1 a) Translation t + Transformationsmatrix x

$$t = \begin{bmatrix} 1 & 0 & -1 \\ 0 & 1 & -1 \\ 0 & 0 & 1 \end{bmatrix}$$

$$x = t2 \times s \times r \times t$$

Rotation r

$$r = \begin{bmatrix} \frac{\sqrt{3}}{2} & -\frac{1}{2} & 0 \\ \frac{1}{2} & \frac{\sqrt{3}}{2} & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$rt = \begin{bmatrix} \frac{\sqrt{3}}{2} & -\frac{1}{2} & 1 \\ \frac{1}{2} & \frac{\sqrt{3}}{2} & -1 \\ 0 & 0 & 1 \end{bmatrix}$$

$$srt = \begin{bmatrix} \sqrt{3} & -\frac{1}{2} & 1 \\ 1 & \frac{\sqrt{3}}{2} & -1 \\ 0 & 0 & 1 \end{bmatrix}$$

Skalierung s

$$s = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$x = t2srt = \begin{bmatrix} \sqrt{3} & -\frac{1}{2} & \sqrt{3}-1 \\ 1 & \frac{\sqrt{3}}{2} & 2\sqrt{3} \\ 0 & 0 & 1 \end{bmatrix}$$

Translation $t2$

$$t2 = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 4 \\ 0 & 0 & 1 \end{bmatrix}$$

b) $p = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$

$x \times p =$