Lecture 1

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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**
      - $\hat{V}$ = **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 $\langle 3, -1 \rangle$

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 Scalers
  - Dimensionless number **x** 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)

PollEV Answers

1. *No Right Answer*
2. *No Right Answer*