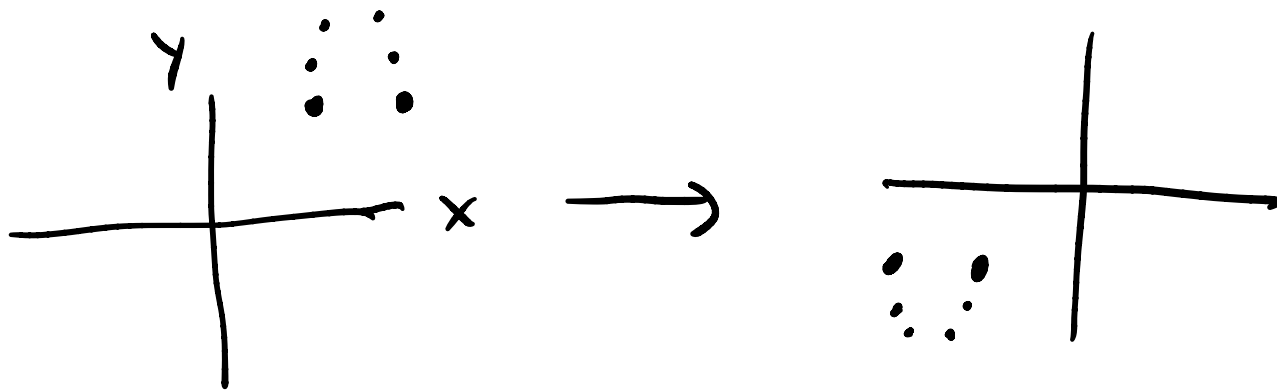
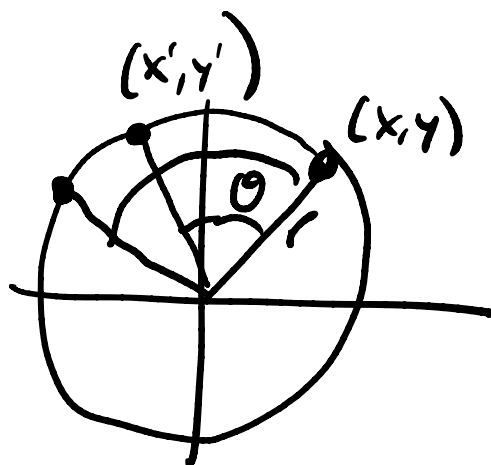


Lecture 9: 2D Rotation

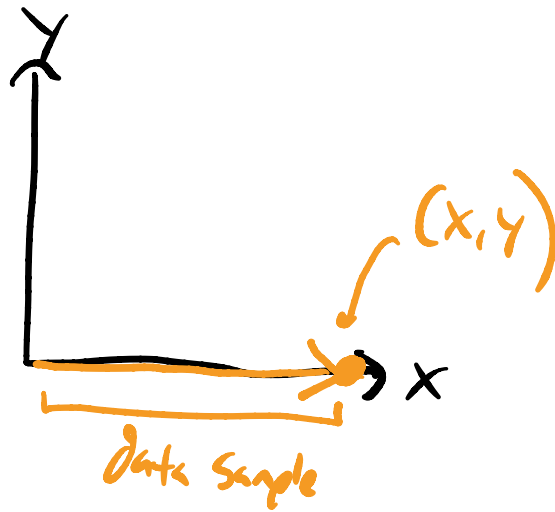


$$\cos \theta = \frac{x}{r}$$

$$\sin \theta = \frac{y}{r}$$



$$\underbrace{\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix}}_{\text{rotated data sample.}} = \begin{bmatrix} \cos \theta & -\sin \theta & 0 \\ \sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \underbrace{\begin{bmatrix} x \\ y \\ 1 \end{bmatrix}}_{\text{data sample}}$$



$\theta = 0^\circ$:

$$\underbrace{\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}}_{\text{identity matrix}} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$$

