Section 3.3 Orthogonality Overview and To-Do List

This section focuses on orthogonal (perpendicular) vectors. The previous definition of an angle θ between two vectors tells us that $\theta = \pi/2$ if and only if the dot product of the vectors is 0. This gives rise to the following definition:

Definition. Two nonzero vectors $\vec{u}$ and $\vec{v}$ in R^n are said to be **orthogonal** (or perpendicular) if $\vec{u} \bullet \vec{v} = 0$. Also we will agree that the zero vector in R^n is orthogonal to every vector in R^n.

Example. The vectors $\vec{u} = (-2, 3, 1, 4)$ and $\vec{v} = (1, 2, 0, -1)$ are orthogonal vectors in R^n for $n = 4$ since
-2(1) + 3(2) +1(0) + 4(-1) = 0.

We see that we have an extension of the **Pythagorean Theorem** in R^n. This is easily proved in **Theorem 3.3.2.** Review this result and its proof.

The rest of Section 3.3. reviews the way orthogonality has been used in the past in Calculus II and our own review of lines and planes at the beginning of the course. The applications addressed include:

- Vector equations of lines and planes which give rise to corresponding linear equations (some of this Calculus II material was reviewed at the beginning of the course);
- Orthogonal projection of one vector onto another; and
- Finding distances between a point and a line in R^2 and between a point and a plane in R^3. **<u>This is a Calculus review. We will not be dealing much with these distances.</u>**

Read Section 3.3. Work Problems 1, 3-4, 7-8, 11, 13a, 15

Video: Inner product and orthogonality

https://youtu.be/-DDsguw-M2w

Video: vector equation of line

https://youtu.be/H7wre3njI0Y Quiz 15.

NO CHECK QUIZ (#15 has been eliminated) for Section 3.3.