Part II
Introduction to Group Theory

What have we done so far? Well, the vectors introduced above make a linear space. Indeed, the algebraic operations between them are linear. The (nonsingular) matrices, on the other hand, makes a new mathematical structure: a group.

In a group, although the commutative law not necessarily holds, the associative law does hold. In what follows, we introduce group theory, including the first, second, and third isomorphism theorems, and their geometrical applications.

Matrices are particularly useful to represent all sorts of practical transformations in geometry and physics. In special relativity, for example, Lorentz transformations are written as 2×2 matrices. Here, we'll put this in a much wider context: group representation. To show how useful this is, we'll represent projective mappings as 3×3 matrices. This is particularly useful in computer graphics. Finally, we'll also use matrices to introduce yet another important field: quantum mechanics.