

### Problem 1

Let  $\vec{u} = 2i + 3j - 4k$  and  $\vec{v} = -i + 2j + 2k$ . Find  $\vec{u} \cdot \vec{v}$  and the angle between them.

### Problem 2

For two arbitrary vectors,  $\vec{u}$  and  $\vec{v}$  in  $\mathbb{R}^3$ , show that  $\vec{u} \cdot \vec{v} = \vec{v} \cdot \vec{u}$  and  $(c\vec{u}) \cdot \vec{v} = \vec{u} \cdot (c\vec{v})$  for any constant  $c$ .

### Problem 3

Find 2 different vectors that are orthogonal to the vector  $\langle 1, 2, 3 \rangle$ .

## Problem 4

Let  $A$  be the triangle with vertices at the points  $(1, 1)$ ,  $(2, 5)$  and  $(4, 3)$ . Determine the 3 interior angles of  $A$ .

## Problem 5

A water main is to be constructed with a 20% grade while headed in the north direction and then takes a right turn to continue at a 10% grade in the east direction. Find the angle at the corner of the pipes. (see 11.3 problem 16 for a picture)

**Problem 6**

Let  $u = 2i + -j$  and  $v = 3i + 4j$ . Find  $\text{proj}_v u$  and  $\text{proj}_u v$ . Graph all 4 vectors to make sure that your computation makes sense.