PMAT 3331 – Projective Geometry — Assignment #1
Winter 2003

Instructions

- Answer each question completely; justify your answers.
- This assignment is due at 3:00 pm on Wednesday January 29, 2003.
- Please place your completed assignment in Box 35.

1. Two vectors $\vec{u}$ and $\vec{v}$ in $A_n(\mathbb{R})$ are said to be *parallel* if $\vec{u} = t\vec{v}$ for some $t \in \mathbb{R}$.

   Determine the value of q such that the vectors $(1, -9)$ and $(-4, q)$ in $A_2(\mathbb{R})$ are parallel.

2. Determine the vector equation for the line passing through the points $Q_0(4, 8)$ and $Q_1(6, -7)$ in $A_2(\mathbb{R})$. Is this line a linear submanifold of $A_2(\mathbb{R})$?

3. Determine the vector equation for the line passing through the points $Q_0(1, 2, 4)$ and $Q_1(8, 0, -3)$ in $A_3(\mathbb{R})$.

4. Determine whether the following three points lie on the same line: $Q_1(4, 3, -2)$, $Q_2(0, 5, 5)$, $Q_3(8, 1, -9)$.

5. Find the equation of the hyperplane in $A_3(\mathbb{R})$ containing the points $Q_1(4, 7, 1)$, $Q_2(3, 0, 2)$, $Q_3(1, 8, -3)$. Does this hyperplane form a linear submanifold of $A_3(\mathbb{R})$?

6. Let $S_1 = \{t(3, 4, 5) \mid t \in \mathbb{R}\}$ and $S_2 = \{(x, y, z) \mid 2x + y - 3z = 0\}$ be linear submanifolds of $A_3(\mathbb{R})$.

   (a) Find $S_1 \cap S_2$.

   (b) Show that $S_1 + S_2 = A_3(\mathbb{R})$.