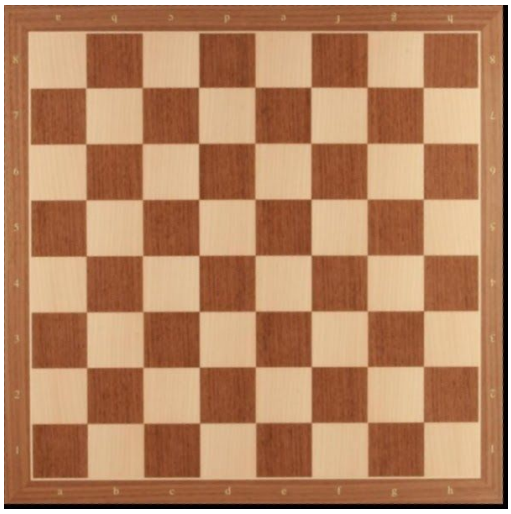
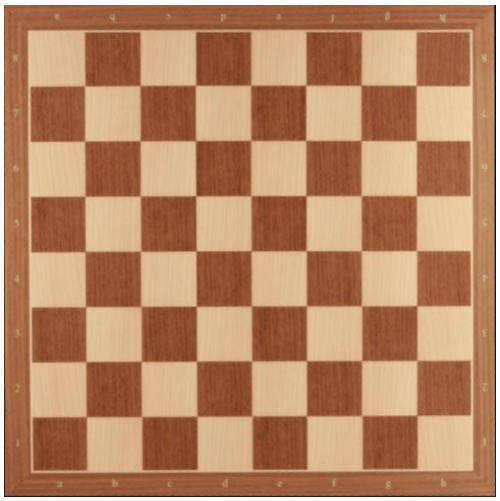
1.1 Affine Transformations

Manually computed Affine Transformation :



After looking at the distorted image, it is observed that there is both shear-x and shear-y involved. After trial and error, I am getting transformation matrix M = [[1,-0.1,0],[-0.1,1,0]] After getting M, I am getting the above resultant image using cv2.warpAffine() function.

API computed Affine Transformation :



For this part, I have used matplotlib to get coordinates of vertices in a distorted image. The upper left corner of the image is at (0,0), so that's why I have excluded this point from mapping. The mapping is as follows :
src = [[59,600], [660,660], [601,61]]

dest = [[0,599], [599,59], [599,0]]
Transformation Matrix is calculated using cv2.getAffineTransform(src,dest) function.
I have used 3 points of correspondence for this part.

Observations :

The resultant image obtained using the first part has black part at the right and bottom end of the resultant image while the resultant image obtained using the second part has no black part. The images obtained in both the parts are satisfactory and there is no significant difference in both of them. The generated images are stored in convincingDirectory/ folder.

1.2 Perspective Transformations

The perspective projection matrix has 8 free parameters and therefore we need 4 pairs of corresponding points between perspective and orthographic view.

The end point of the map is obtained manually using Matplotlib. The correspondence is as follows:
src = [[220,241],[704,1028],[992,826],[481,186]]
dest = [[0,384],[0,0],[511,384], [511,0]]

The final orthographic view is stored in convincingDirectory/ folder as obelisk-output.png.

The role of 3d geometry in the problem comes into use when the 4 points are selected to lie on a plane in 3 dimensions. After perspective transformation, the plane is changed resulting in a different view.

Is the way to go from view 1 to view 2 unique?
No.
One way is using transformation directly for correspondence points
src = [[220,241],[704,1028],[992,826],[481,186]]
dest = [[0,384],[0,0],[511,384], [511,0]]

Another way is first transform src to dst using below correspondence:
src = [[220,241],[704,1028],[992,826],[481,186]]
dest = [[0,0],[0,384],[511,384],[511,0]]
After this transformation, take reflection of this resultant image to get the desired output.

