Sheet 3

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ex. 3)

a) $R_{-90°,(4,-2)} = t_{(4,-2)} \circ R_{-90°,(0,0)} \circ t_{-(4,-2)}$

$R_{-90°,(4,-2)}$: rotation around $(4,-2)$; $t_{(4,-2)}$: translation about $(4,-2)$

$$\Rightarrow R_{-90°,(4,-2)} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = t_{(4,-2)} \circ R_{-90°,(0,0)} \begin{pmatrix} x_1 - 4 \\ x_2 + 2 \end{pmatrix}$$

$$= t_{(4,-2)} \left(\begin{pmatrix} \cos(-90°) & -\sin(-90°) \\ \sin(-90°) & \cos(-90°) \end{pmatrix} \begin{pmatrix} x_1 - 4 \\ x_2 + 2 \end{pmatrix} \right)$$

$$= t_{(4,-2)} \left(\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} x_1 - 4 \\ x_2 + 2 \end{pmatrix} \right)$$

$$R_{-90°,(4,-2)} = \left(\begin{array}{cc|c} 0 & 1 & 6 \\ -1 & 0 & 2 \\ \hline 0 & 0 & 1 \end{array} \right)$$

$$= t_{(4,-2)} \begin{pmatrix} x_2 + 2 \\ -x_1 + 4 \end{pmatrix}$$

$$= \begin{pmatrix} x_2 + 6 \\ -x_1 + 2 \end{pmatrix}$$

(in homogeneous coordinates $(x_1, x_2, 1)$)

↑

(what matrix? This is not even a linear mapping)

$$R_{-90°,(4,-2)} \begin{pmatrix} 0 \\ 0 \end{pmatrix} = \begin{pmatrix} 6 \\ 2 \end{pmatrix} \neq 0$$

b) $$R_{-90°,(4,-2)} \begin{pmatrix} -3 \\ 2 \end{pmatrix} = \begin{pmatrix} 8 \\ 5 \end{pmatrix}$$

$$R_{-90°,(4,-2)} \begin{pmatrix} -5 \\ 3 \end{pmatrix} = \begin{pmatrix} 9 \\ 7 \end{pmatrix}$$

$$R_{-90°,(4,-2)} \begin{pmatrix} -3 \\ 5 \end{pmatrix} = \begin{pmatrix} 11 \\ 5 \end{pmatrix}$$