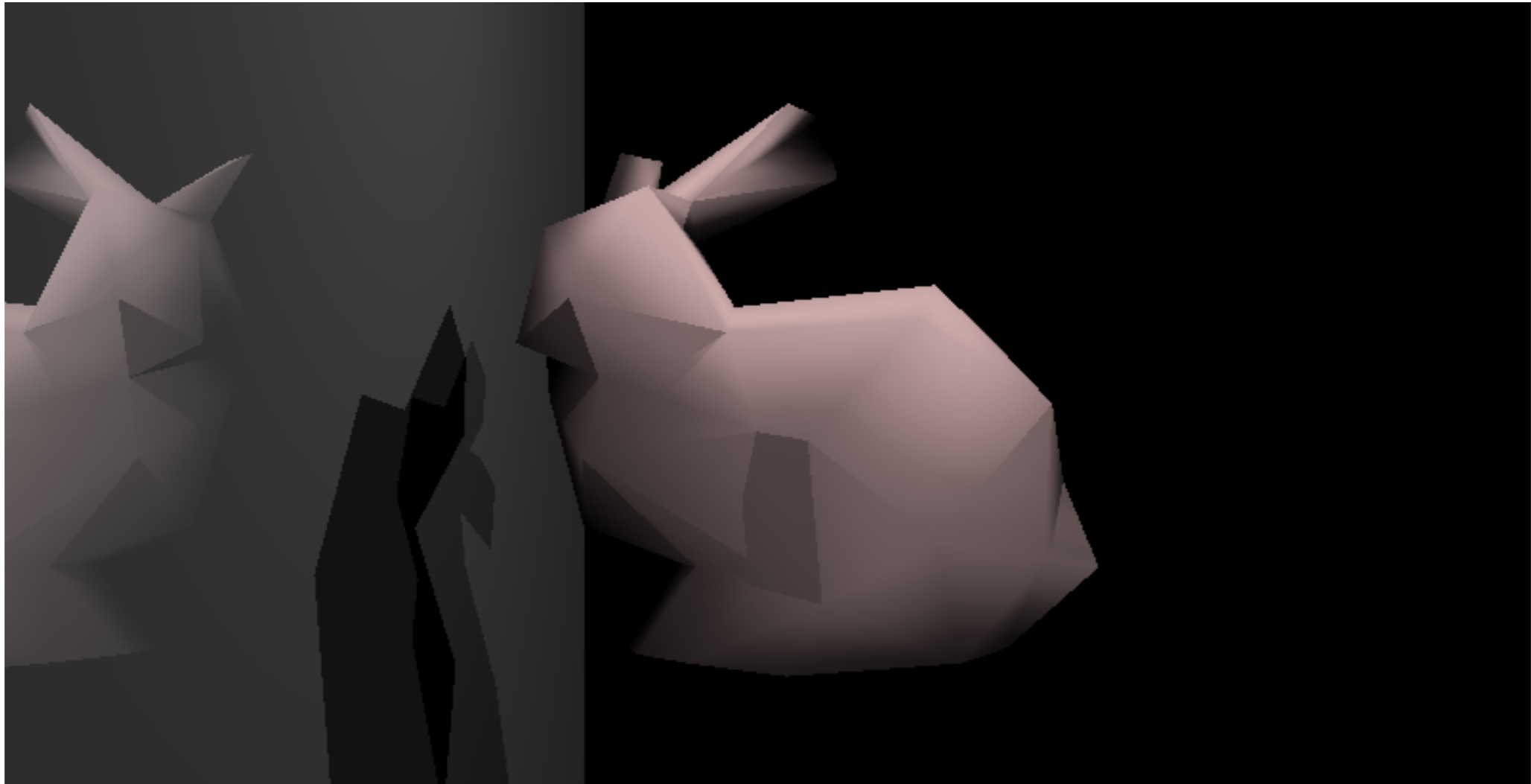


# Computer Graphics

Lecture 10

**Barycentric Coordinates**  
**Ray-Triangle Intersection**

# Let's talk about bunnies.



If we want bunnies, we still need to implement  
`function ray_intersect(ray, triangle, tmin, tmax):`

