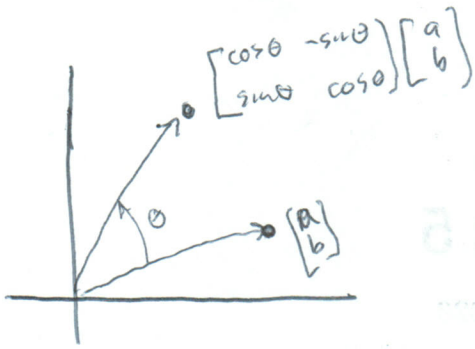
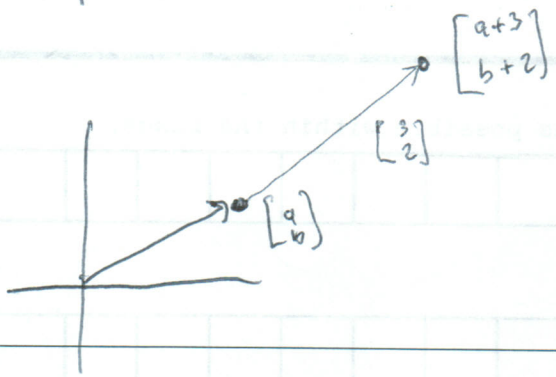
1.





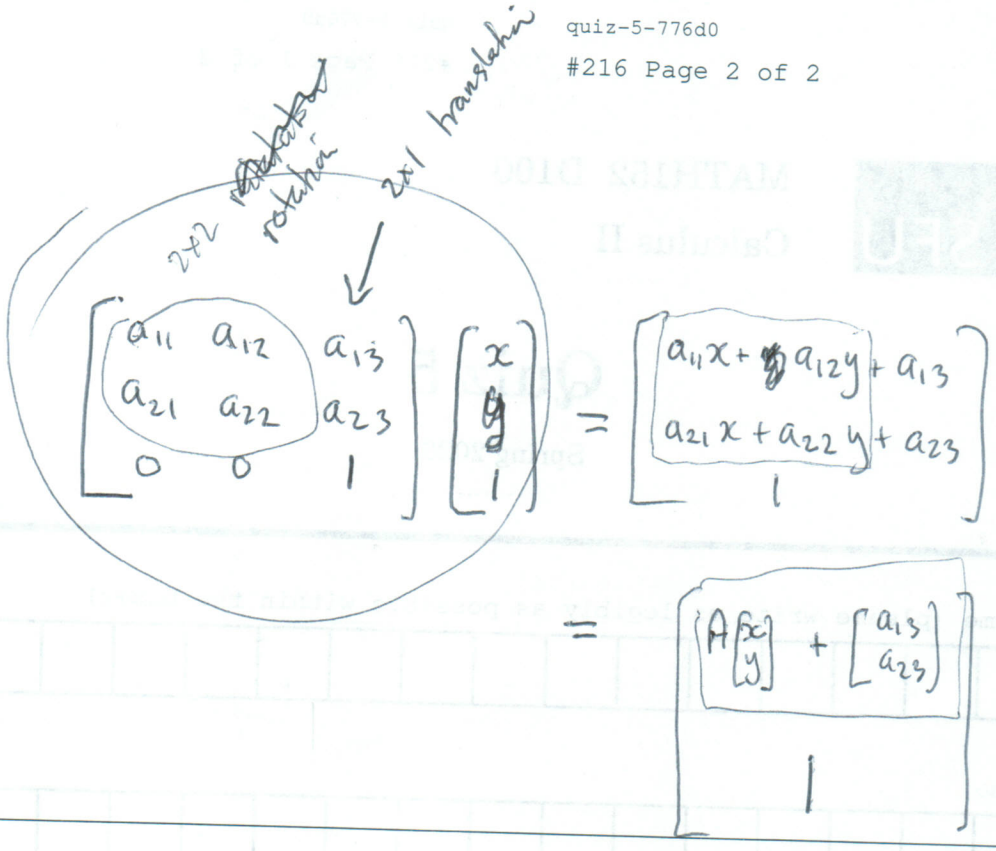
2.

