

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) Notice how the square root from the first Pythagorean theorem use comes off, then another one gets placed over the whole thing? This always happens — $\|a\vec{i} + b\vec{j} + c\vec{k}\| = \sqrt{a^2 + b^2 + c^2}$. Use this 3-dimensional Pythagorean theorem to find $\|\vec{w}\|$, where $\vec{w} = -4\vec{i} + 2\vec{j} - 5\vec{k}$.
- 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.