6.4 Properties of Vectors

Ex 1. If \( \vec{a} = 2\hat{i} - 3\hat{j} \) and \( \vec{b} = \hat{i} + \hat{j} \), find \( \hat{i} \) and \( \hat{j} \) in terms of \( \vec{a} \) and \( \vec{b} \).

Ex 2. Consider the triangle \( \triangle ABC \). Let \( M \) be the midpoint of \( AC \) and \( N \) be the midpoint of \( BC \). Prove that \( MN = \frac{1}{2} AB \).

Ex 3. Consider a polygon \( ABCD \) and let \( P, Q, R, \) and \( S \) be the midpoints of \( AB, BC, CD, \) and \( DA \) respectively. Prove that \( PQRS \) is a parallelogram.
Ex 4. Prove that diagonals of a rhombus (rhomboid) are perpendicular to each other.

Ex 5. Consider the triangle \( \triangle ABC \) and the point \( O \) defined by \( \overrightarrow{AO} = \frac{\overrightarrow{AB} + \overrightarrow{AC}}{3} \). Let \( M \) be the midpoint of \( BC \).

a) Prove that \( \overrightarrow{OA} + \overrightarrow{OB} + \overrightarrow{OC} = \mathbf{0} \).

b) Prove that \( \overrightarrow{AM} = \frac{3}{2} \overrightarrow{AO} \).

**Reading:** Nelson Textbook, Pages 302-306

**Homework:** Nelson Textbook: Page 306 #1, 6, 7, 8, 9; Page 308 #3, 6, 7, 13, 15