Written Homework 11

MATH 126

Solve each of the following problems. Work out your problems on scratch paper first, then write your solutions neatly on the pages you plan to turn in. Write the problems in assigned order, with each problem clearly labeled. Use words to clearly explain your work and methods. The reader should never have to guess or infer your intentions.

For a brief guide to writing homework solutions, see *Writing Mathematics Well* from Harvey Mudd College.

Scan or photograph your solutions and submit them (as a single file) to the Written Homework 11 assignment on Moodle. This assignment is due at classtime on **Wednesday, November 12**.

1. Calculate $\mathbf{u} \cdot \mathbf{v}$ when:

(a) $\mathbf{u} = \langle 4, 7 \rangle$ and $\mathbf{v} = \langle -5, 8 \rangle$

(b) $\mathbf{u} = \langle 3a, a, 2a \rangle$ and $\mathbf{v} = \langle 1, -1, 1 \rangle$

2. Find an expression that gives exact angle between vectors $\mathbf{u}$ and $\mathbf{v}$ when:

(a) $\mathbf{u} = \langle 1, 4, -2 \rangle$ and $\mathbf{v} = \langle 3, 1, 5 \rangle$

(b) $\mathbf{u} = \langle 1, 2, 1 \rangle$ and $\mathbf{v} = \langle b, 0, 3b \rangle$

3. Determine whether each statement is always true, sometimes true, or never true.

Always true means that the statement is true for all vectors $\mathbf{u}$ and $\mathbf{v}$ in $\mathbb{R}^3$. In this case, explain why the statement must be true.

Sometimes true means that the statement is true for some, but not all vectors $\mathbf{u}$ and $\mathbf{v}$ in $\mathbb{R}^3$. In this case, you should give a specific example of vectors for which the statement is true, and another specific example of vectors for which the statement is not true.

Never true means that the statement is false for all vectors $\mathbf{u}$ and $\mathbf{v}$ in $\mathbb{R}^3$. In this case, explain why the statement cannot possibly be true.

(a) For vectors $\mathbf{u}$ and $\mathbf{v}$ in $\mathbb{R}^3$, $|\mathbf{u} \times \mathbf{v}| = |\mathbf{v} \times \mathbf{u}|$.

(b) For vectors $\mathbf{u}$ and $\mathbf{v}$ in $\mathbb{R}^3$, $(\mathbf{u} \times \mathbf{v}) \cdot \mathbf{u} = 0$.

4. Find two unit vectors that are orthogonal to both $\mathbf{j} + 2\mathbf{k}$ and $\mathbf{i} - 2\mathbf{j} + 3\mathbf{k}$.