General stuff:
· vectors
· matrices (det)
· test

1 Basics

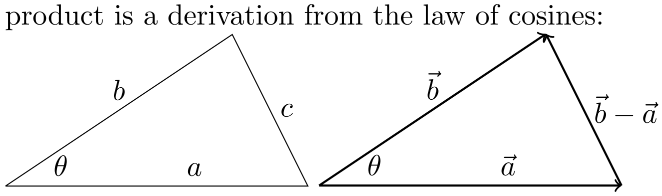
1.1 Cartesian Coordinates

1.2 Contour Maps

2 2

2.1 Dot Product

The dot product of two vectors returns a scalar describing how .... The dot product is a derivation from the law of cosines:



$$\begin{aligned}
c^2 &= a^2 + b^2 - 2ab\cos\theta \\
\|\vec{b} - \vec{a}\|^2 &= \|\vec{a}\|^2 + \|\vec{b}\|^2 - 2\|\vec{a}\|\|\vec{b}\|\cos\theta \\
\vec{a} = \langle a_x, a_y \rangle, \vec{b} = \langle b_x, b_y \rangle & \\
(b_x - a_x)^2 + (b_y - a_y)^2 &= a_x^2 + a_y^2 + b_x^2 + b_y^2 - 2\|\vec{a}\|\|\vec{b}\|\cos\theta \\
\cancel{b_x^2} - 2a_xb_x + \cancel{a_x^2} + \cancel{b_y^2} - 2a_yb_y + \cancel{a_y^2} &= \cancel{a_x^2} + \cancel{a_y^2} + \cancel{b_x^2} + \cancel{b_y^2} - 2\|\vec{a}\|\|\vec{b}\|\cos\theta \\
a_xb_x + a_yb_y &= \|\vec{a}\|\|\vec{b}\|\cos\theta
\end{aligned}$$

We name each side of the resulting equation "the dot product" of the two vectors or $a \cdot b$. Note that $\vec{a}$ and $\vec{b}$ could have an arbitrary amount of entries and yield the same result, so:

$$a \cdot b = a_0b_0 + a_1b_1 + ... + a_nb_n = \|\vec{a}\|\|\vec{b}\|\cos\theta \tag{1}$$

3 Matrices

3.1 What is a Matrix?

A Matrix is a rectangle of numbers. For instance, $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & 0 \end{bmatrix}$ is a 2×3 matrix, for it has height 2 and width 3.
We can name any given entry a_{ij} where i is its row and j is its column. Generally, $\begin{bmatrix} a_{11} & \dots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{m1} & \dots & a_{mn} \end{bmatrix}$ is an $m \times n$ matrix.

3.2 Basic Operations

Scaling The name given to the operation of multiplying every entry within the matrix by a scalar. If a scalar is multiplied to the matrix, the scaling operation is implied.

Given a matrix A and scalar α, $\alpha \cdot A = \begin{bmatrix} \alpha \cdot a_{11} & \dots & \alpha \cdot a_{1n} \\ \vdots & \ddots & \vdots \\ \alpha \cdot a_{m1} & \dots & \alpha \cdot a_{mn} \end{bmatrix}$

Or, $\alpha \cdot A = \Sigma$

Adding When two matrices are separated by a “+” sign, this means that

3.3 Determinant

4 Transformations