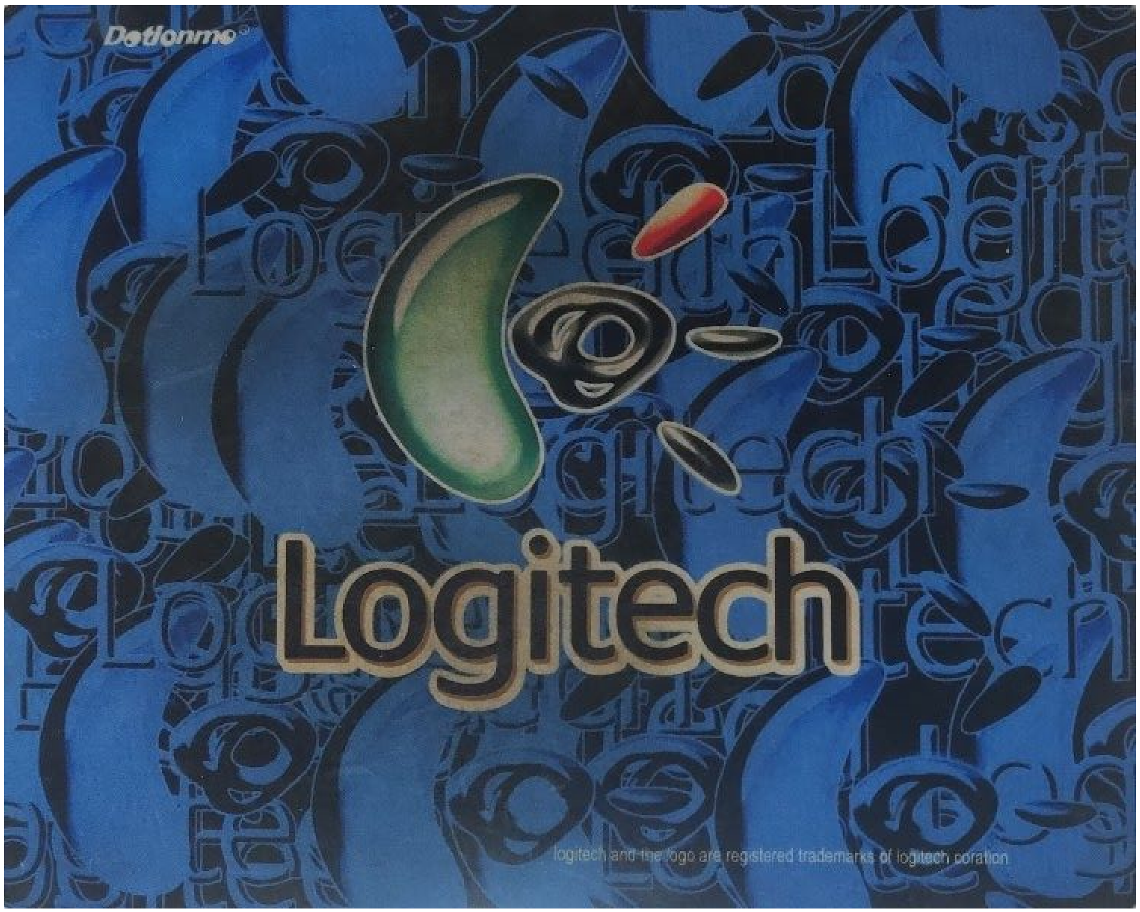
2 Document Scanner

Steps involved in solving this task:

1. First we perform Gaussian Blur to smooth the image.
2. Then we perform Canny Edge detection to detect edges in the image.
3. Then we further apply Gaussian Blur to smooth the image obtained after Canny Edge detection. This step helps in removal of extremely small edges in the image.
4. Then we detect the contour with the largest area in the image. The detected contour does not have 4 vertices as required.
5. We then try to approximate the points in contour to quadrilateral using cv2.approxpolyDP() function. We may get a concave quadrilateral in this case and that's why we are converting end points of the quadrilateral to convex hull and once again approximating the quadrilateral after formation of convex hull. This step tries to ensure that we are getting convex quadrilateral.
6. We then reorder the vertices obtained in clockwise direction, starting from the upper left vertex.
7. We now use perspective transform to get the orthographic projection.

