MATH 2360-D01 WEEK 13

SECTIONS 5.1–5.3; PAGES 225–258

Abstract. The dot product of vectors in $\mathbb{R}^2$ and $\mathbb{R}^3$ generalizes to $\mathbb{R}^n$, so one can speak of length and orthogonality of vectors in $\mathbb{R}^n$. The dot product on $\mathbb{R}^n$ is just one example of an inner product on a vector space. In any vector space with an inner product, one can talk about length and orthogonality, and given a basis for such a space, there is a procedure to produce a basis with pairwise orthogonal vectors of unit length.

Section 5.1

Reading. Make sure that you understand the following:

(1) The well-known dot product on $\mathbb{R}^2$ and $\mathbb{R}^3$ has a straightforward generalization to $\mathbb{R}^n$ for any $n \geq 1$.
(2) All the notions for vectors in $\mathbb{R}^2$ and $\mathbb{R}^3$ that are based on the dot product carry over to $\mathbb{R}^n$. They include lenght of vectors, angle between vectors, and distance between vectors.
(3) The Triangle Inequality and the Pythagorean Theorem also carry over to $\mathbb{R}^n$.

Suggested problems. To verify that you have understood the material, solve the following problems at the end of the section: 1, 3, 7, 11, 21, 23, and 25.

Section 5.2

Reading. Make sure that you understand the following:

(1) That any inner product on a vector space has the same essential properties as the dot product on $\mathbb{R}^n$ and gives definitions of lenght, distance, angle, etc.
(2) What projection of vectors means in an inner product space.

Suggested problems. To verify that you have understood the material, solve the following problems at the end of the section: 3, 5, 11, 19, and 39.

Section 5.3

Reading. Make sure that you understand the following:

(1) What it means for a set of vectors to be orthogonal.
(2) What it means for a set of vectors to be orthonormal.
(3) That an orthogonal set of vectors is linearly independent.
(4) The Gram–Schmidt orthonormalization process.

Suggested problems. To verify that you have understood the material, solve the following problems at the end of the section: 3, 7, 11, 15, and 31.

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