

The function  $T_A: \mathbb{R}^n \rightarrow \mathbb{R}^m$  which is defined by  $T_A(x) = Ax$  for all  $x$  in  $\mathbb{R}^n$  where  $A$  is an  $m \times n$  matrix. Then  $T_A$  is called the matrix Transformation induced  $A$ .

The domain of  $T_A$  is  $\mathbb{R}^n$  and the codomain is  $\mathbb{R}^m$ .

$$w_1 = 5x_1 - 7x_2$$

$$w_2 = 6x_1 + x_2$$

$$w_3 = 2x_1 + 3x_2$$

can be expressed in matrix form as

$$\begin{bmatrix} w_1 \\ w_2 \\ w_3 \end{bmatrix} = \begin{bmatrix} 5 & -7 \\ 6 & 1 \\ 2 & 3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

from which we see that the transformation can be interpreted as multiplication by

$$T_A(x) = \begin{bmatrix} w_1 \\ w_2 \\ w_3 \end{bmatrix} = Ax \quad \text{where } A = \begin{bmatrix} 5 & -7 \\ 6 & 1 \\ 2 & 3 \end{bmatrix}, x = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Now by size of  $A$  we can say the domain of  $T_A$  is  $\mathbb{R}^2$  and the codomain is  $\mathbb{R}^3$ .