Topic: Scalars, Vectors, and Vector Addition

- **Quantities in Physics** are things that can be measured (e.g., time, distance, speed).
- These are divided into two types:
    - **Scalars**: Only magnitude (e.g., time, speed)
    - **Vectors**: Magnitude + direction (e.g., force, velocity)
- **Vector Directions**:
    - Right (East) and Up (North) are positive
    - Left (West) and Down (South) are negative
    - Directions such as NE, NW, SE, SW are 45° angles from the main axes
- **Direction Terminology**:
    - “North of East” means from the east axis going upward
    - “East of North” means from the north axis going rightward
    - Similar naming applies for all 8 direction combinations

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Vector Addition (Parallel and Perpendicular)

- Vectors in the **same direction** are added
- Vectors in **opposite directions** are subtracted (use negatives)
- Direction must be mentioned with magnitude (e.g., 10 N east)

Examples:

- 5 N east + 5 N east = 10 N east
- 5 N east + 5 N west = 0 N (at rest)
- 10 N east + 15 N west = 5 N west

Resultant Vector (Perpendicular Vectors)

- Use the **Head-to-Tail Method**:
    - Identify Vector 1 (First) and Vector 2 (Second)
    - Move tail of first vector to the head of second
    - Resultant is drawn from the tail of second vector to the head of first vector
- If vectors are perpendicular:
    - Use **Pythagorean Theorem**
        - e.g., 3 N up and 4 N right → resultant = 5 N at an angle
    - Solve direction using trigonometry
        - Example: $\sin \theta$ = opposite/hypotenuse → angle = $\sin^{-1}(4/5)$

Vector Components

- To simplify angled vectors, break them into **X and Y components**
- Use:
    - X = magnitude × cos(θ)
    - Y = magnitude × sin(θ)
- Always resolve vectors into components before adding them
- **Key Point**: X is *not always* cosine; it depends on the **angle's position**

Challenging Vector Example

- For vectors at angles:
    - First resolve angled vectors into X and Y
    - Then use addition/subtraction
    - Finally apply Pythagorean theorem to get resultant magnitude
    - Use trig (e.g., $\tan^{-1}$) to find the angle/direction

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Closing Notes

- Focus on process: identify type (scalar/vector), apply direction, break into components
- Practice is essential; don't memorize blindly—**understand the logic**
- Video + notes will be uploaded to Google Classroom