Session 9

How are the matrix equation

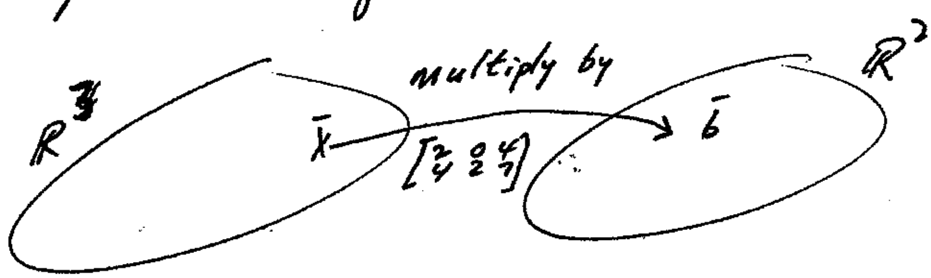
$$(1) \quad \begin{bmatrix} 2 & 0 & 4 \\ 4 & 2 & 7 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 10 \\ 18 \end{bmatrix}$$

and the vector equation

$$(2) \quad x_1 \begin{bmatrix} 2 \\ 4 \end{bmatrix} + x_2 \begin{bmatrix} 0 \\ 2 \end{bmatrix} + x_3 \begin{bmatrix} 4 \\ 7 \end{bmatrix} = \begin{bmatrix} 10 \\ 8 \end{bmatrix}$$

related?

Notice that we could think of the solutions to (1) and (2) above as those vectors $\bar{x} \in \mathbb{R}^3$ that are "transformed" into the vector $\begin{bmatrix} 10 \\ 18 \end{bmatrix}$ under multiplication by $\begin{bmatrix} 2 & 0 & 4 \\ 4 & 2 & 7 \end{bmatrix}$.



A <u>transformation</u> T (<u>function</u>, <u>mapping</u>) from $\mathbb{R}^n$ to $\mathbb{R}^m$ is a rule that assigns to each vector $\bar{x} \in \mathbb{R}^n$ a unique vector $T(\bar{x}) \in \mathbb{R}^m$. $\mathbb{R}^n$ is called the <u>domain</u> of T. $\mathbb{R}^m$ is called the codomain of T. We denote this situation by $T: \mathbb{R}^n \to \mathbb{R}^m$. For $\bar{x} \in \mathbb{R}^n$ we call $T(\bar{x})$ the image of $\bar{x}$ (under T). The set of all images $T(\bar{x})$ is called the range of T.