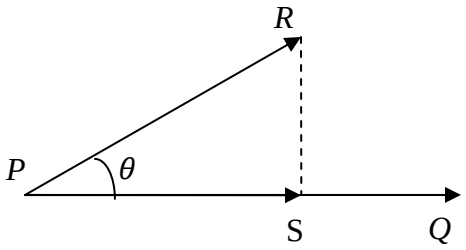
9.3 The Dot Product

Work and the Dot Product



We would like to compute the **work** done by moving an object from *P* to *Q* using constant force $\vec{F} = \overrightarrow{PR}$.

Definition – The Dot Product

Example 1
If a crate is slid 4 m along the floor by a constant force of 100 N at an angle of 15° to the horizontal, find the work done.

Perpendicular or Orthogonal Vectors

Dot Product in Component Form

If $\vec{a} =< a_1, a_2, a_3 >$ and $\vec{b} =< b_1, b_2, b_3 >$, then find $\vec{a} \cdot \vec{b}$

Example 2
Find $< 2, -1,3 > \cdot < 3,2,6 >$

Example 3
Find the angle between $< 2, -1,3 >$ and $< 3,2,6 >$.

Example 4
A force is given by $\vec{F} = 3\vec{\imath} + 2\vec{\jmath} - \vec{k}$ and acts moving an object from $P(2, -1,5)$ and $Q(4,2, -1)$.

Properties of the Dot Product

If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are vectors in V_3 and c is a scalar, then

Projections

Scalar projection of $\vec{b}$ onto $\vec{a}$:

Vector projection of $\vec{b}$ onto $\vec{a}$:

Example 5

Find the scalar projection and vector projection of $\vec{b} =< 2, -3,1 >$ onto $\vec{a} =< -2,5,1 >$.

HW # 1, 3, 7, 9, 11, 13, 17, 21, 23, 26, 27, 31, 35, 37