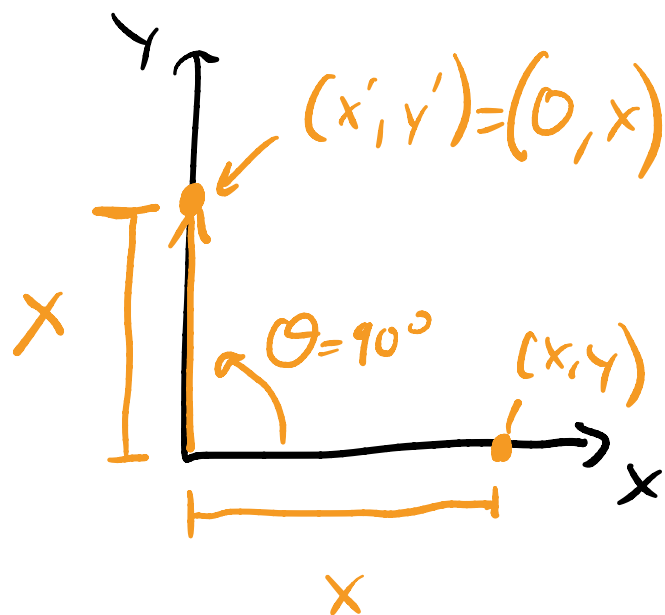
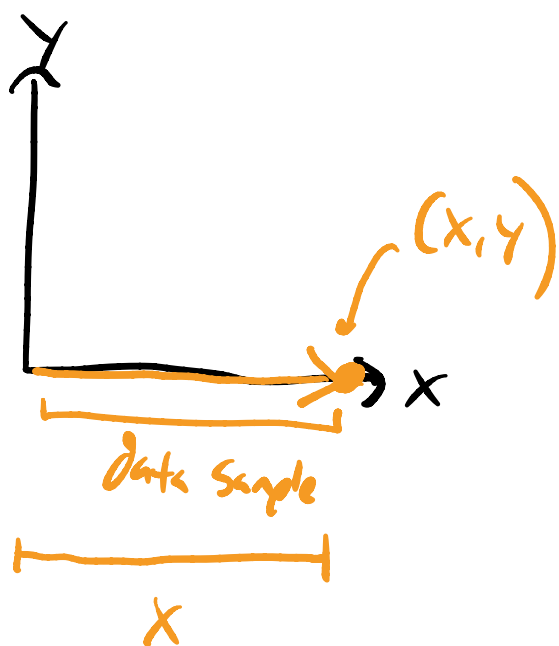
$$\begin{aligned} x' &= x \\ y' &= y \\ 1 &= 1 \end{aligned}$$

$$\underline{\theta = 90^\circ} : \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$$