Working Images :


Logitech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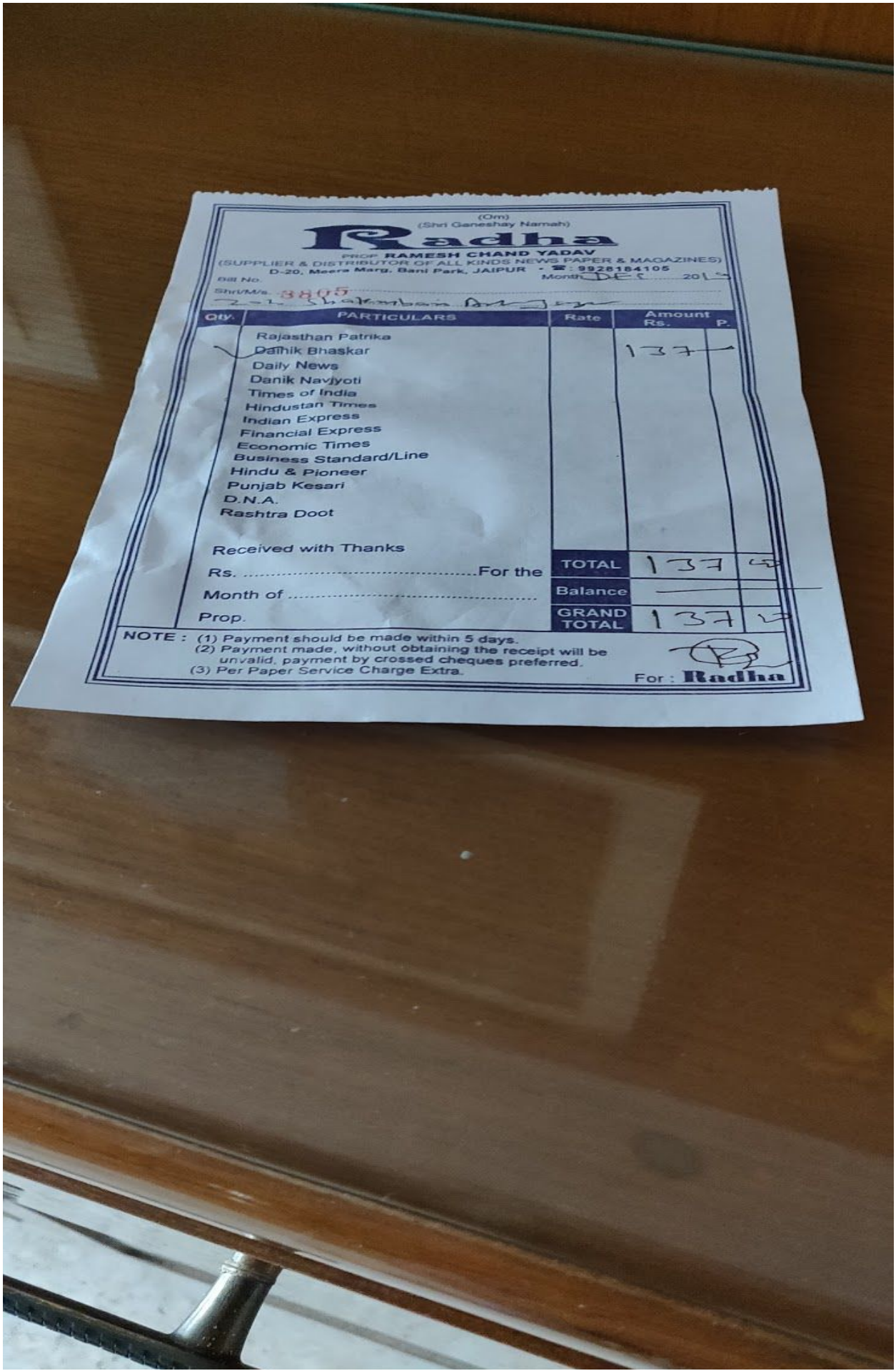

(Om)
(Shri Ganeshay Namah)

Radha

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	Daily News			
	Danik Navjyoti			
	Times of India			
	Hindustan Times			
	Indian Express			
	Financial Express			
	Economic Times			
	Business Standard/Line			
	Hindu & Pioneer			
	Punjab Kesari			
	D.N.A.			
	Rashtra Doot			
	Received with Thanks	TOTAL	137	00
	Rs. .....For the	Balance	—	
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	Daily News			
	Dainik Navjyoti			
	Times of India			
	Hindustan Times			
	Indian Express			
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	D.N.A.			
	Rashtra Doot			
	Received with Thanks	TOTAL	137	45
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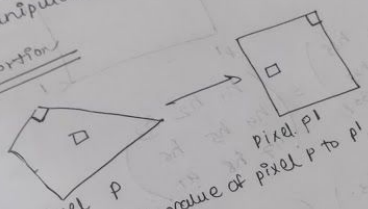
Not Working Images :

★ Distortion :- App1. , App2: Panaromic Mosaicing
↳ Image stitching.

