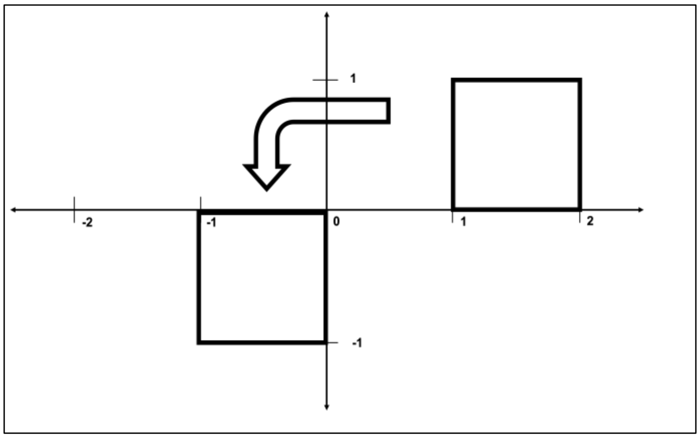
Name: ______________________________

| Problem | Points | Score |
|---|---|---|
| 1 | 50 | |
| 2 | 30 | |
| 3 | 20 | |
| Total | 100 | |

Notes: The exam is closed book and closed notes.

**(50 pts) Problem No. 1**:

A square box is defined by the vertices: [1,0], [2,0], [2,1], [1,1]. Find a transformation, $T(x)$, that transforms this box so that its vertices lie at: [0,0], [-1,0], [-1, -1], [0, -1]. Consider x as a 2x1 vector that represents each vertex. The transformation should map x to the corresponding point in the new object, y. Use the attached picture as a visualization of what your transformation should. Hint: Your transformation should include at least one matrix and one vector.




Note: You must derive the transformation using linear algebra – you cannot simply deduce it using divine inspiration ;) You will be graded on the thoroughness of your derivation.

**(30 pts) Problem No. 2**:

Solve for the matrix Y given the equation: $Y = AB + C^T D^{-1}$, where:

$$A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, B = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}, C = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}, D = \begin{bmatrix} 1 & 1 \\ 0 & 2 \end{bmatrix}$$

**(20 pts) Problem No. 3**:

Determine whether the matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$ is singular using only concepts covered in Chapters 1-2, Show your work and justify your answer.