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 $P(1, 0, -1)$, $Q(2, 3, 1)$, and $R(0, 4, 1)$, find $\angle PQR$. 
Find a unit vector in the direction of the vector from \((1,1,-5)\) to \((0,-6,3)\).

Consider the points \(P, Q,\) and \(R\) from the previous page. Given the nonzero vector \(\langle a, b, c \rangle\) is orthogonal to the vector from \(P\) to \(Q\) and the vector from \(R\) to \(Q\), find \(a, b,\) and \(c\). (NOTE: multiple answers possible)