1 11.2: Review of Vectors

Recall: A **vector** is a quantity that has both magnitude and direction. A vector can be placed anywhere in the coordinate system without changing its value. A vector placed at the origin corresponds to a unique point in the coordinate system.

Operations with Vectors: All the basic operations and notation on 3-dimensional vectors are the same as 2-dimensional vectors as shown in the examples below:

Given $\mathbf{a} = \langle 6, 0, 2 \rangle$ and $\mathbf{b} = 5\mathbf{i} + 3\mathbf{j} - 2\mathbf{k}$:

$\mathbf{a} + \mathbf{b} =$

$\mathbf{a} - \mathbf{b} =$

$-2\mathbf{b} =$

$|\mathbf{a}| =$

$\mathbf{a} \cdot \mathbf{b} =$

$\cos\theta =$

$\text{comp}_{\mathbf{a}}\mathbf{b} =$

$\mathbf{proj_a}\mathbf{b} =$

Other Terms (some new, some old):

Direction Angles/Direction Cosines:

Orthogonal Vectors:

Work:

Examples:

Given the points $P(1, 0, -1)$, $Q(2, 3, 1)$, and $R(0, 4, 1)$, find $\angle PQR$

Find the direction cosines of the vector from P to Q above.

Find a unit vector in the direction of the vector from $(1,\ 1, -5)$ to $(0, -6,\ 3)$.

On Beyond Average:

Find the angle between the diagonal of a cube of side length 1 and the diagonal of one of its sides.

Find the exact angle (in degrees) between the vectors $\mathbf{u} = \langle 1, 1, 0 \rangle$ and $\mathbf{v} = \langle 1, 2, 1 \rangle$.