MATH 2360-D01 WEEK 9

SECTION 4.7; PAGES 202–211

Abstract. Given a basis for a vector space, every vector can be written in a unique way as a linear combination of the basis vectors. The coefficients in this linear combination are the vector's *coordinates* relative to the given basis. The same vector can—and usually will— have different coordinates relative to different bases. Translation of coordinates from one basis to another is accomplished by matrix multiplication.

Section 4.7

Reading. Make sure that you understand the following:

(1) Given a basis $B = \{\mathbf{u}_1, \dots, \mathbf{u}_n\}$ for a vector space V, every vector $\mathbf{v}$ in V is a unique a linear combination

$$\mathbf{v} = c_1\mathbf{u}_1 + \cdots + c_n\mathbf{u}_n \, .$$

That is, the constants $c_1, \dots, c_n$ are uniquely determined. They are called the *coordinates* of $\mathbf{v}$ relative to B; we write them as a column $[\mathbf{v}]_B$ in $\mathbb{R}^n$.

(2) Once a basis for a vector space V of dimension n is fixed, we can "think of V as $\mathbb{R}^n$" as we identify every vector with its coordinate column.

(3) If B and B' are bases for the same vector space, then the transition matrix from B' to B is the matrix P such that $P[\mathbf{v}]_{B'} = [\mathbf{v}]_B$. It is invertible, and its inverse is the transition matrix from B ot B': $[\mathbf{v}]_{B'} = P^{-1}[\mathbf{v}]$.

(4) One can use Gauss–jordan elimination to find the transition matrix for bases for $\mathbb{R}^n$.

Suggested problems. To verify that you have understood the material, solve the following problems at the end of the section: 5, 7, 9, 11, 13, 23, and 43.

Date: October 14, 2014.