Analytic Geometry - Assignment #1

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Exercise 1 Let ΔABC be a triangle and let M, N, P be the midpoints of the line segments AB, BC and CA, respectively. Write the vectors $\overrightarrow{BP}, \overrightarrow{AN}$ and $\overrightarrow{CM}$ as linear combinations of $\overrightarrow{AB}$ and $\overrightarrow{AC}$.

Exercise 2 Let $\vec{u}, \vec{v}, \vec{w}, \vec{z}$ be vectors satisfying
(1) $\vec{w} = \vec{u} + \vec{v}$; and
(2) $\vec{u}$ is parallel to $\vec{z}$.
Prove that $\vec{w}$ is parallel to $\vec{z}$ if, and only if, $\vec{v}$ is parallel to $\vec{z}$.

Exercise 3 Suppose that $\overrightarrow{AB} = \lambda \overrightarrow{BC}$. Prove that the vectors $\overrightarrow{OA}, \overrightarrow{OB}$ and $\overrightarrow{OC}$ are LD for any given point O.

Exercise 4 Prove that if the vectors $\vec{u}, \vec{v}, \vec{w}$ are LI then $\vec{u} + \vec{v}, \vec{u} - \vec{v}, \vec{w} - 2\vec{u}$ are also LI.

Exercise 5 Find scalars m, n such that the vectors $\vec{u}, \vec{v}$ are LD, where
(1) $\vec{v} = (1, m, n+1)$ and $\vec{w} = (m, n, 2)$;
(2) $\vec{v} = (1, m-1, m)$ and $\vec{w} = (m, n, 4)$.

Exercise 6 In each of the following prove or disprove that the given subset is a basis for the vector set V.
(1) $B = \{(1, -1, 2), (0, -2, 1), (-1, 0, 1)\}$
(2) $B = \{(0, -1, 2), (1, 2, -4), (-1, 0, 0)\}$

Exercise 7 Consider the vectors $\vec{u} = (2, -1, 2)$ and $\vec{v} = (1, 2, -2)$. Find scalars a, b such that $\vec{w} = a\vec{u} + b\vec{v}$ and $\vec{w} \cdot \vec{v}$=0.

Exercise 8 Prove that $(\vec{u} \times \vec{v}) \times \vec{w} \neq \vec{u} \times (\vec{v} \times \vec{w})$.