MATH 152 Study Notes
Linear Systems

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1. Scalars

A scalar x has

$$x \in \mathbb{R}. \tag{1}$$

In this course,

$$x \in \mathbb{C} \text{ (complex numbers)} \tag{2}$$

is also a scalar.

2. Vectors

A vector is 2 or more scalars arranged in a predetermined order.

When written, an arrow is placed above the variable to indicate that it is a vector.

$$x \text{ is a normal variable,} \tag{3.1}$$

$$\vec{x} \text{ is a vector.} \tag{3.2}$$

In printed media, vectors are often written in boldface.

$$\boldsymbol{x} \text{ is a vector.} \tag{4}$$

2.1. Vector Demensions

The number of scalars in a vector is called the dimension of the vector. For example,

$$\boldsymbol{a} = \begin{pmatrix} 1 \\ 2 \end{pmatrix} \text{ is a } \mathbb{R}^2 \tag{5.1}$$

$$\boldsymbol{b} = \begin{pmatrix} 1 \\ 2 \\ 3 \\ 4 \end{pmatrix} \text{ is a } \mathbb{R}^4 \tag{5.2}$$

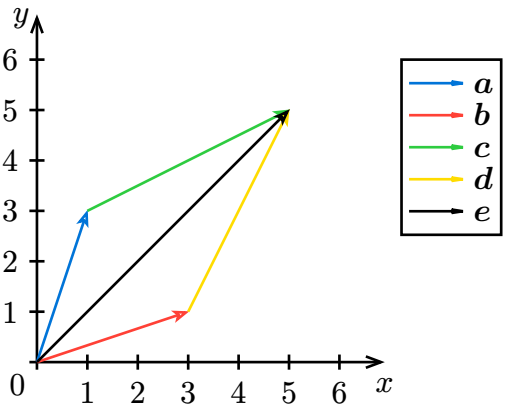
2.2. Vector Operations

2.2.1. Vector & Scalar

Yeah just do it.

2.2.2. Vector & Vector

For addition and subtraction, simply add or subtract the corresponding scalars. Commutate, associate and distribute them.



$$\boldsymbol{a} + \boldsymbol{b} = \boldsymbol{c} + \boldsymbol{d} \tag{6.1}$$

$$= \boldsymbol{e} \tag{6.2}$$

$$\boldsymbol{e} - \boldsymbol{a} = \boldsymbol{b} \tag{6.3}$$

$$\boldsymbol{e} - \boldsymbol{c} = \boldsymbol{d} \tag{6.4}$$