Problem 2

Part 1

$$\begin{bmatrix} A & t \\ 0^T & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ 0 \end{bmatrix} = \begin{pmatrix} A \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} \\ 0 \end{pmatrix} \qquad l = H^{-T} l$$

$$\begin{bmatrix} A & T \\ V^T & v \end{bmatrix} \begin{pmatrix} x_1 \\ x_2 \\ 0 \end{pmatrix} = \begin{pmatrix} A \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} \\ v_1 x_1 + v_2 x_2 \end{pmatrix}$$

Part 2

Under point transformation: $x_i' = H x_i$

line transformation: $l' = H^{-T} l$

$$l'^T x_i' = l^T H^{-1} H x_i = 0$$

$$l'^T = l^T H^{-1}$$

Transformation of Conics

$x_i' = H x_i$

conic transformation: $C' = H^{-T} C H^{-1}$

$$x^T C x = x'^T [H^{-1}]^T C H^{-1} x'$$

$$= x'^T H^{-T} C H^{-1} x'$$