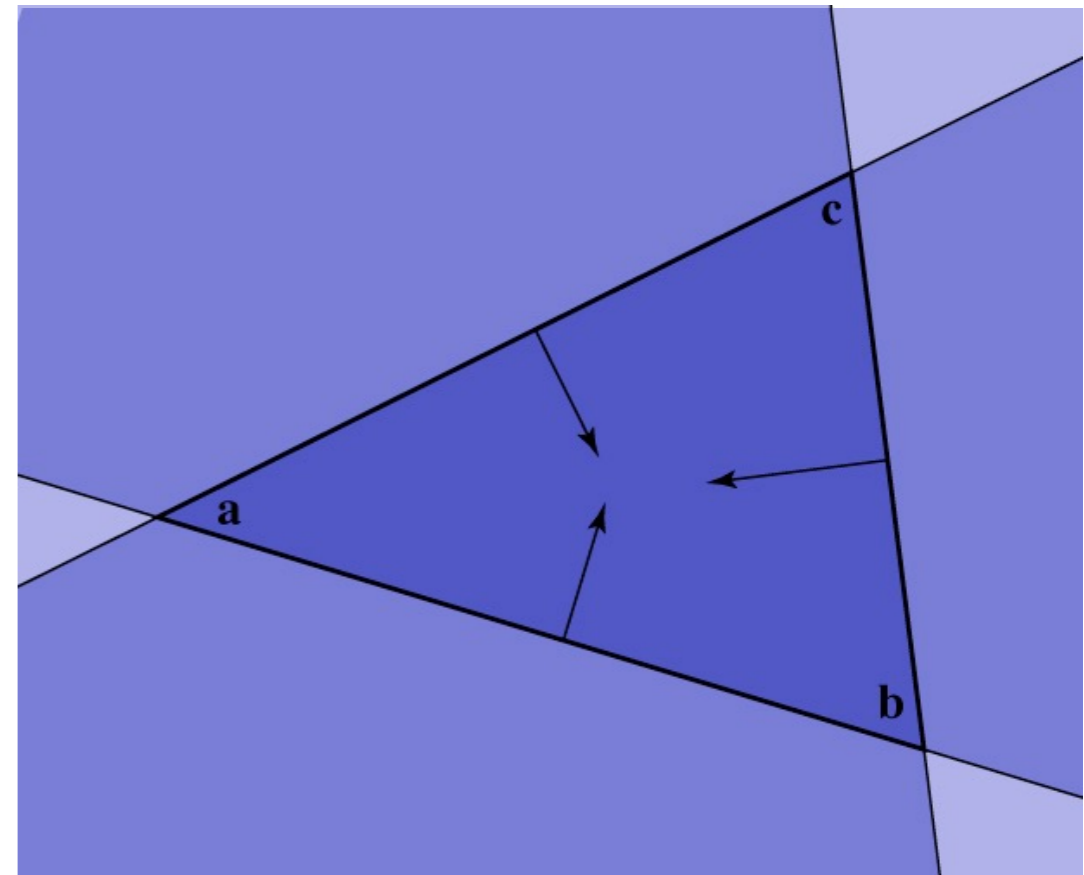
Then, we can treat a triangle mesh as simply a list of triangles.

# Let's talk about triangles.

A triangle is the intersection of three half-planes

High-level approach:

