$$P = (P_x, P_y)$$

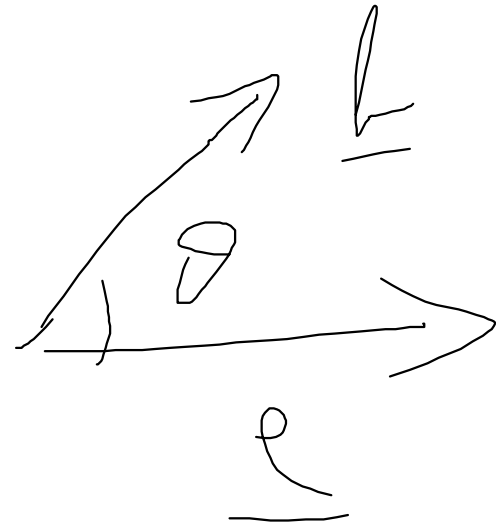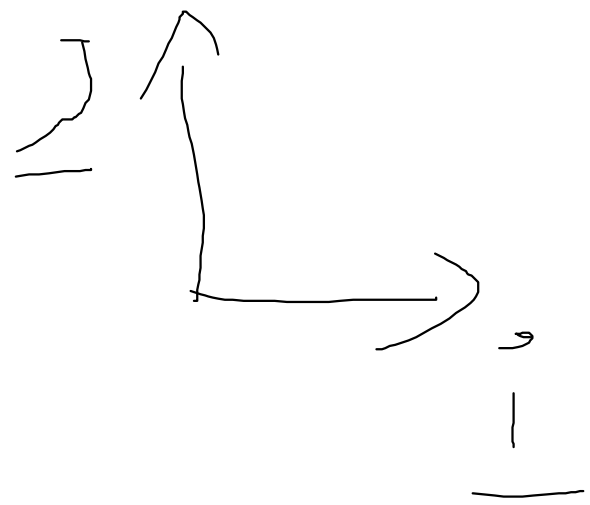$$R = \begin{pmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix}$$

$$\underline{P}^B = R\,\underline{P}$$

$$\begin{cases} X_B = \cos\theta\, X_A + \sin\theta\, Y_A \\ Y_B = -\sin\theta\, X_A + \cos\theta\, Y_A \end{cases}$$

$$\begin{cases} X_A = \cos\theta\, X_B - \sin\theta\, Y_B \\ Y_A = \sin\theta\, X_B + \cos\theta\, Y_B \end{cases}$$
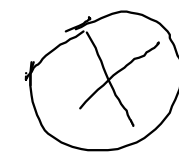
VECTOR PRODUCT

$$a \times b = |a||b| \sin \theta \, \underline{k}$$

$\bigcirc$ OUT OF PAPER

$\otimes$ INTO PAPER

$$\underline{a} \times \underline{b} = -\underline{b} \times \underline{a}$$

$$\underline{a} \times \underline{a} = \underline{0} = (0, 0, 0)$$

$$\begin{cases} \underline{i} \times \underline{j} = \underline{k} \\ \underline{j} \times \underline{k} = \underline{i} \\ \underline{k} \times \underline{i} = \underline{j} \end{cases}$$

$$\underline{a} \times \underline{b} = (a_x \underline{i} + a_y \underline{j} + a_z \underline{k}) \times (b_x \underline{i} + b_y \underline{j} + b_z \underline{k})$$

$$= a_x b_y \underbrace{(\underline{i} \times \underline{j})}_{=\underline{k}} + a_y b_x \underbrace{(\underline{j} \times \underline{i})}_{-\underline{k}} + \theta$$

$$\underline{a} \times \underline{b} = (a_y b_z - a_z b_y)\underline{i} + (a_z b_x - a_x b_z)\underline{j} +$$

$$+ (a_x b_y - b_x a_y)\underline{K} =$$

$$= \begin{vmatrix} \underline{i} & \underline{J} & \underline{K} \\ a_x & a_y & a_z \\ b_x & b_y & b_z \end{vmatrix} = \begin{pmatrix} a_y b_z - a_z b_y \\ b_z b_x - a_x b_z \\ a_x b_y - b_x a_y \end{pmatrix} \begin{pmatrix} \underline{i} \\ \underline{J} \\ \underline{K} \end{pmatrix}$$