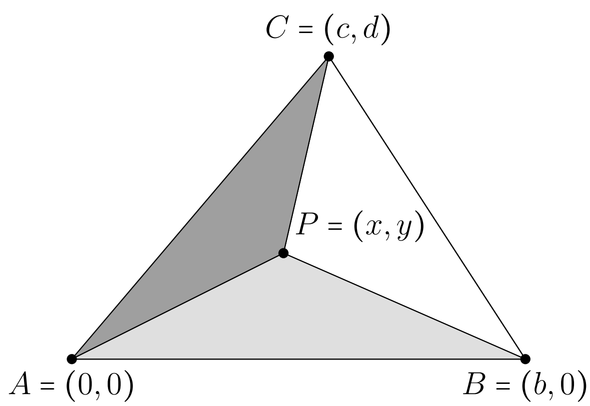
CS130 - Barycentric coordinates

Name: ______________________________ SID: __________________

1. In class, we formulated the barycentric coordinates through ratios of triangle areas. We then implicitly assumed that $P = \alpha A + \beta B + \gamma C$. That is, the barycentric coordinates have the property that they interpolate the vertices of the triangle to the point P. In this problem, you will prove this property.

For the triangle ABC illustrated, show that when the barycentric coordinates are determined through ratios of triangle areas, they interpolate the vertices to the point P. That is, show that $P = \alpha A + \beta B + \gamma C$.



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2. The transformation $\mathbf{x} \to \mathbf{M}\mathbf{x} + \mathbf{b}$ is called an *affine* transformation, where $\mathbf{M}$ is a matrix and $\mathbf{b}$ is a vector. Let P be a point inside triangle ABC. The transformed point $P' = \mathbf{M}P + \mathbf{b}$ is inside the triangle with vertices $A' = \mathbf{M}A + \mathbf{b}$, $B' = \mathbf{M}B + \mathbf{b}$, and $C' = \mathbf{M}C + \mathbf{b}$. Show that P' has the same barycetric coordinates (in $A'B'C'$) as P (in ABC). That is, barycentric coordinates are preserved under affine transformations.

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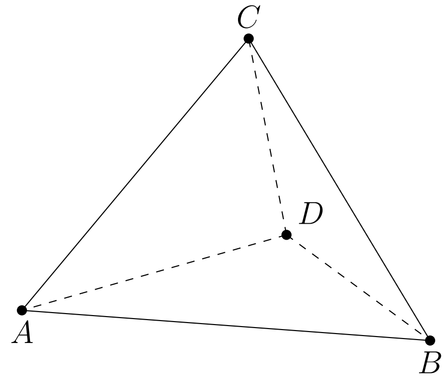
3.



How might one formulate barycentric coordinates for a tetrahedron? Suggest formulas for computing them.