1. Intersect with the plane
2. Check if intersection is inside the triangle



# Let's talk about triangles.

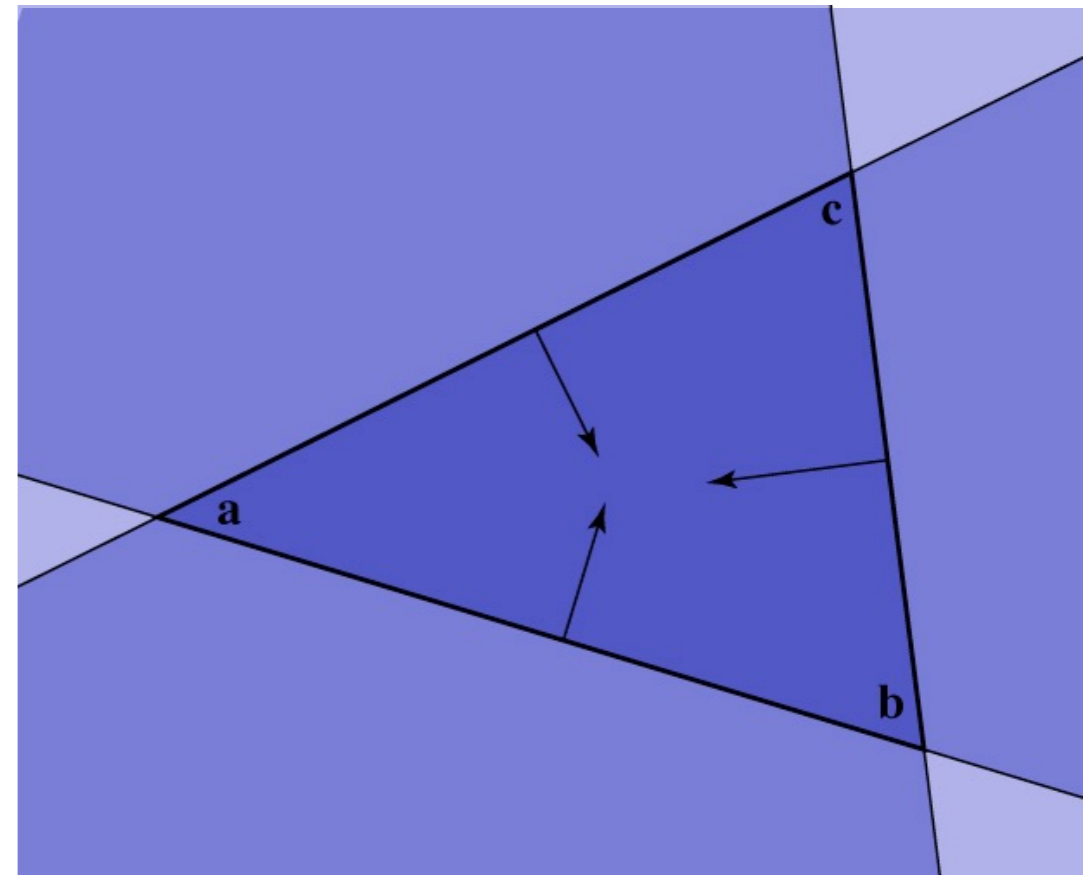
A triangle is the intersection of three half-planes

High-level approach:

1. Intersect with the plane
- 2. Check if intersection is inside the triangle**

Sound familiar? There's a catch:

We're in **3D** now!

