



## Why

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## Definition

The *quadratic form* of a square matrix  $A$  with a vector  $x$  is the value  $x^\top Ax$ .

## Notation

Let  $\mathbf{F}$  be a field and  $A \in \mathbf{F}^{m \times m}$ . For a vector  $x \in \mathbf{R}^d$ , A quadratic for in  $A$  Let  $x \in \mathbf{R}^d$ . Then  $x^\top Ax$  is a quadratic form.

$$x^\top Ax = \sum_{i,j} A_{ij} x_i x_j$$

## Under trace

Observe that  $\text{tr } x^\top Ax = \text{tr } Axx^\top = \text{tr } xx^\top A$ .

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



