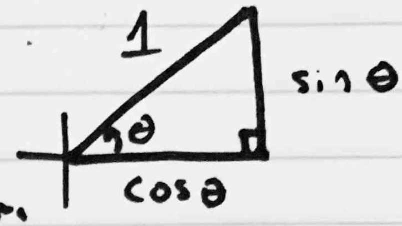
1. $\cos(-\theta) = \cos(\theta)$

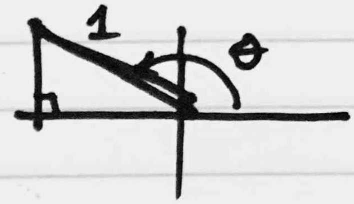
2. $\sin(-\theta) = -\sin(\theta)$



3. for $\underline{\theta \in [0, \pi/2]}$: we have

$\Rightarrow \sin^2\theta + \cos^2\theta = 1$ by Pythag Thm.

for $\underline{\theta \in [\pi/2, \pi]}$: we have



$\Rightarrow \sin^2(\pi-\theta) + \cos^2(\pi-\theta) = 1$

(i) $\sin^2, \cos^2$ are π-periodic

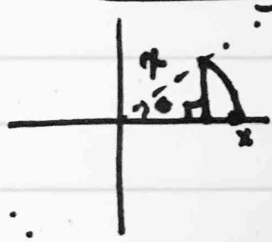
(ii) $\sin^2, \cos^2$ are even

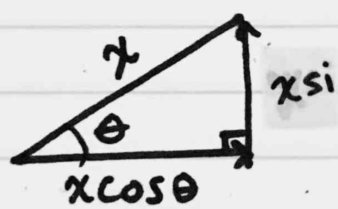
(i) $\Rightarrow \sin^2(-\theta) + \cos^2(-\theta) = 1$

(ii) $\Rightarrow \sin^2(\theta) + \cos^2(\theta) = 1$

for $\underline{\theta \text{ everywhere}}$ we then have the identity holds by (i).

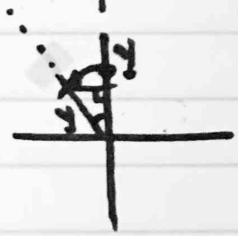
4.

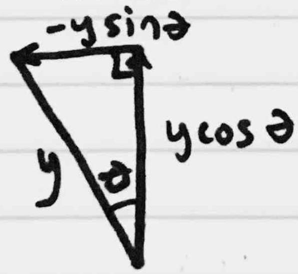




$$\Rightarrow p' = \begin{bmatrix} x\cos\theta \\ x\sin\theta \end{bmatrix}$$

5.





$$\Rightarrow p' = \begin{bmatrix} -y\sin\theta \\ y\cos\theta \end{bmatrix}$$

6. $v = q - p$

7. x-axis cross y-axis is z-axis

$$\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} \times \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \qquad \left(\begin{bmatrix} 0\cdot 0 - 0\cdot 1 \\ 0\cdot 0 - 1\cdot 0 \\ 1\cdot 1 - 0\cdot 0 \end{bmatrix} \right)$$

8. x-axis and y-axis are orthogonal

$$\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} \cdot \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} = 0 \qquad (1\cdot 0 + 0\cdot 1 + 0\cdot 0)$$

9. $$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix} = \begin{bmatrix} 1\cdot 5 + 2\cdot 7 & 1\cdot 6 + 2\cdot 8 \\ 3\cdot 5 + 4\cdot 7 & 3\cdot 6 + 4\cdot 8 \end{bmatrix} = \begin{bmatrix} 19 & 22 \\ 43 & 50 \end{bmatrix}$$

10. identity matrix times a vector returns the vector unchanged $(5,7)^T$