PROBLEM 4:

Motion model equations are given:

$$(x_1, y_1) \xrightarrow{T} (x_2, y_2)$$

$$x_2 = a x_1^2 + b y_1^2 + c x_1 y_1 + d x_1 + e y_1 + f$$
$$y_2 = A x_1^2 + B y_1^2 + C x_1 y_1 + D x_1 + E y_1 + F$$

→ to estimate all the variable $\begin{pmatrix} a, b, c, d, e, f \\ A, B, C, D, E, F \end{pmatrix}$

we can choose, 6 ~~control~~ feature points in control. Both the Images.

Now We know (x_{1i}, y_{1i}) and (x_{2i}, y_{2i})

where $i \in \{1, 2, 3, 4, 5, 6\}$

→ we have total 12 equations;

we can use vector Algebra to convert this into Matrix form

We know M, X_2, Y_2

we have to find C_X, C_Y

$$M = \begin{bmatrix} x_{11}^2 & y_{11}^2 & x_{11}y_{11} & x_{11} & y_{11} & 1 \\ x_{12}^2 & y_{12}^2 & x_{12}y_{12} & x_{12} & y_{12} & 1 \\ \vdots & \vdots & \vdots & \vdots & \vdots & 1 \\ x_{16}^2 & y_{16}^2 & x_{16}y_{16} & x_{16} & y_{16} & 1 \end{bmatrix}$$

$$C_X = \begin{bmatrix} a \\ b \\ c \\ d \\ e \\ f \end{bmatrix} \quad X_2 = \begin{bmatrix} x_{21} \\ x_{22} \\ x_{23} \\ x_{24} \\ x_{25} \\ x_{26} \end{bmatrix}$$

we can write in matrix form

$$MC_X = X_2$$
$$MC_Y = Y_2$$

⇒ using Pseudo Inverse / simple Inverse as M is (6X6)

$$C_Y = \begin{bmatrix} A \\ B \\ C \\ D \\ E \\ F \end{bmatrix} \quad Y_2 = \begin{bmatrix} y_{21} \\ y_{22} \\ y_{23} \\ y_{24} \\ y_{25} \\ y_{26} \end{bmatrix}$$

$$\boxed{\begin{aligned} C_X &= M^{-1} X_2 \\ C_Y &= M^{-1} Y_2 \end{aligned}}$$