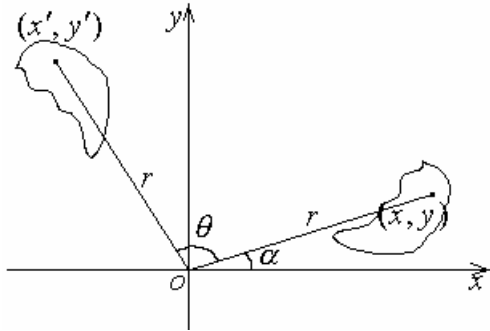$\cos \alpha = \dfrac{x}{r}$ ， $\sin \alpha = \dfrac{y}{r}$

$\cos(\alpha + \theta) = \dfrac{x'}{r} = \cos \alpha \cos \theta - \sin \alpha \sin \theta = \dfrac{x}{r}\cos \theta - \dfrac{y}{r}\sin \theta$

$\quad \therefore x' = x\cos \theta - y\sin \theta$

$\sin(\alpha + \theta) = \dfrac{y'}{r} = \sin \alpha \cos \theta + \cos \alpha \sin \theta = \dfrac{x}{r}\sin \theta + \dfrac{y}{r}\cos \theta$

$\quad \therefore y' = x\sin \theta + y\cos \theta$

即 $\begin{cases} x' = x\cos \theta - y\sin \theta \\ y' = x\sin \theta - y\cos \theta \end{cases}$ ， $(x', y') = (x, y)\begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix}$

例 1：試求點 $(3,1)$ 朝著逆時針方向旋轉 $30°$ 後的新座標？

解：$(3,1)\begin{bmatrix} \cos 30° & \sin 30° \\ -\sin 30° & \cos 30° \end{bmatrix} = (3,1)\begin{bmatrix} \dfrac{\sqrt{3}}{2} & \dfrac{1}{2} \\ -\dfrac{1}{2} & \dfrac{\sqrt{3}}{2} \end{bmatrix}$

$\quad = (3 \times \dfrac{\sqrt{3}}{2} + 1 \times (-\dfrac{1}{2}), 3 \times \dfrac{1}{2} + 1 \times \dfrac{\sqrt{3}}{2})$

$\quad = (\dfrac{3\sqrt{3}-1}{2}, \dfrac{3+\sqrt{3}}{2})$

例 2：試求點 $(4,1)$ 朝著逆時針方向旋轉 $45°$ 後的新座標？

解：$(4,1)\begin{bmatrix} \cos 45° & \sin 45° \\ -\sin 45° & \cos 45° \end{bmatrix} = (4,1)\begin{bmatrix} \dfrac{\sqrt{2}}{2} & \dfrac{\sqrt{2}}{2} \\ -\dfrac{\sqrt{2}}{2} & \dfrac{\sqrt{2}}{2} \end{bmatrix}$

$\quad = (4 \times \dfrac{\sqrt{2}}{2} + 1 \times (-\dfrac{\sqrt{2}}{2}), 4 \times \dfrac{\sqrt{2}}{2} + 1 \times \dfrac{\sqrt{2}}{2})$

$\quad = (\dfrac{3\sqrt{2}}{2}, \dfrac{5\sqrt{2}}{2})$