Tutorial: Advance Linear Algebra

1. Find the inverse transformation of the linear transformation $T : \mathbb{R}^3 \to \mathbb{R}^3$ given by

$$T(x, y, z) = (2x, x + y + z, -y).$$

2. Consider two bases $B = \{(1, 0), (0, 1)\}$ and $C = \{(1, 2), (2, 1)\}$ of $\mathbb{R}^3$. Find the transition matrix from B-coordinates to C-coordinates and from C-coordinates to B-coordinates.

3. Consider the linear transformation $T : \mathbb{R}^2 \to \mathbb{R}^2$ given by

$$T(x, y) = (4x + 3y, x + y).$$

   Find the matrix representation of T with respect to bases $B = \{(1, 0), (0, 1)\}$ and $C = \{(1, 2), (2, 1)\}$.
   Show that the matrix A_{BB} is similar to A_{CC}.