Formulas & Definitions: Section 12-2

Definition of vector addition: If u and v are vectors positioned so the terminal point of v is at the terminal point of u, then the **sum** $u+v$ is the vector from the initial point of u to the terminal point of v.

Definition of scalar multiplication: If c is a scalar and v is a vector, then the **scalar multiple** cv is the vector whose length is $|c|$ times the length of v and whose direction is the same as v if $c > 0$ and is opposite to v if $c < 0$. If $c = 0$ or $v = 0$, then $cv = 0$.

Definition: Given points $A(x_1, y_1, z_1)$ and $B(x_2, y_2, z_2)$, the vector a with representation $\overrightarrow{AB}$ is

$$\boxed{\text{a}= \langle x_2 - x_1, y_2 - y_1, z_2 - z_1 \rangle}$$

Definition: The length of the two-dimensional vector $a = \langle a_1, a_2 \rangle$ is

$$a = \sqrt{a_1^2 + a_2^2}.$$

The length of the three-dimensional vector $a = \langle a_1, a_2, a_3 \rangle$ is

$$a = \sqrt{a_1^2 + a_2^2 + a_3^2}.$$

Definition: If $a = \langle a_1, a_2 \rangle$ and $b = \langle b_1, b_2 \rangle$, then

$$a + b = \langle a_1 + b_1, a_2 + b_2 \rangle, \quad a - b = \langle a_1 - b_1, a_2 - b_2 \rangle, \quad ca = \langle ca_1, ca_2 \rangle,$$

$$\langle a_1, a_2, a_3 \rangle + \langle b_1, b_2, b_3 \rangle = \langle a_1 + b_1, a_2 + b_2, a_3 + b_3 \rangle,$$

$$\langle a_1, a_2, a_3 \rangle - \langle b_1, b_2, b_3 \rangle = \langle a_1 - b_1, a_2 - b_2, a_3 - b_3 \rangle,$$

$$c\langle a_1, a_2, a_3 \rangle = \langle ca_1, ca_2, ca_3 \rangle.$$

Definition: If a, b, and c are vectors in V_n and c and d are scalars, then

1. $a + b = b + a$
2. $a + 0 = a$
3. $\alpha(a + b) = \alpha a + \alpha b$
4. $(\alpha\beta)a = \alpha(\beta a)$
5. $a + (b + c) = (a + b) + c$
6. $a + (-a) = 0$
7. $(\alpha + \beta)a = \alpha a + \beta a$
8. $1 \cdot a = a$

$$\boxed{\text{i}= \langle 1, 0, 0 \rangle, \quad j = \langle 0, 1, 0 \rangle, \quad k = \langle 0, 0, 1 \rangle}$$