**Miscellaneous Math**

**Dot Product**

**What:**

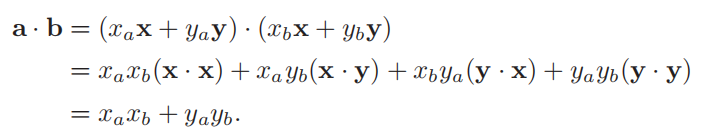
**Why:**

1. 计算夹角
2. 计算投影

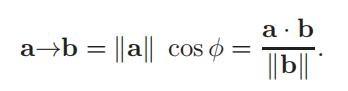
**How:**

1，计算夹角





2，计算投影



**Cross Product**

**What**

**Why**

求平行四边形面积，表面法线

**How**

叉积大小：





叉积方向：

左右手定则

**Orthonormal Bases**

**What:**

相互正交的单位向量组成的向量集。

**Why:**

**How:**

1. 点积投影
2. 叉积

3，SVD

**Gradient**

**What:**

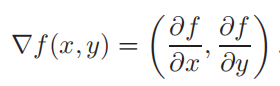
梯度是一个向量，表示函数在该点处的方向导数沿着该方向取得最大值，即函数在该点处沿着该方向变化最快，变化率最大。

**Why:**

求解法线

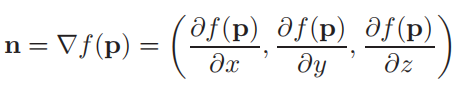
**How:**

梯度公式：



在隐式曲线f（x，y）=0的点处计算的梯度向量为曲线在该点的法向量。此外，由于梯度点上坡，表示f（x，y）>0区域的方向。

表面法线：



Plane

What:

Why:

How:

(p − a) · n = 0.

3D Curves

What:

Why:

How:

A 3D curve can be constructed from the intersection of two simultaneous

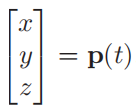
implicit equations:

f(p)=0, g(p)=0.

Typically, it is more convenient to use parametric curves instead

x = f(t), y = g(t), z = h(t).

In vector form we can write

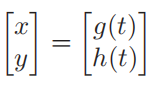


2D Parametric Curves

What:

Why:

How:



Often we can write a parametric curve in vector form p = f(t)

3D Parametric Surfaces

x = f(u, v), y = g(u, v), z = h(u, v).

x = r cos φ sin θ,

y = r sin φ sin θ,

z = r cos θ.

Barycentric coordinates

What:

Why:

How:

The coordinate origin is a and the vectors from a to b and c are the basis vectors.

p = a + β(b − a) + γ(c − a)

p = (1 − β − γ)a + βb + γc.

α ≡ 1 − β – γ

p(α, β, γ) = αa + βb + γc

α + β + γ = 1

The same mixing coefficients (α, β, γ) can be used to mix other properties,

such as color

