Homework 7

Math 112

Due June 5th at the start of class

Textbook Exercises

4.1: 4.1.4B, 4.1.5B, 4.1.6B, 4.1.7B

4.2: 4.2.1B, 4.2.2B, 4.2.3B, 4.2.5B, 4.2.7B, 4.2.11B

4.3: 4.3.1B, 4.3.3B, 4.3.5B, 4.3.8B, 4.3.10B, 4.3.12B, 4.3.15B

Whenever the book uses the word perpendicular, treat it as through they'd used orthogonal.

Exercise 1: Let $\vec{v}$ be the vector from $(-1,-1)$ to $(1,5)$ and $\vec{w}$ the vector from $(0,0)$ to $(-3,0)$.

a) Find a unit vector decomposition for $\vec{v}$ and $\vec{w}$.

b) Find $\vec{v}+\vec{w}$ and draw all three vectors.

c) Find $||\vec{v}||$, $||\vec{w}||$, and $||\vec{v}+\vec{w}||$.

d) Find $\vec{v} \bullet \vec{w}$.

e) What is the angle between $\vec{v}$ and $\vec{w}$?

Exercise 2: We can talk about vectors in higher dimensions — let's have a look at 3-dimensional ones.

a) Let $\vec{k}$ be the unit vector that points in the positive z-direction (so if you draw an xy-plane, it points straight up out of the origin). Let $\vec{v}$ be the vector from $(1, 2, 3)$ to $(4, 4, 4)$. Find the unit vector decomposition of $\vec{v}$ in terms of $\vec{i}$, $\vec{j}$, and $\vec{k}$.

b) Move $\vec{v}$ so that it starts at the origin and imagine casting a shadow down from above (so from the positive-z direction). Use the Pythagorean theorem to find the distance from the origin to the tip of that shadow.

c) Now use the Pythagorean theorem again to find $\|\vec{v}\|$. The hard part here is finding the right triangle — drawing a picture might help!

d) Consider the vector $\vec{w} = -4\vec{i} + 2\vec{j} - 5\vec{k}$. Use the same process from the previous two parts to find $\|\vec{w}\|$.

e) What should $\vec{v} \bullet \vec{w}$ be?

f) It's not quite as clear what we mean when we say the *angle between* $\vec{v}$ *and* $\vec{w}$, but we can still use the dot product formula to find it. Do so, and make sure it seems reasonable.