



Objective:

To explore the fundamental concepts of vectors, including their representation, operations (addition, subtraction, and scalar multiplication), and geometric interpretation. Investigate and apply the concepts of vectors in the context of a real-world problem. This will involve exploring geometric and algebraic properties of vectors, creating diagrams, and providing mathematical justifications.

Background Knowledge:

Ensure you understand:

- The different notations for vectors (bold type, tilde, arrow notation, and ordered pairs).
- Representation of vectors in terms of components and unit vectors
- Operations on vectors (addition, subtraction, scalar multiplication).
- Displacement vectors and their connection to geometry.

Investigation Scenario:

You are designing a simple navigation system for a drone delivery service. The drone operates in a two-dimensional plane, where each position is represented as a vector in terms of its x and y coordinates.

Task 1, 2 & 3 - Drone Pathway Analysis

Task 4 - Visual Representation

Task 5 & 6 - Vector Operations

Task 7 & 8 - Challenge

Submission Requirements:

- **Submit documents via google classroom Assessment Task 1 before the due date**
- **Provide clear working, diagrams, and explanations.**
- **Justify your calculations and reasoning. Use graphing software or neatly hand-drawn diagrams for visual representations.**

Drone Path Analysis

Task 1: Vector Representation of Locations

- The drone starts at point **A**(2,3)
- It delivers packages at points **B**(6,8), **C**(10,2), and **D**(4,-1)
- Represent the position of each point as a vector **OA**, **OB**, **OC** and **OD**

Task 2 : Displacement Vectors

- Calculate the displacement vectors for each leg of the journey, represent these in component form.

Task 3: Total Journey Analysis

- Calculate the total displacement vector for the entire journey.
- Verify this by adding all individual displacement vectors.

Visual Representation

Task 4: Geometric Representation

- Plot the journey on a Cartesian plane, clearly indicating each vector and its direction. Use arrows to show displacement vectors.

Vector Operations

Task 5: Scalar Multiplication and Scaling

- If the drone travels twice as fast in the **AB** segment, determine the scaled vector. Represent this geometrically.

Task 6: Midpoint and Average Position:

- Calculate the midpoint of the path **AC**.
- Interpret the result in terms of the drone's average position for this segment.

Challenge

Task 7: Efficiency Analysis

- Determine the magnitude of each displacement vector.
- Calculate the total distance traveled by the drone.

Task 8: Alternative Pathway

- Propose a different sequence of deliveries. Repeat the displacement calculations and discuss if the total distance differs.