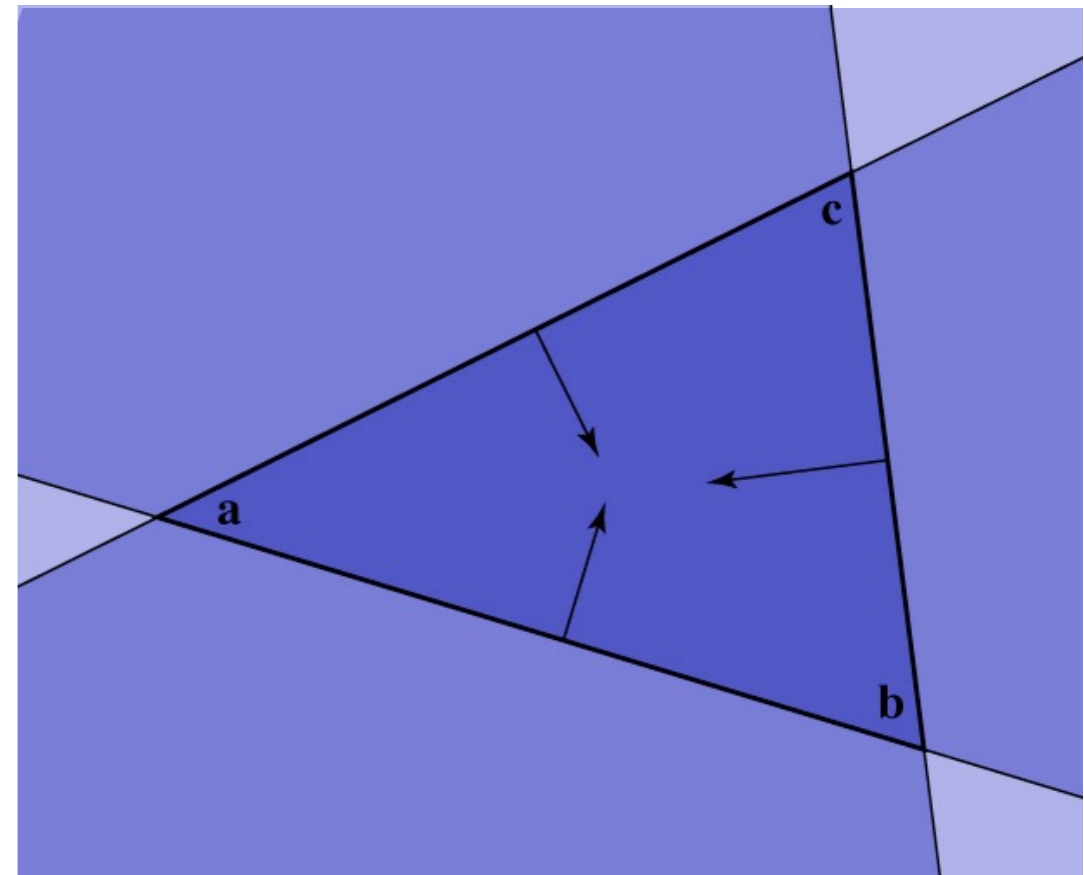


# Let's talk about triangles.

A triangle is the intersection of three half-planes

High-level approach:

1. Intersect with the plane
- 2. Check if intersection is inside the triangle**



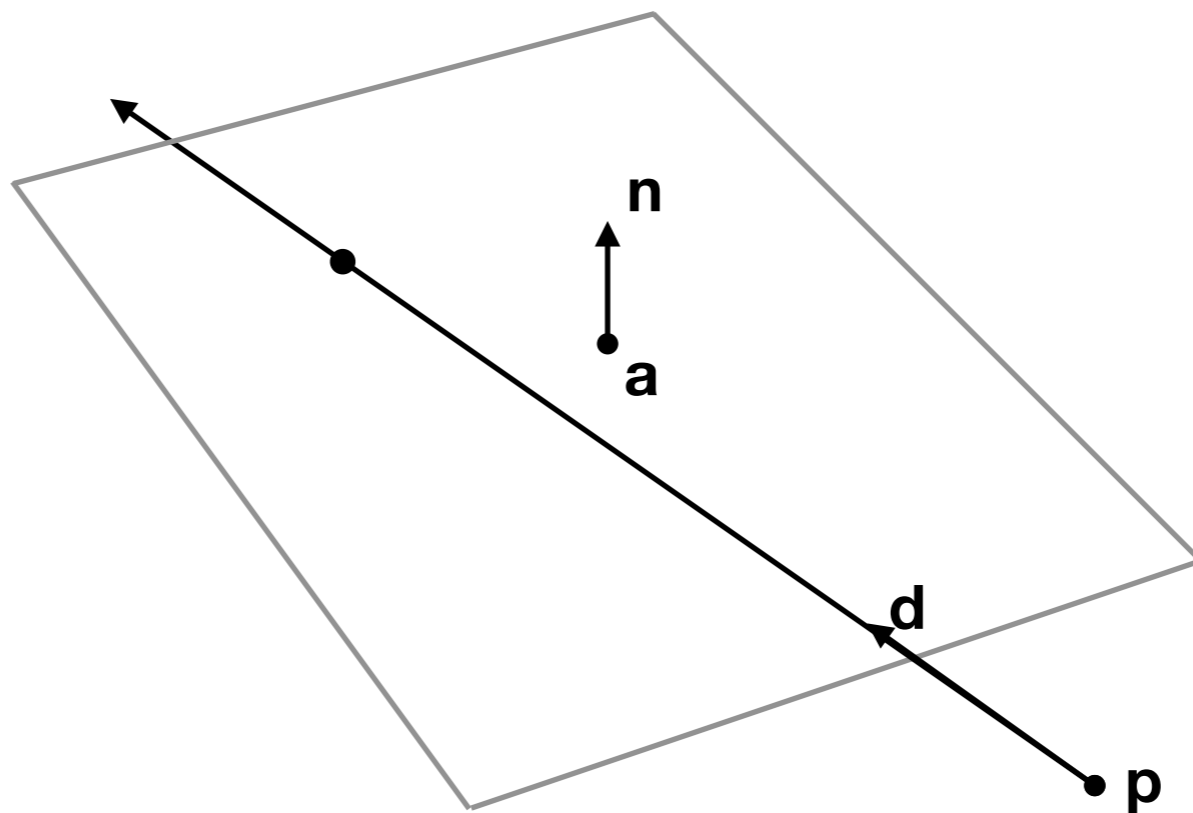
To make this easy, we'll introduce the ***weirdest coordinate system you've ever seen.***

