Math 155A - Fall 2022 - Quiz #15 - November 22

Name:

PID:

1. Let $\mathbf{x} = \langle -2, 0, 4\rangle$ and $\mathbf{y} = \langle 4, 6, -2\rangle$ be points in $\mathbb{R}^3$. Let $\mathbf{u} = \langle -4, 0, 8, 2\rangle$ and $\mathbf{v} = \langle 12, 18, -6, 3\rangle$ be homogeneous represention of $\mathbf{x}$ and $\mathbf{y}$ (respectively). Find scalars α and β so that $\alpha + \beta = 1$ and so that $\mathbf{w} = \alpha\mathbf{u} + \beta\mathbf{v}$ is a homogeneous representation of the midpoint of $\mathbf{x}$ and $\mathbf{y}$. In other words, $\mathbf{w}$ is an affine combination of $\mathbf{u}$ and $\mathbf{v}$, and a homogeneous representation of $\frac{1}{2}(\mathbf{x} + \mathbf{y})$.

2. A triangle in $\mathbb{R}^2$ has three vertices $\mathbf{x} = \langle 0, 0\rangle$, $\mathbf{y} = \langle 3, 3\rangle$ and $\mathbf{z} = \langle 6, 0\rangle$. The point $\mathbf{a} = \langle 3, 1\rangle$ has barycentric coordinates $\alpha = \frac{1}{3}$, $\beta = \frac{1}{3}$, and $\gamma = \frac{1}{3}$.

Let $\mathbf{u} = \langle 2\mathbf{x}; 2\rangle$, $\mathbf{v} = \langle \mathbf{y}; 1\rangle$ and $\mathbf{w} = \langle 2\mathbf{z}; 2\rangle$ be homogeneous representations of $\mathbf{x}$, $\mathbf{y}$ and $\mathbf{z}$, respectively.

Find values α', β', γ' so that the affine combination $\alpha'\mathbf{u} + \beta'\mathbf{v} + \gamma'\mathbf{w}$ is a homogeneous representation of $\mathbf{u}$.