→ The pictures are 2-dimensional manipulation.

* Distortion



Pixel p Pixel p'

copy colour value of pixel p to p'.

$\vec{x'} = H\vec{x}$

$H = 3 \times 3$ Matrix.

x was supposed to indicate the position p (x, y)

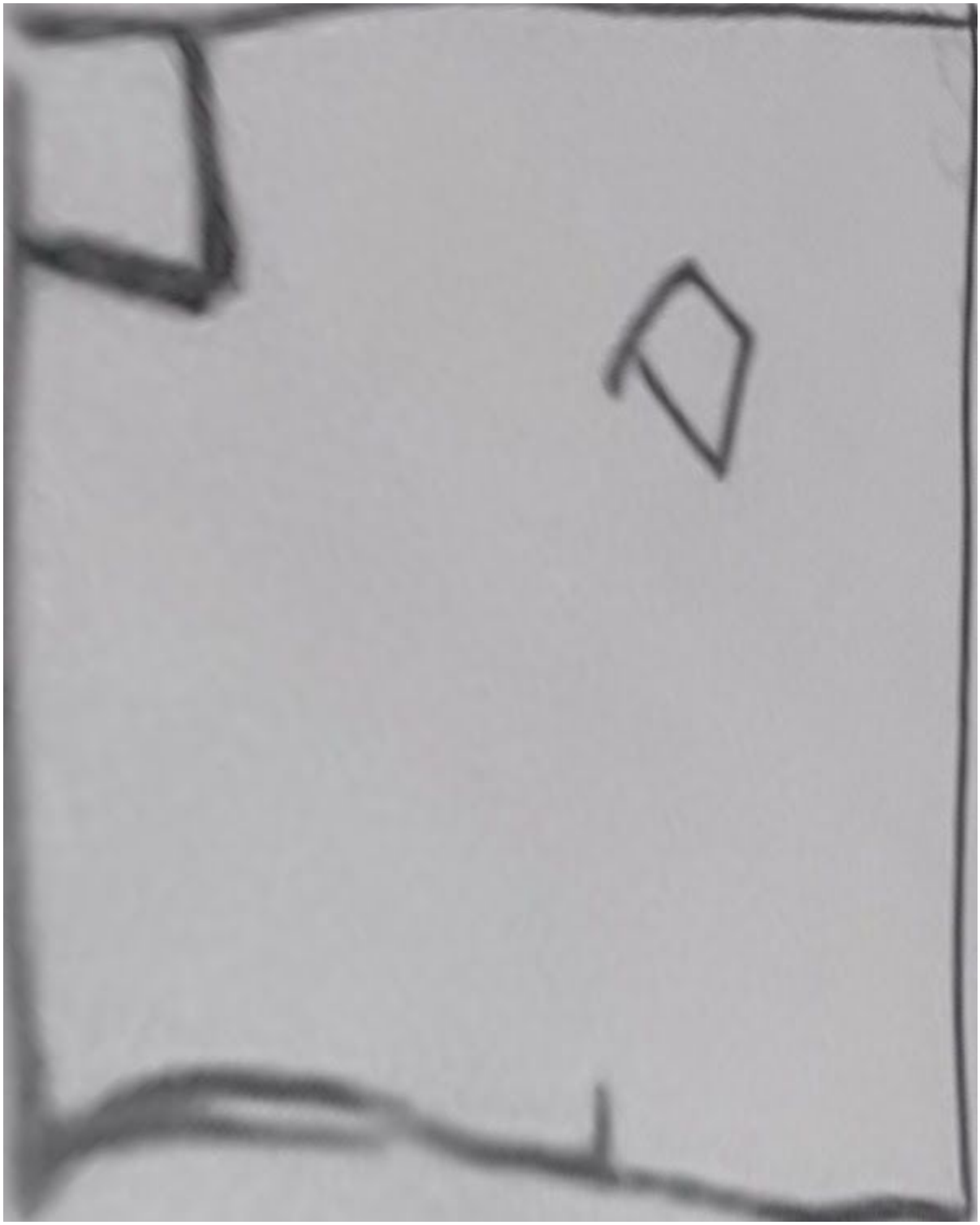
$x_{3\times1}$.