As a bonus, we'll get interpolation of vertex data for free!

# Roadmap for today

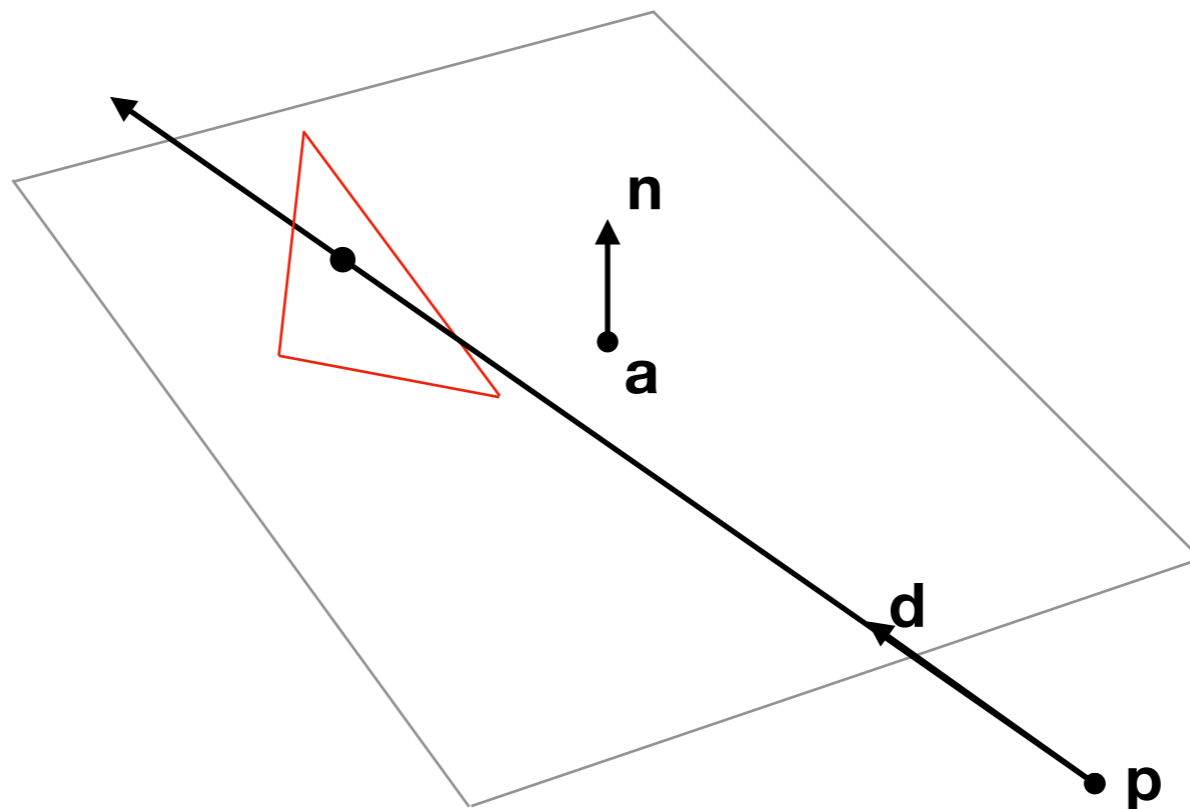
- Reminder: implicit equation for a plane
- Barycentric coordinates
- Finding barycentric coordinates at a ray-plane intersection.

