Exercise 1
Find the matrix for the linear transformations $T$ defined by the equations
(i) $w_1 = x_1$, $w_2 = 2x_2 - x_1$,
(ii) $w_1 = -y$, $w_2 = y + 2z$, $w_3 = -x$,
and by the formulas
(iii) $T(x_1, x_2) = (x_2, x_1)$,
(iv) $T(x_1, x_2, x_3) = (x_3, x_1 + x_2, x_1 + 4x_2 + x_3, -2x_1, x_3, x_1)$.

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) $A = \begin{pmatrix} 0 & -1 & 0 \\ 1 & -1 & 5 \end{pmatrix}$, $x = \begin{pmatrix} 2 \\ -2 \end{pmatrix}$,
(ii) $A = \begin{pmatrix} 0 & 1 & -1 \\ 1 & 0 & -2 \end{pmatrix}$, $x = \begin{pmatrix} -1 \\ 1 \\ 0 \end{pmatrix}$,
(iii) $A = \begin{pmatrix} 1 & 2 \\ -1 & 4 \\ 0 & -1 \end{pmatrix}$, $x = \begin{pmatrix} -5 \\ 1 \end{pmatrix}$.

Exercise 3
Use matrix multiplication to find:
(i) the reflection of the vector $(-3, 1)$ 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 $\frac{-\pi}{4}$ about the origin.
(iv) the image of the vector $(2, 1, 1)$ under rotation through the angle $\frac{\pi}{6}$ about $z$-axis.