Math 210 (Lesieutre)
11.3: Dot products
January 13, 2017

Problem 1. For each of the following, try to estimate the dot product without making any calculations. Then check your answer using the formula.

a) $\langle 3, 4\rangle \cdot \langle 4, 3\rangle$

b) $\langle 3, 1\rangle \cdot \langle -1, 4\rangle$

c) $\langle 1, 0, 0\rangle \cdot \langle 0, 1, -1\rangle$

d) $\langle 1, 2, 3\rangle \cdot \langle -2, -2, -2\rangle$

Problem 2. Compute the angle between the two vectors in 1(a). (Your answer might be in terms of an $\cos^{-1}$).

Problem 3. Suppose that $\mathbf{v} = \langle a, b\rangle$ is a vector. What is $\mathbf{v} \cdot \mathbf{v}$?

Problem 4. Sketch the vectors $\mathbf{u} = \langle 2, 1\rangle$ and $\mathbf{v} = \langle 1, 1\rangle$, and draw the vector $\text{proj}_{\mathbf{v}}\,\mathbf{u}$. What is $\text{scal}_{\mathbf{v}}\,\mathbf{u}$?

Problem 5. A force $\mathbf{F} = 2, 1, 1$ (Newtons) pushes an object from $(1, 0, 0)$ to $(3, 0, 0)$ (meters). Calculate the work done (Joules).

Problem 6. A 20 pound block sits on a plane with slope 30 degrees. Compute the components of the gravitation force that are parallel and perpendicular to the plane.

Problem 7. a) Describe the set of all vectors $\mathbf{v}$ for which $\mathbf{v} \cdot \langle 1, 1, 1\rangle = 0$.

b) For which vectors is $\text{proj}_{\langle 1,0,0\rangle} = 5$?