Math F305: Homework 12 **Due: April 17, 2006**

1.

Find the general form for the homogeneous coordinates of a line passing through $(1, 1, 1)$. (Your answer should depend on two parameters).

2.

Show that the two distinct lines $u = [u_1, u_2, u_3]$ and $v = [v_1, v_2, v_3]$ are parallel if and only if there is a number λ such that $u_i = \lambda v_i$ for $i = 1, 2$, but $u_3 \neq \lambda v_3$.

Hint: Show that

$$u_1 x_1 + u_2 x_2 + u_3 = 0$$
$$v_1 x_1 + v_2 x_2 + v_3 = 0$$

does not have a solution if and only if the above conditions hold.

3.

Use Exercise 2 to show that Playfair's axiom holds in this analytic model of the Euclidean plane.

4.

Let T be the affine transformation with matrix

$$A = \begin{pmatrix} 1 & 5 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}.$$

What does T take the line $k = [1, -2, 3]$ to? Does T keep any points on k invariant? Describe the action of T on the plane (it might be helpful to make a sketch with k and $T(k)$ in it).

5.

Sibly 4.3.1 Matrices A, B, C, and D.