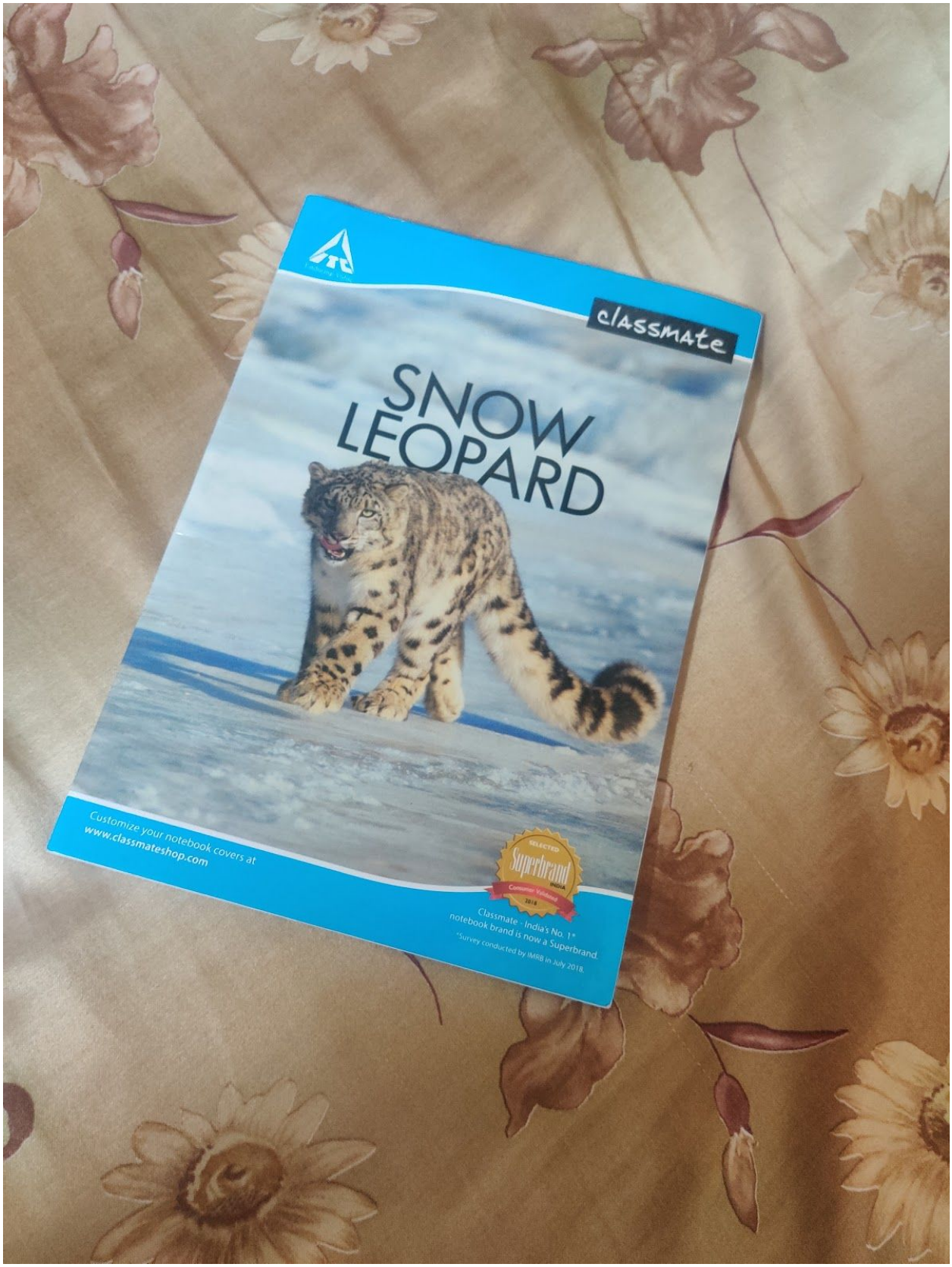
$\vec{x}_{3\times1} = [x, y, 1]^T$

$\vec{x'} = (u, v, w)$.

$\vec{x'} = (\frac{u}{w}, \frac{v}{w}, 1) = (x', y')$

Figuring out H.

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