1. Assume that you are given an input image A that you want to warp into output image B using the warping functions $x = u + 2v$, $y = v$.

• If the image A is 300 pixels high and 500 pixels wide, what would the minimum dimensions of B need to be to completely contain the output image? [1pt]

U = height V = width
1300x500

• If image A contains a 200x200 square, what would the square's shape be in image B? [1pt]

I'm assuming it would look very similar to a parallelogram

2. Using the same images as above, consider the following questions, and briefly answer them:

• Explain what artifacts, if any, could appear in image B if you use a forward map to do the warp? [1pt]

The image would look very blocky/jagged since it's being scaled up in size

• What would the inverse mapping functions be?[1pt]

$x = u - 2v$
$y = v$

3. Suppose that the matrix M =
determines a forward warp from the input image (u, v) space to the output image (x, y) space.

If the input image is 300 pixels wide × 200 pixels high, what will be the minimum required size for the output pixmap? [2pts]

I'm assuming again that u = height and v = width

$X = 0.866u - 0.5v$
$Y = 0.5u + 0.866v$

X = .86*200 - 150	y = 23 rounded down
Y = 100 + (.866)(300)	x = 360 rounded up

4. Given the output pixmap from the previous question, determine to which input pixel the output image pixel located at row y=120 and column x=40 will map. To do so, you also need to compute the inverse map among other things; see the lecture slides for details, or use online tools, or the code from Project 5. [4pts]

Inverse Matrix

Inverse matrix is on the right of the augmented matrix

$$= \begin{pmatrix} 0.86603\dots & 0.50002\dots & 0 \\ -0.50002\dots & 0.86603\dots & 0 \\ -0.00866\dots & -0.00500\dots & 1 \end{pmatrix}$$

- Inverse map operates on output pixels (x, y)

$$\begin{bmatrix} u \\ v \end{bmatrix} = \begin{bmatrix} U(x,y) \\ V(x,y) \end{bmatrix}$$

This time I am assuming u = width and v = height
X = 40*.866 + .5*120 = 94.64 (95)
Y = -.5*40 + .866*120 = 83.92 (84)

So it maps to (95, 84)