Mathematics 3260H – Geometry II: Projective and non-Euclidean geometry
TRENT UNIVERSITY, Fall 2017

Assignment #~~10~~ 11
Linear algebra and the real projective plane
Due on Wednesday, 6 December.

Recall that one of the ways to get the real projective plane is to call the 1-dimensional subspaces of $\mathbb{R}^3$ points and the 2-dimensional subspaces of $\mathbb{R}^3$ lines, with a "point" being incident with a "line" if and only if the 1-dimensional subspace is a subpace of the 2-dimensinal subspace. Projective coordinates for points and lines of the real projective plane are then direction vectors for the 1-dimensional subspaces and normal vectors for the 2-dimensional subspaces.

1. It was noted in class that an invertible linear transformation of $\mathbb{R}^3$ gives a collineation of the real projective plane. Does every collineation of the real projective plane come from an invertible linear transformation of $\mathbb{R}^3$? Prove that it does or find a counterexample. *[10]*