

# Assignment 15

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Download codes from

Rewriting (1.0.1)

<https://github.com/KUSUMAPRIYAPULAVARTY/assignment15>

$$T_2 T(z) = \begin{pmatrix} x+7y \\ 5y \\ -10y \\ x-7y \end{pmatrix} \quad (2.0.4)$$

$$= \begin{pmatrix} 1 & 7 \\ 0 & 5 \\ 0 & -10 \\ 1 & -7 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} \quad (2.0.5)$$

$$T_2 T : \mathbf{V} \rightarrow R^4 \quad (2.0.6)$$

$$rref \begin{pmatrix} 1 & 0 & 0 & 1 \\ 7 & 5 & -10 & -7 \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & -2 & -\frac{14}{5} \end{pmatrix} \quad (2.0.7)$$

Let  $\mathbf{V}$  be the set of complex numbers regarded as a vector space over the field of real numbers. We define a function  $T$  from  $\mathbf{V}$  into the space of  $2 \times 2$  real matrices, as follows. If  $z = x + iy$  with  $x$  and  $y$  real numbers, then

$$T(z) = \begin{pmatrix} x+7y & 5y \\ -10y & x-7y \end{pmatrix} \quad (1.0.1)$$

How would you describe the range of  $T$ ?

So, the vectors  $\begin{pmatrix} 1 \\ 0 \\ 0 \\ 1 \end{pmatrix}, \begin{pmatrix} 7 \\ 5 \\ -10 \\ -7 \end{pmatrix}$  are linearly independent.

From, (2.0.5)

$$\text{range}(T_2 T) = \text{columnspace of } \begin{pmatrix} 1 & 7 \\ 0 & 5 \\ 0 & -10 \\ 1 & -7 \end{pmatrix} \quad (2.0.8)$$

$$\text{range}(T) = \text{span of } \left\{ \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, \begin{pmatrix} 7 & 5 \\ -10 & -7 \end{pmatrix} \right\} \quad (2.0.9)$$

## 2 SOLUTION

$$T : \mathbf{V} \rightarrow R^{2 \times 2} \quad (2.0.1)$$

where  $R^{2 \times 2}$  is the space of all  $2 \times 2$  real matrices  
If  $R^4$  is the space of all 4-tuple vectors, then  $R^{2 \times 2}$  and  $R^4$  are isomorphic with

$$T_2 \left[ \begin{pmatrix} a & b \\ c & d \end{pmatrix} \right] = \begin{pmatrix} a \\ b \\ c \\ d \end{pmatrix} \quad (2.0.2)$$

$$T_2 : R^{2 \times 2} \rightarrow R^4 \quad (2.0.3)$$