Does there exist a 2×2 matrix A such that

$$A\begin{bmatrix}a\\b\end{bmatrix} = \begin{bmatrix}a+3\\b+2\end{bmatrix} \quad \text{for all } \begin{bmatrix}a\\b\end{bmatrix} \in \mathbb{R}^2$$

No! $L(\vec{x}) = \vec{x} + \begin{bmatrix}3\\2\end{bmatrix}$ is not a linear map (a matrix mult)

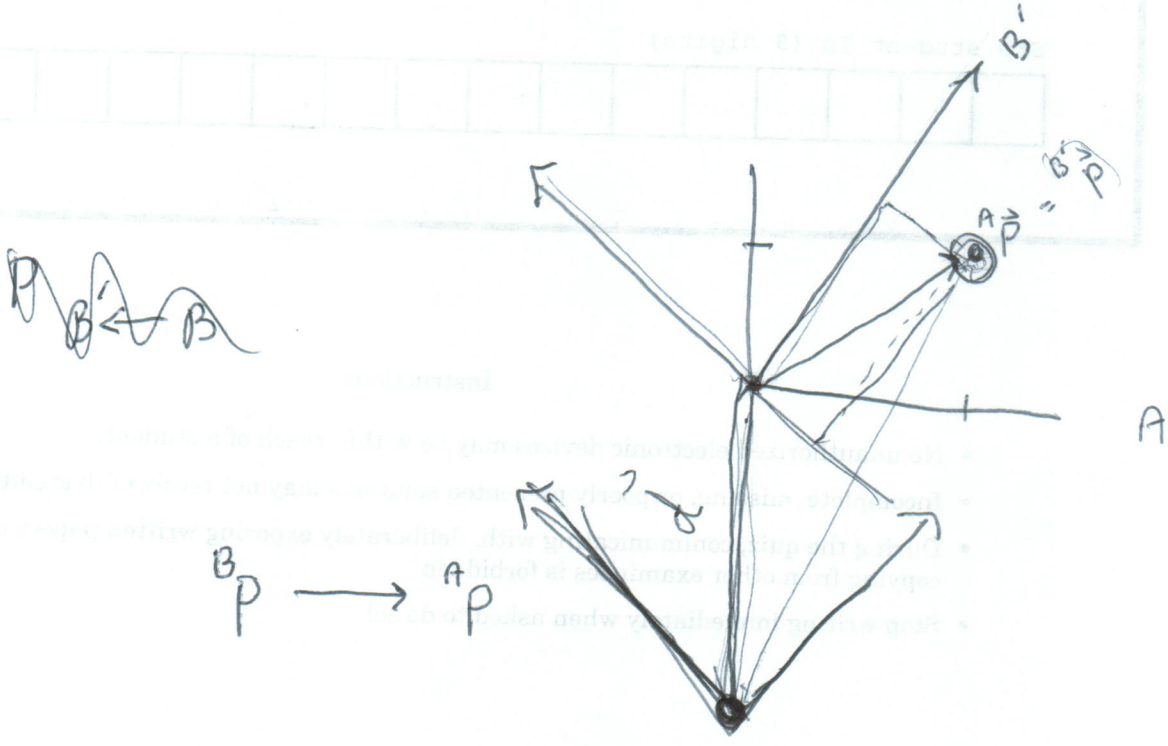
1.



$$\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix} = \begin{bmatrix} a_{11}x + a_{12}y + a_{13} \\ a_{21}x + a_{22}y + a_{23} \\ 1 \end{bmatrix}$$

