(1) Let \( \overrightarrow{a} = (3, 5, -2) \) and \( \overrightarrow{b} = (2, -1, 0) \). Find

(a) \( \overrightarrow{a} + \overrightarrow{b} = (5, -4, -2) \)  
(b) \( 3\overrightarrow{a} - 4\overrightarrow{b} = (1, 19, -6) \)

(2) Let \( u = i + 2j - 3k \) and \( v = 2i + k \). Find

(a) \( |u| = \sqrt{14} \)  
(b) \( |2u - 3v| = \sqrt{113} \)

(3) Write each combination of vectors as a single vector.

(a) \( \overrightarrow{AB} + \overrightarrow{BC} = \overrightarrow{AC} \)
(b) \( \overrightarrow{CD} + \overrightarrow{DB} = \overrightarrow{CB} \)
(c) \( \overrightarrow{DB} - \overrightarrow{AB} = \overrightarrow{DA} \)
(d) \( \overrightarrow{DC} + \overrightarrow{CA} + \overrightarrow{AB} = \overrightarrow{DB} \)

(4) Determine whether the points are collinear.

(a) \( A = (2, 4, 2), \quad B = (3, 7, -2), \quad C = (1, 3, 3) \) NOT Collinear  
(b) \( D = (0, -5, 5), \quad E = (1, -2, 4), \quad F = (3, 4, 2) \) Collinear

(5) Normalize \( \overrightarrow{a} = (2, 4, -4) \). \( \overrightarrow{a}/|\overrightarrow{a}| = \left( \frac{1}{\frac{6}{\sqrt{6}}}, \frac{2}{\frac{6}{\sqrt{6}}}, -\frac{2}{\frac{6}{\sqrt{6}}} \right) \)

(6) Find a vector that has the same direction as \((-2, 4, 2)\), but has length 6. \( \left( -\frac{6}{\sqrt{6}}, \frac{12}{\sqrt{6}}, \frac{6}{\sqrt{6}} \right) \)

(7) Find the vector and parametric equations for the line through the point \((3, 2, 6)\) and parallel to the vector \((6, -5, 1)\).

**Vector Equation** \[ l(t) = (3, 2, 6) + t(6, -5, 1), t \in \mathbb{R} \]

**Parametric Equations** \[
\begin{align*}
x &= 3 + 6t \\
y &= 2 - 5t, \quad t \in \mathbb{R} \\
z &= 6 + t
\end{align*}
\]
(8) Find the vector and parametric equations for the line through the point \((0, 14, -10)\) and parallel to the line \(x = -1 + 2t, y = 6 - 3t, z = 3 + 9t\).

Vector Equation

\[ l(t) = (0, 14, -10) + t(2, -3, 9), \quad t \in \mathbb{R} \]

Parametric Equations

\[ x = 2t \]
\[ y = 14 - 3t, \quad t \in \mathbb{R} \]
\[ z = -10 + 9t \]

(9) Find the vector equation of the line segment through the points \(P = (4, 7, 10)\) and \(Q = (-1, -4, -9)\).

\[ l(t) = (-1, -4, -9) + t(5, 11, 19) \text{ where } 0 \leq t \leq 1 \]

(10) Do problem (9) again, but find a different equation for the line segment. [This is called finding a different parametrization for the line segment.]

\[ l(t) = (-1, -4, -9) + t(10, 22, 38) \text{ where } 0 \leq t \leq 1/2 \]

or

\[ l(t) = (4, 7, 10) + t(-5, -11, -19) \text{ where } 0 \leq t \leq 1 \]

These are not the only different parametrizations for the line segment. In fact, you can multiply the direction vector by any scalar \(\alpha\) and then restrict \(t\) so that \(0 \leq t \leq 1/\alpha\).

(11) Use set theoretic or vector notation to describe the points that lie in the plane spanned by \(u = (2, 6, -4)\) and \(v = (-1, 3, 5)\).

\[ \{(2, 6, -4)t + (-1, 3, 5)s | t \in \mathbb{R}, s \in \mathbb{R}\} = \{(2t - s)i + (6t + 3s)j + (5s - 4t)k | t, s \in \mathbb{R}\} \]

(12) Use set theoretic or vector notation to describe the points that lie in the parallelogram whose adjacent sides are the vectors \(i - 2k\) and \(i + j + k\).

\[ \{(s + t)i + t(j + (t - 2s)k | 0 \leq t \leq 1, 0 \leq s \leq 1\} \]