Announcements 1/22

- Reminder: first lab this week (tonight or Wed)!
  - Read lab ahead of time on LON-CAPA
- Remember assigned side of room from last time
  - Today: work with at least one person you didn’t on Wednesday (groups recorded by TA)

Vectors vs. Scalars

- https://www.smbc-comics.com/comic/scalars

Vectors vs. Scalars

- Key difference between vectors and scalars: vectors represent quantities in space and require more than one number to describe in 2D, 3D
  - Can be amount of vector along each coordinate (component)
  - Can be magnitude and direction
- Vector quantities get a special notation: $\vec{F}, \boldsymbol{F}$
- Scalars are just plain numbers

Which is Vector and Which is Scalar?

- Distance
- Time
- Speed
- Velocity
- Acceleration
- Displacement
- Magnitude of a vector
- Energy
- Force
- Electric Field
- Power

Between Components and Magnitude/Direction (2D)

- If θ is the angle measured ccw from the +x axis:

Magnitude & Direction

$$A = |\vec{A}| = \sqrt{A_x^2 + A_y^2}$$

$$\theta = \tan^{-1}\left(\frac{A_y}{A_x}\right)$$

Components

$$A_x = A\cos\theta$$

$$A_y = A\sin\theta$$

- When adding/subtracting vectors, add and subtract their components
  - Convert to components first!

Relative Motion

- Velocity depends on a difference in position (displacement)
- We measure velocities as differences in motion compared to something else (like yourself)
- Observers moving relative to one another measure different velocities!

$$\vec{v} = \vec{v}' + \vec{V}$$

Vector Equations

- For vectors to be equal, every component must be equal
- We can write equations with vectors: these stand for equations in every component!
- Ex: $\Delta \vec{r} = \vec{v}_0 t + \frac{1}{2}\vec{a}\, t^2$