

Lecture 1

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Table of Contents

1. [Vectors & Scalars](#)
2. [Units](#)
3. [PollEV Answers](#)

Vectors & Scalars

- Scaler
 - A quantity that has magnitude only
- Vectors are quantities that have both *magnitude* and *direction*
 - Magnitude
 - The size of the vector
 - Examples: 1, 2, 3, 4
 - Direction
 - The direction the vector is pointing
 - Examples: North, South, East, West
 - Examples: Velocity, force, displacement
 - Position vector
 - A vector that points from the origin to a point in space
 - Example: home is $\langle 0, 0 \rangle$, lecture hall is $\langle -1, 3 \rangle$, and coffee shop is $\langle 2, 2 \rangle$
 - The noted as \vec{V} from home to lecture hall is **X mph north**
 - $\hat{V} = \text{north}$
 - $|\vec{V}| = X$
 - To go from the lecture hall to the coffee shop, you would go **X MPH east**
 - To get the vector length, you would use the Pythagorean theorem (where vector length is the hypotenuse)
 - $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
 - $\sqrt{(2 - (-1))^2 + (2 - 3)^2} =$
 - $\sqrt{3^2 + (-1)^2} =$
 - $\sqrt{9 + 1} =$
 - $\sqrt{10}$
 - To get the vector displacement, you would subtract the two vectors
 - $\langle x_2, y_2 \rangle - \langle x_1, y_1 \rangle = \langle x_2 - x_1, y_2 - y_1 \rangle$
 - $2 - (-1) = 3$ and $2 - 3 = -1$ and thus the vector displacement is **$\langle 3, -1 \rangle$**

\rangle

Units

- Dimensionless numbers
 - Numbers that have no units
 - Examples: 1, 2, 3, 4
 - Dimensional numbers
 - Numbers that have units
 - Examples: $100W$, $10kg$, $25V$
 - Examples: The temperature in a room, the mass of an object
- Dimensional Scalars
 - Dimensionless number \times unit
 - Examples: $1m$, $2kg$, $3s$, $300,000m/s$

| Thing to Measure | Unit |
|------------------|---|
| Length | Meters (m) |
| Area | Square meters (m^2) |
| Volume | Cubic meters (m^3) |
| Time | Seconds (s) |
| Angle | Radians (rad), 1 degree = $\pi/180$ radians |
| Mass | Kilograms (kg) |
| Speed | Meters per second (m/s) |
| Force | Newtons ($kg \cdot m/s^2$) |
| Temperature | Fahrenheit (F), Celsius (C), Kelvin (K) |

PolIEV Answers

1. No Right Answer
2. No Right Answer