MATH1061/1961 Linear Algebra Notes

Contents

1 What linear algebra studies

Linear algebra studies finite-dimensional vector spaces and linear transformations between them. In applications, complicated systems are often approximated by linear systems so that questions about geometry, change, equilibrium, and long-run behaviour become questions about vectors and matrices.

2 Vectors, vector spaces and linear combinations

2.1 Vectors in $\mathbb{R}^n$

A vector in $\mathbb{R}^n$ is an ordered list

$$\mathbf{u} = \begin{bmatrix} u_1 \\ u_2 \\ \vdots \\ u_n \end{bmatrix}, \qquad u_i \in \mathbb{R}. \tag{2.1}$$

Geometrically, vectors can be viewed as floating arrows determined by magnitude and direction, or as position vectors from the origin to a point.

For $\mathbf{u}, \mathbf{v} \in \mathbb{R}^n$ and $c \in \mathbb{R}$,

$$\mathbf{u} + \mathbf{v} = \begin{bmatrix} u_1 + v_1 \\ \vdots \\ u_n + v_n \end{bmatrix}, \qquad c\mathbf{u} = \begin{bmatrix} cu_1 \\ \vdots \\ cu_n \end{bmatrix}. \tag{2.2}$$