

Section 12.3: Dot Products

Warm up:

Problem 1 If $\vec{u} = \hat{i} - 2\hat{j}$ and $\vec{v} = 3\hat{i} + 4\hat{k}$, find $\vec{u} \cdot \vec{v}$.

Group work:

Problem 2 Find a vector (in the xy -plane) with length 4 that makes a $\frac{\pi}{3}$ radian angle with the vector $\langle 3, 4 \rangle$.

Problem 3 Answer the following questions about $\text{proj}_{\vec{v}} \vec{u}$.

- (a) Is $\text{proj}_{\vec{v}} \vec{u}$ a vector of the form $c\vec{v}$ or $c\vec{u}$ (where c is a real number)? ie, is $\text{proj}_{\vec{v}} \vec{u}$ parallel to \vec{u} or \vec{v} ?
 - (b) If $\vec{u} = 5\hat{i} + 6\hat{j} - 3\hat{k}$ and $\vec{v} = 2\hat{i} - 4\hat{j} + 4\hat{k}$, find $\text{proj}_{\vec{v}} \vec{u}$.
 - (c) For \vec{u} and \vec{v} from part (b), write \vec{u} as the sum of two perpendicular vectors, one of which is parallel to \vec{v} . Verify that the other vector is perpendicular to \vec{v} .
-

Challenge Problem

Problem 4 Suppose that the deli at the Tiny Sparrow grocery store sells roast beef for \$9 per pound, turkey for \$4 per pound, salami for \$5 per pound, and ham for \$7 per pound. For lunches this week, Sam the sandwich maker buys 1.5 pounds of roast beef, 2 pounds of turkey, no salami, and half a pound of ham. How can you use a dot product to compute Sam's total bill from the deli?
