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concepts in linear algebra

Canonical name	ConceptsInLinearAlgebra
Date of creation	2013-03-22 14:13:30
Last modified on	2013-03-22 14:13:30
Owner	matte (1858)
Last modified by	matte (1858)
Numerical id	13
Author	matte (1858)
Entry type	Definition
Classification	msc 16-00
Classification	msc 13-00
Classification	msc 20-00
Classification	msc 15-00

The aim of this entry is to present a list of the key objects and operators used in linear algebra. Each entry in the list links (or will link in the future) to the corresponding PlanetMath entry where the object is presented in greater detail. For convenience, this list also presents the encouraged notation to use (at PlanetMath) for these objects.

Some of this notation is simply an example of more general notation, either notation in set theory or notation for functions. Some notation is also standard from category theory.

Suppose V is a vector space over a field K. Where the field K is clear from context it is sometimes eliminated from the notation. Let L be a linear operator, or linear transformation, from V to W, and E be an endomorphism of V.

- $\mathscr{L}(V, W)$, the set of linear transformations between vector spaces V and W (also $\operatorname{Hom}_K(V, W)$),

- basis of a vector space and the matrix associated with the basis,

- $\dim_K V$, http://planetmath.org/Dimension2 dimension of V,

- $\operatorname{span}\{e_1, \ldots, e_n\}$ vector space spanned by vectors $\{e_i\}$ (note that the list of vectors need not be finite). Some other notations are $(e_1, e_2, \ldots, e_n)$ or $\langle e_1, e_2, \ldots, e_n \rangle$ (do not confuse last one with similar inner product notation),

- $\det E$, determinant of a linear operator,

- $\operatorname{tr} E$, trace of a linear operator (also $\operatorname{trace} E$),

- $\operatorname{im} L$, image of a linear operator (also $\operatorname{img} L$ and $L(V)$),

- $\ker L$, kernel of a linear operator,

- for sets A, B and a point $x \in V$, the expressions $A + B$, $A - B$, $A + x$ are the http://planetmath.org/MinkowskiSum2 Minkowski sums (not especially if A and B are subspaces, then their sum is a subspace, but the result may not be a direct sum),

- V^*, dual space of a vector space V (also $V^\vee$ or $\operatorname{Hom}_K(V, K)$),

- A^*, adjoint operator of a linear operator,

- $V \oplus W$, direct sum of vector spaces V and W (both internal end external),

- $V \otimes_K W$, tensor product of V and W, and

- $V \wedge W$, antisymmetrized tensor product (also called the wedge product),

- bilinear forms and quadratic forms

- generalizations of vector spaces over a field to vector spaces over a division ring to modules over a ring.