Question 1

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1. **Pixel size: I_1: 0.5 × 0.5, I_2: 0.25 × 0.25** Here, the pixel size in Image 2 is exactly half that of Image 1 in both dimensions. This indicates a **uniform scaling** in both the x and y directions by a factor of 2. Since the scaling is uniform and there's no mention of rotation or shear, the appropriate motion model is scaling and **translation** (a specific case of similarity transformation).

   The transformation matrix for aligning the images can be represented as:

$$\mathbf{T} = \begin{bmatrix} 2 & 0 & t_x \\ 0 & 2 & t_y \\ 0 & 0 & 1 \end{bmatrix}$$

2. **Pixel size: I_1: 0.5 × 0.5, I_2: 0.25 × 0.5** In this scenario, the pixel size in Image 2 is half that of Image 1 in the x-dimension but identical in the y-dimension. The images are likely captured with the same orientation, so rotation is not needed. The main difference is in pixel size, which can be addressed by scaling. This requires **non-uniform scaling** along with **translation**.

   The appropriate transformation matrix is:

$$\mathbf{T} = \begin{bmatrix} 2 & 0 & t_x \\ 0 & 1 & t_y \\ 0 & 0 & 1 \end{bmatrix}$$

   Note: If the control points in one image are already perfectly aligned with the corresponding points in the other image after scaling, then t_x and t_y would be zero. However, if there's any offset (e.g., due to the images being captured from slightly different positions), these **translations** are necessary to align the images properly.