



## Why

We can view the set of real-valued  $n \times k$  matrices as a vector space over  $\mathbf{R}$ .

## Definition

The *matrix sum* of two matrices  $A, B \in \mathbf{R}^{n \times k}$  is the matrix  $C \in \mathbf{R}^{n \times k}$  defined by  $C_{ij} = A_{ij} + B_{ij}$ . In other words, the matrix  $C$  is given by summing the entries of  $A$  and  $B$  “entry-wise”. We denote the matrix sum by  $A + B$ .

For  $\alpha \in \mathbf{R}$ , the  $\alpha$ -scaled version of  $A \in \mathbf{R}^{n \times k}$  is the matrix  $C \in \mathbf{R}^{n \times k}$  given by  $C_{ij} = \alpha A_{ij}$ . In other words, the matrix  $C$  is given by scaling the entries of  $A$  “entry-wise”. We denote the  $\alpha$ -scaled version of  $A$  by  $\alpha A$ . These two definitions are justified by the following.

The  $n \times k$ -matrix space is the vector space over  $\mathbf{R}^{n \times k}$  in which addition is given by the matrix sum and scalar multiplication by entry-wise scaling.<sup>1</sup>

## Subspace of symmetric matrices

The subset of symmetric  $n$  by  $n$  matrices is a subset of  $\mathbf{R}^{n \times n}$ .

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<sup>1</sup>Future editions will rework this sheet.



