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 \( \mathbf{a} = (6, 0, 2) \) and \( \mathbf{b} = 5\mathbf{i} + 3\mathbf{j} - 2\mathbf{k} \):

\[
\mathbf{a} + \mathbf{b} =
\]

\[
\mathbf{a} - \mathbf{b} =
\]

\[
-2\mathbf{b} =
\]

\[
|\mathbf{a}| =
\]

\[
\mathbf{a} \cdot \mathbf{b} =
\]

\[
\cos \theta =
\]

\[
\text{comp}_\mathbf{a} \mathbf{b} =
\]

\[
\text{proj}_\mathbf{a} \mathbf{b} =
\]
Other Terms (some new, some old):

Direction Angles/Direction Cosines:

Orthogonal Vectors:

Work:

Examples:

Given the points $P(1, 0, -1), Q(2, 3, 1), \text{ and } R(0, 4, 1)$, find $\angle PQR$
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 $u = \langle 1, 1, 0 \rangle$ and $v = \langle 1, 2, 1 \rangle$. 