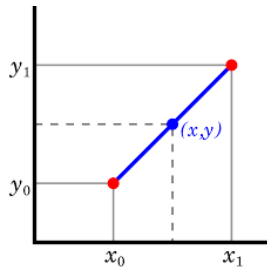# Interpolation

1. Linear Interpolation

Interpolation is a mathematical process that fills in unknown intermediate data points between two known points. Linear interpolation does this by fitting line to the two known points.

Example: Suppose a function f has two known points: f(0,0)=4 and f(4,8)=12 Use linear interpolation to find f(2,4). Hint: think of the line parametrically.
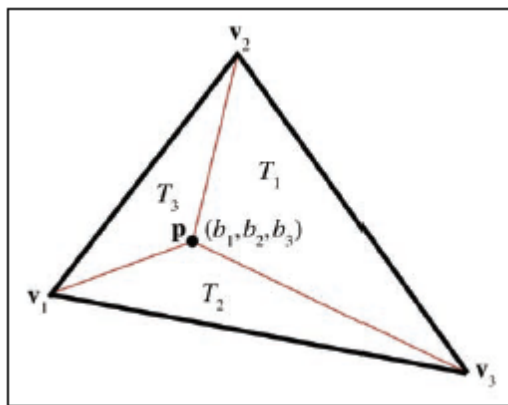
2. Barycentric Coordinates

When a GPU fills in a triangle using Gouraud Shading, colors are interpolated across the face of the triangle. One way this can be implemented is by using barycentric coordinates. Given a triangle (v1,v2,v3) we can convert any point p from Cartesian coordinates to barycentric coordinates.

- **What are they?** Based on this image which shows some examples of points written in barycentric coordinates, describe what barycentric coordinates are and their relationship to (v1,v2,v3)
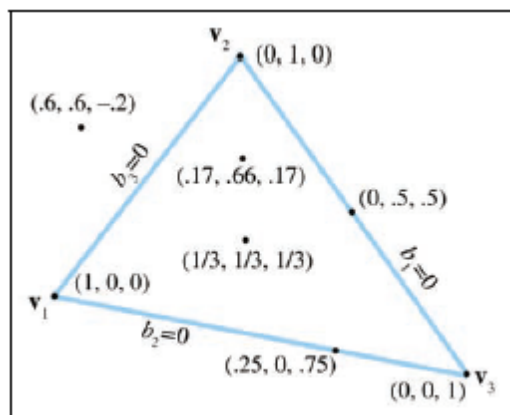
- **Inside?** What is a simple test to determine if a point p described by barycentric coordinates is inside or outside triangle (v1,v2,v3)?

- **Dimension?** The vertices v1, v2, and v3 are originally described in Cartesian coordinates. What restrictions are there on the dimension of the space they are in?

- **How can they be computed?**
  Based on this picture, come up with a suggestion for how you can convert p from Cartesian to barycentric coordinates.

- **Use them to interpolate.**
  Suppose we have colors f(v1)=(1,1,1) and f(v2)=(0.6,0.6,0.0) and f(v3)=(0.3, 0.0, 0.0). What is the color at p=(1/3, 1/3, 1/3) assuming p is in barycentric coordinates.