# Implicit Planes: Reminder



# Implicit Planes: Reminder

How can we tell if an intersection point is inside a particular triangle?





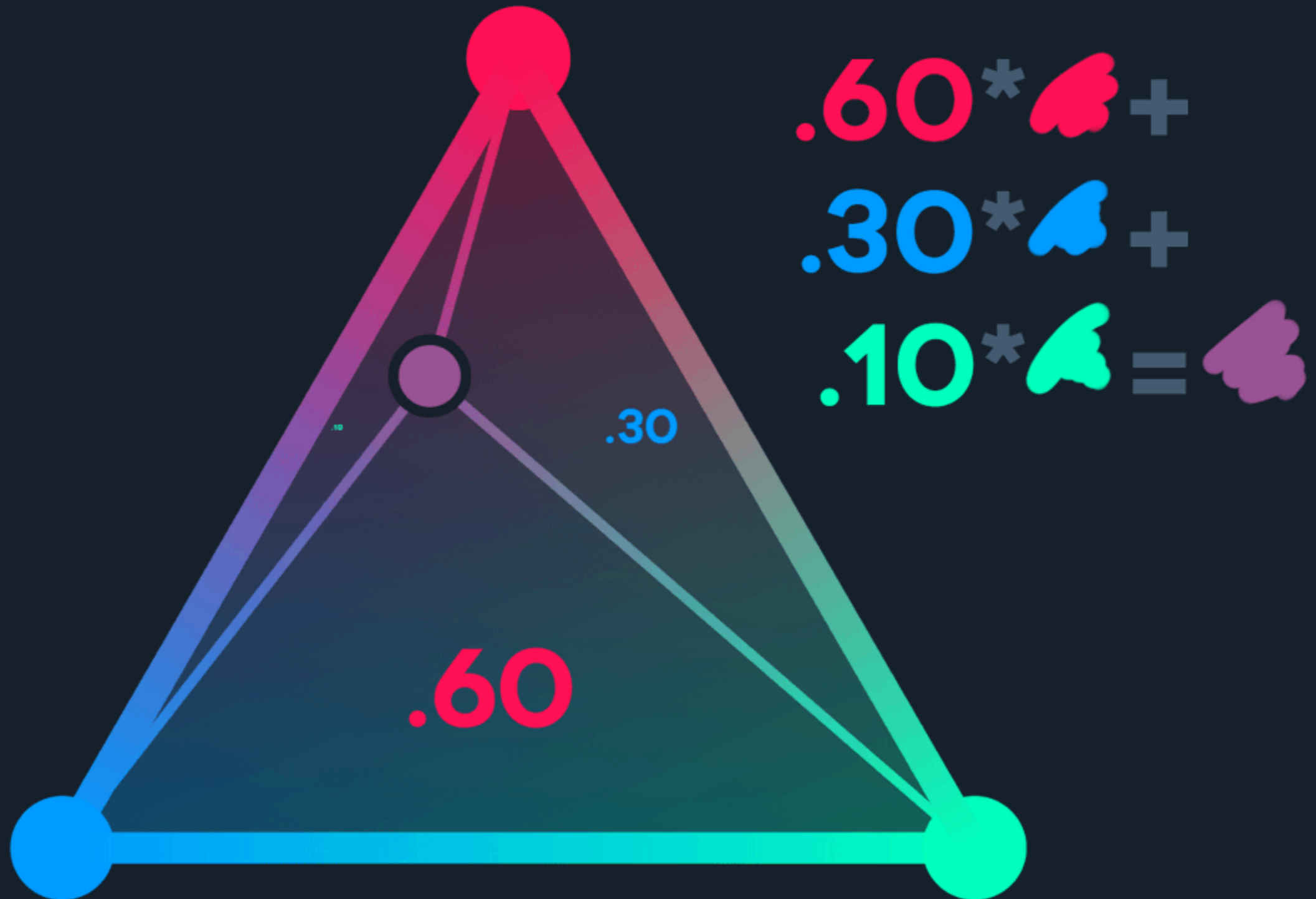
# Barycentric Coordinates

A purpose-built coordinate system for talking about points in a specific triangle's plane.

It seems weird at first, but it will give us:

- The intersection point with the plane
- Whether the intersection is inside the triangle
- Interpolation weights for vertex data(!)

