

Matrix Operations

- Linear Combination
- Vector Algebra
- Angle Between Vectors
- Projections and Reflections
- Equality of matrices, Augmented Matrix
- Matrix Addition and Matrix Scalar Multiply
- Matrix Multiply
 - Matrix multiply as a dot product extension
 - Matrix multiply as a linear combination of columns
 - How to multiply matrices on paper
- Special matrices and square matrices
- Matrix Algebra and Matrix Multiply Properties
- Transpose
- Inverse matrix, Inverse of a 2×2 Matrix

Linear Combination

A linear combination of vectors $\mathbf{v}_1, \dots, \mathbf{v}_k$ is defined to be a sum

$$\mathbf{x} = c_1 \mathbf{v}_1 + \dots + c_k \mathbf{v}_k,$$

where $c_1, \dots, c_k$ are constants.

Vector Algebra

The norm or length of a fixed vector $\vec{X}$ with components $x_1, \dots, x_n$ is given by the formula

$$|\vec{X}| = \sqrt{x_1^2 + \dots + x_n^2}.$$

The dot product $\vec{X} \cdot \vec{Y}$ of two fixed vectors $\vec{X}$ and $\vec{Y}$ is defined by

$$\begin{pmatrix} x_1 \\ \vdots \\ x_n \end{pmatrix} \cdot \begin{pmatrix} y_1 \\ \vdots \\ y_n \end{pmatrix} = x_1 y_1 + \dots + x_n y_n.$$

Angle Between Vectors

If $n = 3$, then $|\vec{X}||\vec{Y}|\cos\theta = \vec{X} \cdot \vec{Y}$ where θ is the angle between $\vec{X}$ and $\vec{Y}$. In analogy, two n -vectors are said to be **orthogonal** provided $\vec{X} \cdot \vec{Y} = 0$. It is usual to require that $|\vec{X}| > 0$ and $|\vec{Y}| > 0$ when talking about the angle θ between vectors, in which case we *define* θ to be the acute angle ($0 \leq \theta < \pi$) satisfying

$$\cos\theta = \frac{\vec{X} \cdot \vec{Y}}{|\vec{X}||\vec{Y}|}.$$

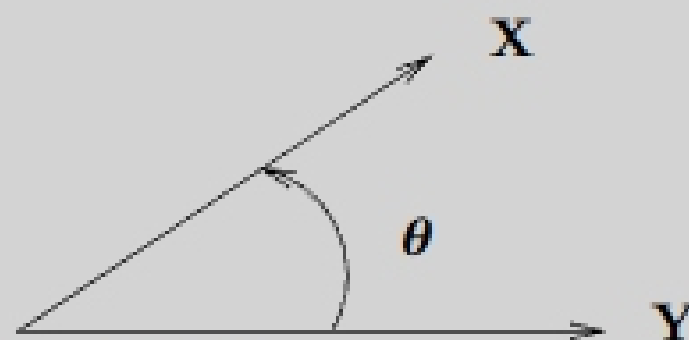


Figure 1. Angle θ between two vectors X , Y .