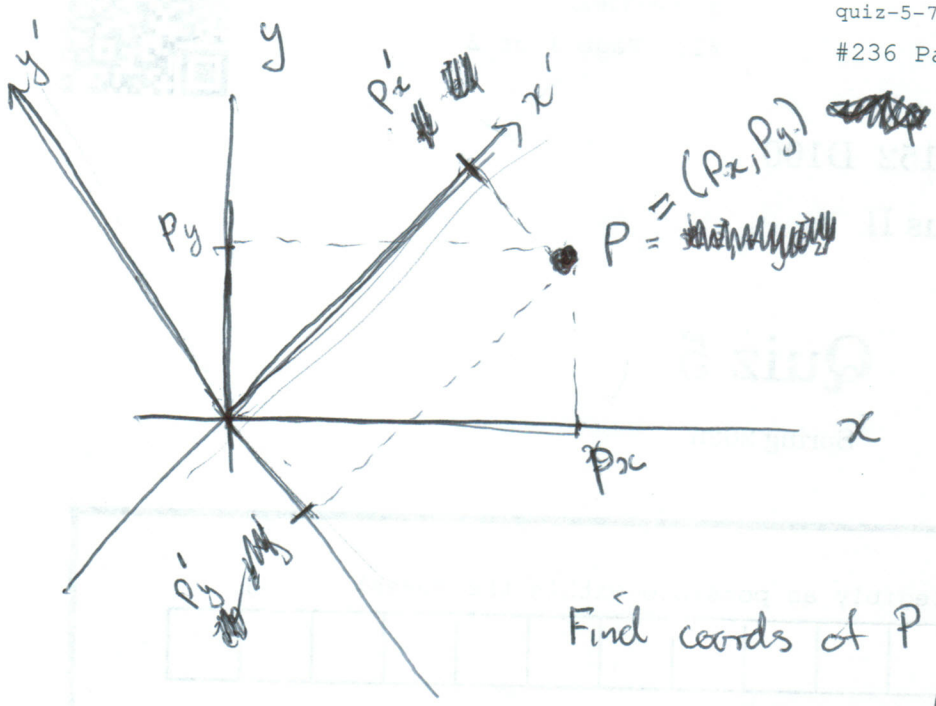
$$= \begin{bmatrix} A\begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} a_{13} \\ a_{23} \end{bmatrix} \\ 1 \end{bmatrix}$$

2.



$${}^{B}p \longrightarrow {}^{A}p$$

1.

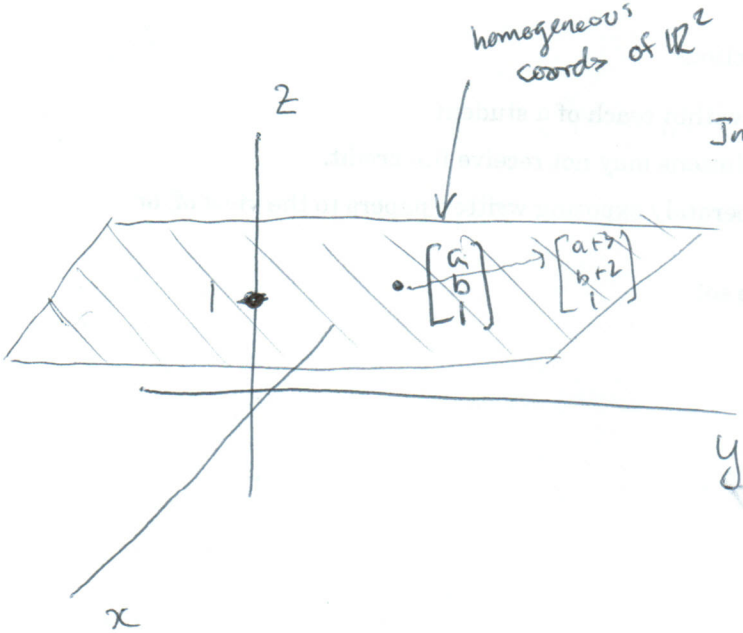


Find coords of P in new frame:

$$[P]_{B'} = \begin{bmatrix} p_x' \\ p_y' \end{bmatrix}$$

$$= \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} p_x \\ p_y \end{bmatrix}$$

2.



Imagine $\mathbb{R}^2$ inside $\mathbb{R}^3$ as $\begin{bmatrix} a \\ b \end{bmatrix} \mapsto \begin{bmatrix} a \\ b \\ 1 \end{bmatrix}$

$$L(\vec{x}) = \vec{x} + \begin{bmatrix} 3 \\ 2 \\ 0 \end{bmatrix}$$

$$= \begin{bmatrix} a+3 \\ b+2 \\ 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 3 \\ 0 & 1 & 2 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ 1 \end{bmatrix}$$