NOTATION · CHEAT SHEET

Decomposition Notation at a Glance

The marks from the notation cards across the decomposition pages: how each is read and what it means. Every group links to the full card on its page.

LU DECOMPOSITION

$A = LU$

A EQUALS L U
Lower triangular times upper triangular.

$PA = LU$

PERMUTE, THEN FACTOR
P on the left reorders the rows of A.

$l_{ij},\ i > j$

ENTRIES OF L BELOW THE DIAGONAL
The multipliers used in elimination; ones on the diagonal.

QR DECOMPOSITION

$A = QR$

A EQUALS Q R
Orthonormal columns times upper triangular; $Q_1 R_1$ is the thin form.

$Q^T Q = I$

BUT NOT ALWAYS Q Q TRANSPOSE
For a thin Q, $QQ^T \neq I$.

$A_{k+1} = R_k Q_k$

THE QR ITERATION
Factor, then multiply back in reverse order.

CHOLESKY DECOMPOSITION

$A = LL^T$

L TIMES L TRANSPOSE
One factor, used twice; $LL \neq A$.

$\mathbf{x}^T A \mathbf{x} > 0$

POSITIVE DEFINITE
Required for all $\mathbf{x} \neq \mathbf{0}$.

$A = LDL^T$

L D L TRANSPOSE
The diagonal carried separately; no square roots.

SPECTRAL DECOMPOSITION

$A = QDQ^T$

Q D Q TRANSPOSE
For symmetric A: Q^T stands where Q^{-1} would be.

$\sum \lambda_i \mathbf{q}_i \mathbf{q}_i^T$

A SUM OF RANK-ONE TERMS
The same matrix, written by eigenvalues.

SINGULAR VALUE DECOMPOSITION

$A = U\Sigma V^T$

U SIGMA V TRANSPOSE
Orthogonal U and V, diagonal Σ.

Σ

CAPITAL SIGMA
A diagonal matrix here, not a sum.

$\sigma_1 \geq \sigma_2 \geq \cdots \geq 0$

THE SINGULAR VALUES
σ_1 always means the largest.

SAME MARKS, DIFFERENT JOB

Σ	A diagonal matrix in the SVD; elsewhere the summation sign.
Q	Always orthonormal columns; Q^T then acts as the inverse.
L	Lower triangular in both LU and Cholesky, but with ones on the diagonal only in LU.