# Barycentric Interpolation

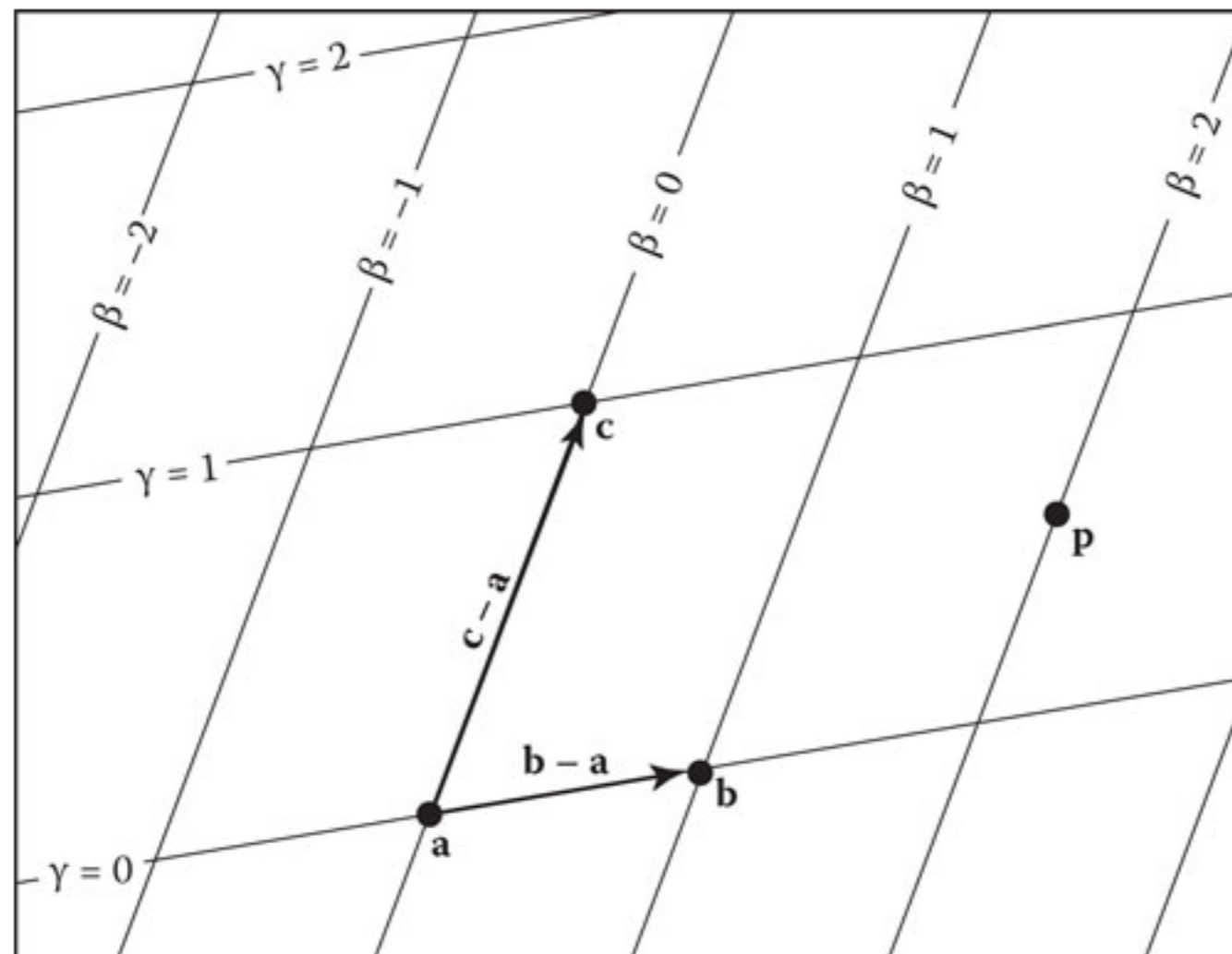




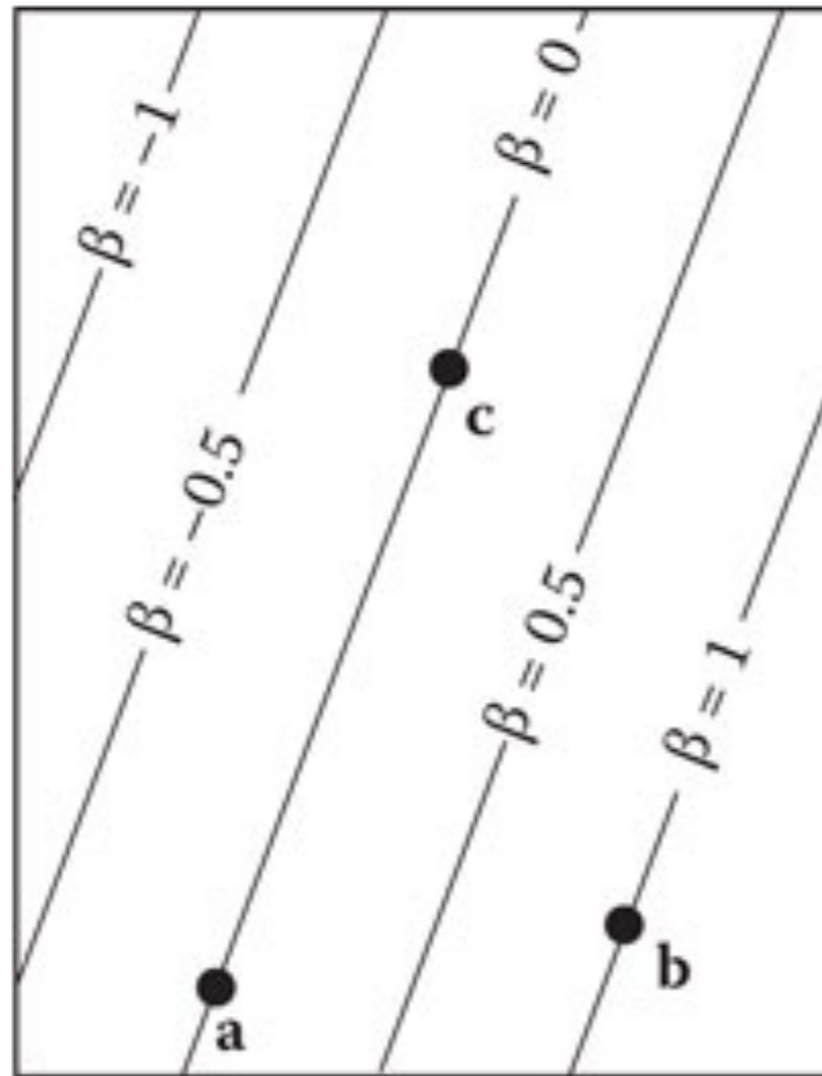
# Barycentric Coordinates

A purpose-built coordinate system for talking about points in a specific triangle's plane.

$$\mathbf{p} = \mathbf{a} + \beta(\mathbf{b} - \mathbf{a}) + \gamma(\mathbf{c} - \mathbf{a})$$



# Properties of Barycentric Coordinates



- Coordinates are proportional to area of subtriangles:

