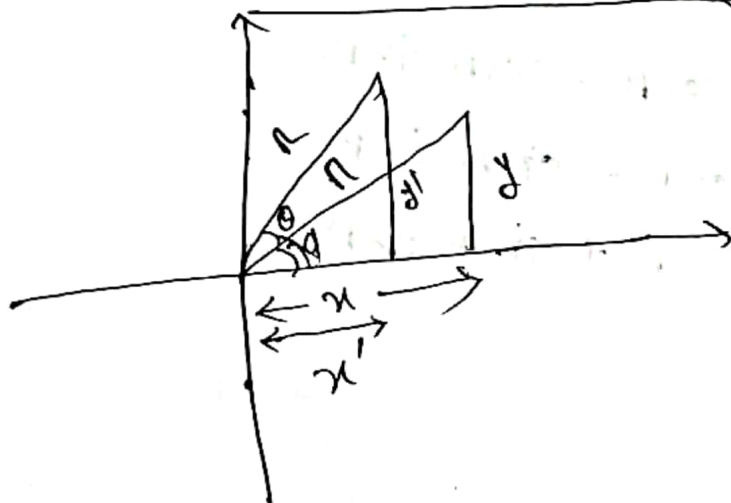


2D Rotation (Anti Clockwise)



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

$$x = r \cos \phi$$

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

$$y = r \sin \phi$$

$$\cos (\phi + \theta) = \frac{x'}{r}$$

$$\Rightarrow x' = r \cos (\phi + \theta)$$

$$\Rightarrow x' = r (\cos \phi \cos \theta - \sin \phi \sin \theta)$$

$$\Rightarrow x' = r \cos \phi \cos \theta - r \sin \phi \sin \theta$$

$$\Rightarrow x' = x \cos \theta - y \sin \theta$$

$$\sin(\theta + \theta) = \sin\theta \cos\theta + \cos\theta \sin\theta$$

$$\Rightarrow y' = n \sin \phi \cos \theta + n \cos \phi \sin \theta$$

$$\Rightarrow y' = y \cos \theta + y \sin \theta$$

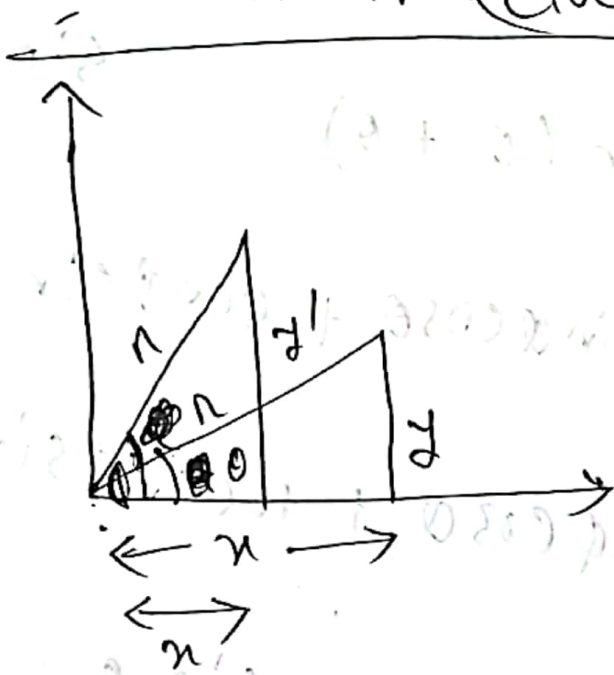
$$\Rightarrow y'$$

$$\begin{bmatrix} x' \\ y' \end{bmatrix}$$

$$= \begin{bmatrix} y \cos \theta + x \sin \theta \\ x \sin \theta + y \cos \theta \\ \cos \theta & \sin \theta \\ \sin \theta & \cos \theta \end{bmatrix}$$

$$\begin{bmatrix} \gamma \\ \gamma \end{bmatrix}$$

2D Rotation (Clockwise)



$$\cos \phi = \frac{x}{n}$$

$$\Rightarrow x = n \cos \phi$$

$$\sin \phi = \frac{y}{n}$$

$$\Rightarrow y = n \sin \phi$$

$$\cos(\phi - \theta) = \cos \phi \cos \theta + \sin \phi \sin \theta \frac{n'}{n}$$

$$\Rightarrow n' = n \cos(\phi - \theta)$$

$$\Rightarrow n' = n (\cos \phi \cos \theta + \sin \phi \sin \theta)$$

$$\Rightarrow n' = n \cos \phi \cos \theta + n \sin \phi \sin \theta$$

$$\Rightarrow n' = x \cos \theta + y \sin \theta$$

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$$\sin(\phi - \theta) = \frac{y'}{r}$$

$$\Rightarrow y' = r \sin(\phi - \theta)$$

$$\Rightarrow y' = r (\sin \phi \cos \theta - \cos \phi \sin \theta)$$

$$\Rightarrow y' = r (\sin \phi \cos \theta - \cos \phi \sin \theta)$$

$$\Rightarrow y' = y \cos \theta - r \sin \theta$$

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$$

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$$x' = x + tx$$

$$y' = y + ty$$

$$A = (2, 2), B = (10, 2), C = (5, 5)$$

$$tx = 5 \quad ty = 6$$

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} tx \\ ty \end{bmatrix}$$

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 2 & 10 & 5 \\ 2 & 2 & 5 \end{bmatrix} + \begin{bmatrix} 5 \\ 6 \end{bmatrix}$$

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 7 & 15 & 10 \\ 8 & 8 & 11 \end{bmatrix}$$

$$A = (-1, 1), B = (-5, 1), C = (-3, 6)$$

$$t_n = 2$$

$$+y = 1$$

$$t_{n_1} = 0$$

$$+y_1 = -2$$

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} t_n \\ +y \end{bmatrix}$$

$$= \begin{bmatrix} -1 & -5 & -3 \\ 1 & 1 & 6 \end{bmatrix} + \begin{bmatrix} 2 \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & -3 & -1 \\ 2 & 2 & 7 \end{bmatrix}$$

$$A = (1, 2)$$

$$B = (-3, 2)$$

$$C = (-2, 7)$$

$$\begin{bmatrix} x'' \\ y'' \end{bmatrix} = \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} t_{n_1} \\ +y_1 \end{bmatrix} = \begin{bmatrix} 1 & -3 & -1 \\ 2 & 2 & 7 \end{bmatrix} + \begin{bmatrix} 0 \\ -2 \end{bmatrix} = \begin{bmatrix} 1 & -3 & -1 \\ 0 & 0 & 5 \end{bmatrix}$$