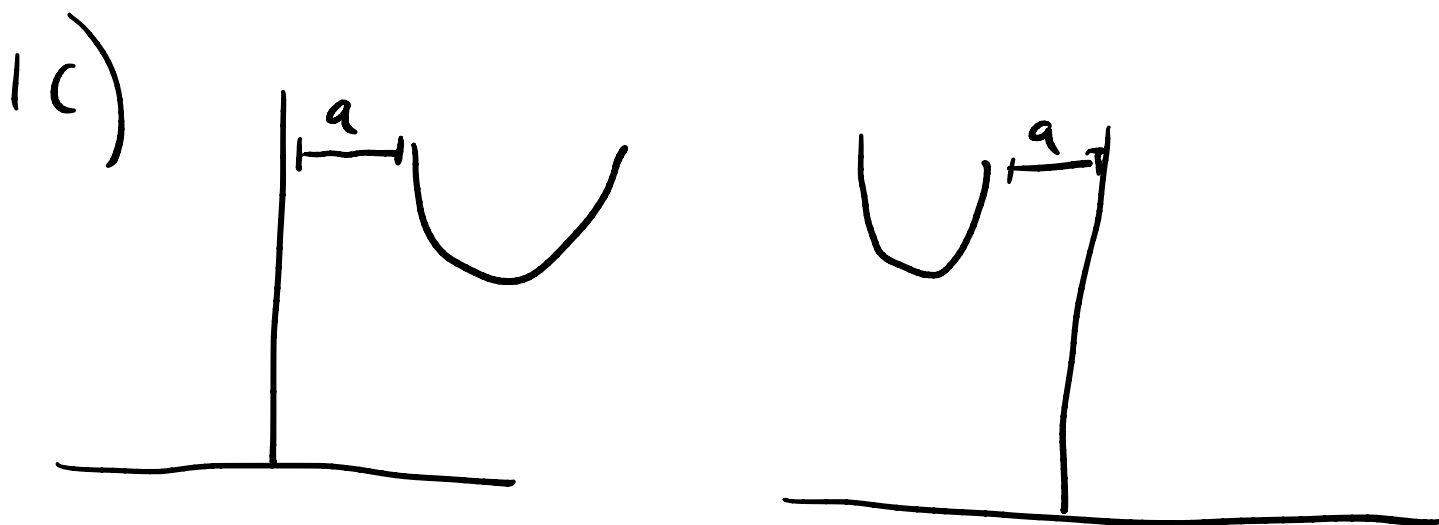
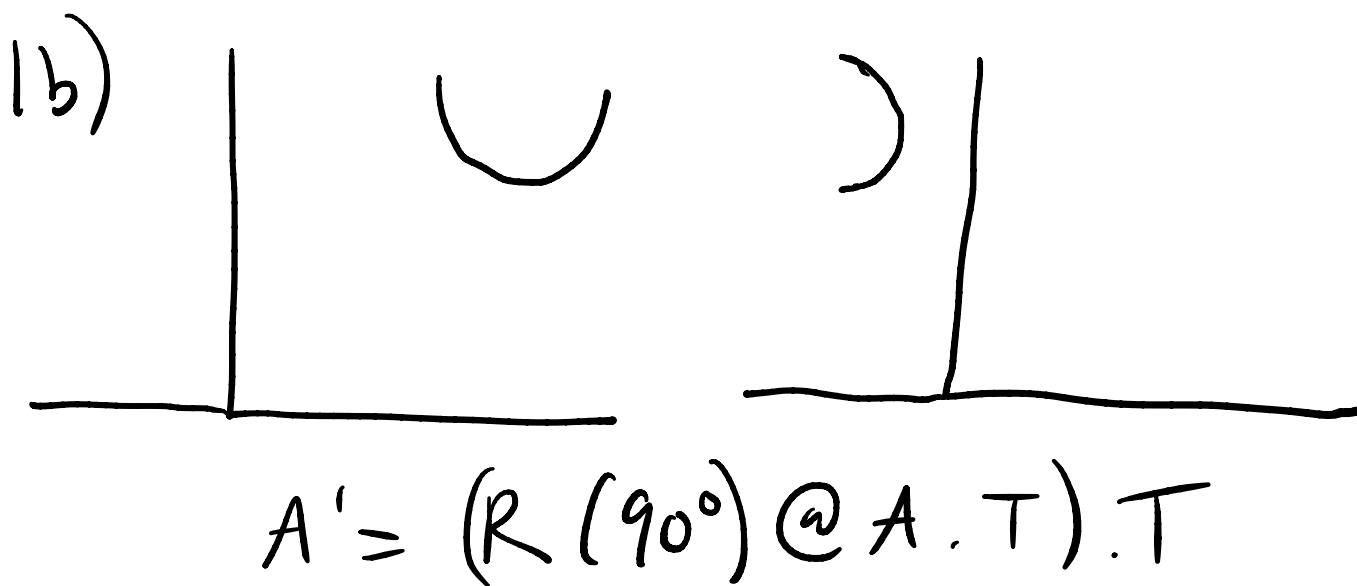
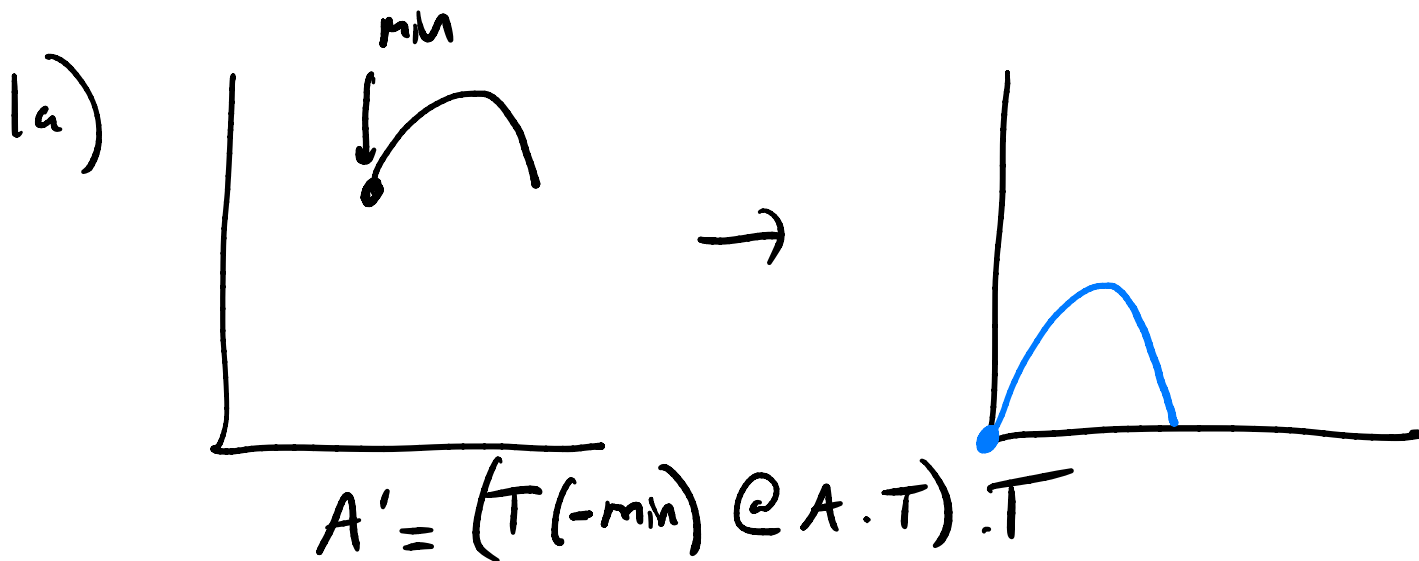
$$x' = \overbrace{-y}^{y=0} \Rightarrow x' = 0$$

