



## Why

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## Definition

The *matrix-vector product* between an  $m \times n$ -matrix and an  $n$ -vector is the result of the linear combination of the columns of the matrix with the sequence of scalars in the vector. So the matrix-vector product is an  $m$ -vector.

## Notation

Let  $C$  be a nonempty set. Let  $A \in C^{m \times n}$  and let  $x \in C^n$ . As usual, we denote the matrix-vector product of  $A$  with  $x$  by  $Ax$ , read “A x,” and defined by

$$b_i = \sum_{j=1}^n a_{ij}x_j$$

for  $i \in \{1, 2, \dots, m\}$ . Let

$$A = \begin{bmatrix} a_1^\top \\ a_2^\top \\ \vdots \\ a_m^\top \end{bmatrix}$$

Or, if  $a_i^\top$  is the  $i$ th row of  $A$ , then

$$b_i = a_i^\top x$$

for  $i \in \{1, 2, \dots, m\}$ .

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<sup>1</sup>Future editions will include.



