

**MATH V1201 WEEK 1 REVIEW**  
**VECTORS, COORDINATE SYSTEMS, DOT PRODUCT**  
**SEPTEMBER 8 & 10, 2009.**

In the textbook: §12.1, 12.2, 12.3, pp. 1001, 1005-1006

BASIC SKILLS<sup>1</sup>

- Add vectors and multiply vectors by scalars (real numbers), both geometrically and in coordinates.
- Convert between rectangular and polar coordinates on  $\mathbb{R}^2$ , and between rectangular, cylindrical and spherical coordinates on  $\mathbb{R}^3$ ,
- Compute the dot product of two vectors.
- Compute the angle between two vectors, a unit vector in a given direction, and the correlation between two vectors.
- Determine if two vectors are orthogonal.
- Project one vector onto the line through another.

WHERE THIS MATERIAL WILL BE USED NEXT

- We'll use vectors in  $\mathbb{R}^n$  every day for the rest of the semester.
- We'll next use the dot product next Thursday when writing implicit equations for lines and planes.

APPLICATIONS OF THIS MATERIAL

- The correlation between two vectors of data.

MANTRAS<sup>2</sup>

- The same vector can be represented in many different ways.
- The dot product of  $\vec{v}$  and  $\vec{w}$  is the length of  $\vec{v}$  times the length of  $\vec{w}$  times the cosine of the angle between  $\vec{v}$  and  $\vec{w}$ .
- Vectors  $\vec{v}$  and  $\vec{w}$  are orthogonal if  $\vec{v} \cdot \vec{w} = 0$ .

THINGS TO THINK ABOUT<sup>3</sup>

- One encounters vectors, both geometric ones and ones corresponding to lists of data, all the time. Try to notice them. For the vectors of data, think about their correlations. For example, there's a vector of (number of textbooks in each class)—e.g., (17 [history], 1 [math], . . .) . Is it negatively or positively correlated with (number of hours you spend per week on each class)?

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<sup>1</sup>i.e., after this week you should be able to do these in your sleep.

<sup>2</sup>i.e., short summaries of key ideas you should understand.

<sup>3</sup>i.e., deeper or more complicated ideas to mull over.