$$y' = x$$

$$1 = 1$$



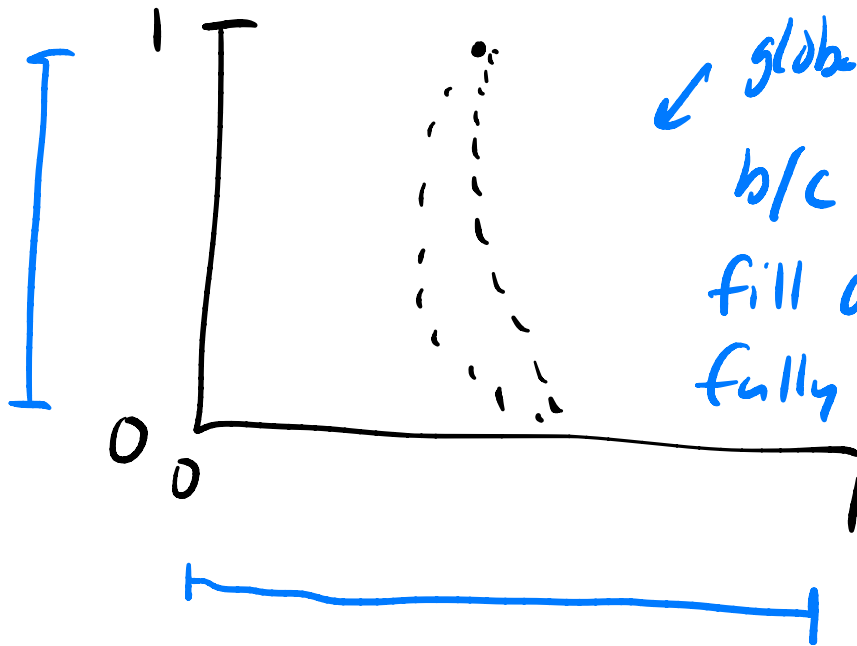
Worksheet



$$A' = (T(-2a, 0) @ A.T) . T$$

$$A' = (S(-1, 0) @ A.T) . T$$

Q2:



↙ global / together
b/c does not
fill out x range
fully between 0 & 1.