PDF 7.050 Dot Product Component Method

In R^2, given that $\vec{a} = \overrightarrow{(a_1, a_2)}$ and that $\vec{b} = \overrightarrow{(b_1, b_2)}$, then $\vec{a} \cdot \vec{b} = a_1 b_1 + a_2 b_2$

In R^3, given that $\vec{a} = \overrightarrow{(a_1, a_2, a_3)}$ and that $\vec{b} = \overrightarrow{(b_1, b_2, b_3)}$, then $\vec{a} \cdot \vec{b} = a_1 b_1 + a_2 b_2 + a_3 b_3$

The above rule in R^2 is proved in your powerpoint

Example 1

Determine the angle between the vectors $\vec{a} = \overrightarrow{(1, -3, 4)}$ and $\vec{b} = \overrightarrow{(-8, 5, 7)}$

Example 2

For what value(s) of k are the vectors $\overrightarrow{(-1, 3, 4)}$ and $\overrightarrow{(3, k, -2)}$ perpendicular?

Example 3

For what value(s) of m are the vectors $\overrightarrow{(m, m, -3)}$ and $\overrightarrow{(m, -3, 6)}$ perpendicular?

Example 4

For the vectors $\vec{p} = \overrightarrow{(4, m, -8)}$ and $\vec{q} = \overrightarrow{(-2, 16, n)}$, determine values of m and n that make the vectors either collinear or perpendicular.

Example 5

Determine the acute and obtuse angles between the diagonals of a box that measures 12 cm by 4 cm by 6 cm

Example 6

The vectors $\vec{a}$ and $\vec{b}$ are such that $\vec{a} = \overrightarrow{(-1,4,-8)}$ and $\vec{b} = \overrightarrow{(4,-3,m)}$ are such that $\theta = cos^{-1}\left(\frac{-16}{45}\right)$ where θ is the angle between $\vec{a}$ and $\vec{b}$. Solve for m.