PMAT 3331 – Projective Geometry — Assignment #5
Winter 2003

Instructions

- Answer each question completely; justify your answers.
- This assignment is due at 3:00 pm on February 27, 2003.
- Please place your completed assignment in Box 35.

1. Consider the set of points on the hyperbola $xy = -2$ in $\mathbb{R}^2$. Determine the corresponding set of points in $P_2(\mathbb{R})$. Sketch these points in $P_2(\mathbb{R})$ and identify all points of interest.

2. Consider the set of points on the parabola $y = x^2 - 7$ in $\mathbb{R}^2$. Determine the corresponding set of points in $P_2(\mathbb{R})$. Sketch these points in $P_2(\mathbb{R})$ and identify all points of interest.

3. Consider the set of points on the unit circle $x^2 + y^2 = 1$ in $\mathbb{R}^2$. Determine the corresponding set of points in $P_2(\mathbb{R})$. Sketch these points in $P_2(\mathbb{R})$ and identify all points of interest.

4. Consider the line $y = 5$ and the curve $x - y^2 + 4 = 0$ in $\mathbb{R}^2$.

   (a) Express both in homogeneous coordinates.

   (b) What are the points of intersection of the corresponding line and curve in $P_2(\mathbb{R})$?

   (c) At what points does the corresponding line in $P_2(\mathbb{R})$ intersect the reference triangle?

   (d) At what points does the corresponding curve in $P_2(\mathbb{R})$ intersect the reference triangle?

   (e) Sketch the graphs of the corresponding line and curve in $P_2(\mathbb{R})$.

5. Consider the line $2x - 1 = 0$ and the curve $-2x^2 + 2y^2 + 4x - 6 = 0$ in $\mathbb{R}^2$.

   (a) Express both in homogeneous coordinates.

   (b) What are the points of intersection of the corresponding line and curve in $P_2(\mathbb{R})$?

   (c) At what points does the corresponding line in $P_2(\mathbb{R})$ intersect the reference triangle?

   (d) At what points does the corresponding curve in $P_2(\mathbb{R})$ intersect the reference triangle?