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LARSON—OPER 731—HOMEWORK WORKSHEET 08
Barycentric Coordinates

Let X^1 , X^2 , and X^3 be non-collinear points in the plane. Let X^* be a point in the triangle formed by these points. There are unique non-negative real numbers λ_1 , λ_2 , λ_3 which sum to 1, where

$$X^* = \lambda_1 X^1 + \lambda_2 X^2 + \lambda_3 X^3.$$

The tuple $(\lambda_1, \lambda_2, \lambda_3)$ is called the *barycentric coordinates* of X^* .

1. Let $X^1 = (1, 1)$, $X^2 = (3, 2)$, and $X^3 = (2, 4)$. Find the barycentric coordinates of the point $X^* = (2, 3)$.
2. Prove that the barycentric coordinates of this point are unique.
3. Find a formula for the barycentric coordinates of an arbitrary point X^* in the triangle formed by arbitrary non-collinear points X^1 , X^2 , and X^3 in the plane.