Exam 3 Part 2 - Lab Component

Directions: You should upload a MATLAB .m file with all your code. Make sure that all code in the file executes properly and gives the correct answers/plots before submitting because I will check your answers by running your code. Any written explanations should be included in the file as comments.

See the Lab2Template.m file for an example (run this file to see the output) that you should use as a guide. Most of the code you need is provided for you; your main job is to find the standard matrices for the transformation, make sure you are obtaining the correct picture, and determine if the transformation has an inverse.

- **Part 1:** 2D Transformations from $\mathbb{R}^2$ to $\mathbb{R}^2$.
    1. Rotation of 120 degrees clockwise (Note: MATLAB expects radians for angle measures, so adjust accordingly!
    2. Projection onto the line $y = 2x$.
    3. Shear to the right (your choice of angle).
    4. Reflect across the y = x line and then expand the x-dimension by a factor of 3 (leave the y-dimension unchanged). Define this using the composition of two transformation matrices.
- **Part 2:** 3D Transformations from $\mathbb{R}^3$ to $\mathbb{R}^3$.
    5. Reflect across the yz-plane.
    6. Double its length (x-direction) and triple its height (z-direction).
    7. Project onto the the yz-plane
    8. Rotate 45 degrees clockwise around the positive z-axis.

For EACH of the given linear transformations (1-8).

a. Define the standard matrix of the transformation and demonstrate on a generic vector.

b. Demonstrate your transformation by using transform2D on the square and the bug (or transform3D on the cube and the house for the 3D transformations) to see the action on these shapes and make sure it is the correct transformation.

c. Determine whether this transformation have an inverse. If so, describe and demonstrate it geometrically. If not, explain why not geometrically (and not just because the standard matrix for the transformation doesn't have an inverse!)