Exercise 1
Find the matrix for the linear transformations $T$ defined by the equations
(i) \( w_1 = x_1, \quad w_2 = x_1 - x_2, \)
(ii) \( w_1 = x + 2z, \quad w_2 = y, \quad w_3 = -z, \)
(iii) \( w_1 = x_4, \quad w_2 = x_4 + x_3, \quad w_3 = x_4 + x_3 + x_2, \quad w_4 = x_4 + x_3 + x_2 + x_1, \)
and by the formulas
(iv) \( T(x_1, x_2) = (-x_1, x_2), \)
(v) \( T(x_1, x_2, x_3) = (x_2, x_1 - x_2, x_1 - x_2 + x_3, -2x_2, 5x_3). \)

Exercise 2
Find $T(x) = Ax$ for the matrix $A$ and the vector $x$ whenever the product makes sense (i.e. the sizes of $A$ and $x$ fit together):
(i) \( A = \begin{pmatrix} 0 & 1 \\ 1 & -2 \end{pmatrix}, \quad x = \begin{pmatrix} -1 \\ 2 \end{pmatrix}, \)
(ii) \( A = \begin{pmatrix} 0 & 2 & 1 \\ 3 & 0 & -2 \end{pmatrix}, \quad x = \begin{pmatrix} -1 \\ 1 \\ 0 \end{pmatrix}, \)
(iii) \( A = \begin{pmatrix} 1 & 2 & 0 \\ -1 & -4 & 1 \end{pmatrix}, \quad x = \begin{pmatrix} -5 \\ 4 \end{pmatrix}. \)

Exercise 3
Use matrix multiplication to find:
(i) the reflection of the vector $(-1, 2)$ about the $x$-axis;
(ii) the orthogonal projection of the vector $(-1, 2)$ to the $y$-axis;
(iii) the image of the vector $(-1, 2)$ under rotation through the angle $\frac{2\pi}{3}$ about the origin.