

Question 2.

②	X (mm)	Y (mm)	U (pixels)	V (pixels)
	0	0	1.213×10^3 ≈ 0	974.1 ≈ 0
POINT 1	50	50	1.298×10^3 ≈ 78	899.13 ≈ 73.5
POINT 2	70	70	1.331×10^3 ≈ 109.2	870.75 ≈ 101.35
POINT 3	90	90	1.350×10^3 ≈ 144	840.7 ≈ 132
POINT 4	110	110	1.395×10^3 ≈ 208.05	810.76 ≈ 162
POINT 5	130	130	1.421×10^3 ≈ 208.5	783.93 ≈ 189
POINT 6	150	150	1.453×10^3 ≈ 241.5	757.35 ≈ 219

	U	V
POINT 1	75.9	74
POINT 2	110	101
POINT 3	142.1	136
POINT 4	176	163
POINT 5	206	191
POINT 6	239	220

→ Calculating $A^T A h = \lambda h$ (eigen vector h with smallest eigen value λ of matrix $A^T A$).

$$A = \begin{bmatrix} 78, 73, 1, 0, 0, 0, -5875, -5681.75, -77.1 \\ 0, 0, 0, 109, 101.75, 1, -11169, -10378.5, -102 \\ 144, 132, 1, 0, 0, 0, -20520, -18810, -142.5 \\ 0, 0, 0, 174, 162, 1, -28536, -26568, -164 \\ 208, 189, 1, 0, 0, 0, -43199, -39123, -207 \\ 0, 0, 0, 241.5, 219, 1, -53371, -48399, -221 \end{bmatrix}$$

```
[3] import numpy as np  
  
[1] A=[[78,73,1,0,0,-5875,-5681.75,-77.1],  
      [0,0,0,109,101.75,1,-11169,-10378.5,-102],  
      [144,132,1,0,0,-20520,-18810,-142.5],  
      [0,0,0,174,162,1,-28536,-26568,-164],  
      [208,189,1,0,0,-43199,-39123,-207],  
      [0,0,0,241.5,219,1,-53371.5,-48399,-221]]  
  
[4] A=np.array(A)  
  
[5] values = np.dot(A.T,A)  
  
[6] H = []  
    for i in values:  
        H.append(min(i))  
  
    np.array(H).reshape(3,3)  
  
array([[-12419061.75, -11304360. ,   -69646.5 ],  
       [-19077486.75, -17447636.25,   -93076.5 ],  
       [-19077486.75, -11304360. ,   -93076.5 ]])
```