



# Matrices

## 1 Why

## 2 Definition

Consider two sets: the natural numbers from 1 to  $n$  and those from 1 to  $m$ . Consider a third non-empty set. A *matrix of* elements of the third set is a function from the cartesian product of the first two sets of natural numbers to the third set. We call such a function a *matrix*. We call the function's values the *entries* of the matrix.

We think of the objects in the third set as arrayed in a grid or arrayed in a table. We call  $n$  and  $m$  the *dimensions* of the matrix. We call  $n$  the *height* and  $m$  the *width*. If the height of the matrix is the same as the width of the matrix then we call the matrix *square*. If the height is larger than the width, we call the matrix *tall*. If the width is larger than the height, we call the matrix *wide*.

### 2.1 Notation

Let  $S$  be nonempty set. We denote the set of  $n \times m$   $S$ -valued matrices by  $S^{n \times m}$ . Let  $a \in S^{n \times m}$ . This means the same as  $a : \{1, 2, \dots, n\} \times$

Ordered Pairs



Algebras



Operations



Functions



Relations



Ordered Pairs