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7.4 The Dot Product of Algebraic Vectors

Remember that algebraic vectors are those that can be expressed in component form. Dot product calculations are actually easier for algebraic vectors.

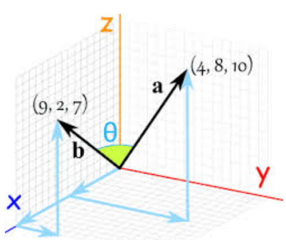
Calculating the Dot Product for Algebraic Vectors in $R^3$:

$\vec{x} \cdot \vec{y} = |\vec{x}||\vec{y}|\cos\theta = x_1y_1 + x_2y_2 + x_3y_3$, where $\vec{x} = (x_1, x_2, x_3)$ and $\vec{y} = (y_1, y_2, y_3)$

To show why this formula is true, find the dot product of the nonzero vectors $\vec{a} = a_1i + a_2j + a_3k$ and $\vec{b} = b_1i + b_2j + b_3k$.

Now rearrange the formula to determine how to find the angle between two vectors joined tail to tail.

Example: Given the vectors $\vec{a} = (-1, 2, 4)$ and $\vec{b} = (3, -2, 1)$, calculate the angle between them.



Practice Problems:

1) For what values of m are the vectors $\vec{p}$ = (m, m, 3) and $\vec{q}$ = (m, -3, 6) perpendicular?

2) Find a vector perpendicular to both $\vec{a}$ = (1, 5, -1) and $\vec{b}$ = (-3, 1, 2)

3) Find $\vec{u}$ $\vec{v}$, where $\vec{u}$ = 3i + 2j - 7k and $\vec{v}$ = -7i + 4j - 3k.