PHYS 210 - General Physics I

- From lab …
- Vectors
- Average and instantaneous acceleration
- Problem solving
- Example
- Motion at a constant acceleration

11 Sep 19

From lab …

Dealing with uncertainties

Precision of measurement is indicated by number of decimal places

- Absolute uncertainties

$$\text{Suppose } x = 5.14cm \text{ and } \delta x = 0.02cm$$

$$\text{We write } x \pm \delta x = 5.14cm \pm 0.02cm$$

Note that precision of *x* matches precision of *δx*

- Relative (percent) uncertainties

$$\frac{\delta x}{x} = \frac{0.02cm}{5.14cm} = 0.00389 = 0.389\%$$

From lab …

Dealing with uncertainties

- Adding or subtracting quantities:
  - Add (always add!) their absolute uncertainties

$$\text{E.g., if } L = x + y, \text{ then } \delta L = \delta x + \delta y$$

- Multiplying or dividing quantities:
  - Add (always add!) their relative uncertainties

$$\text{E.g., if } L = xy, \text{ then } \frac{\delta L}{L} = \frac{\delta x}{x} + \frac{\delta y}{y}$$

Motion diagrams

- We can indicate positions of our motion diagram points using Cartesian coordinates (if you define a coordinate system!)

OR

with

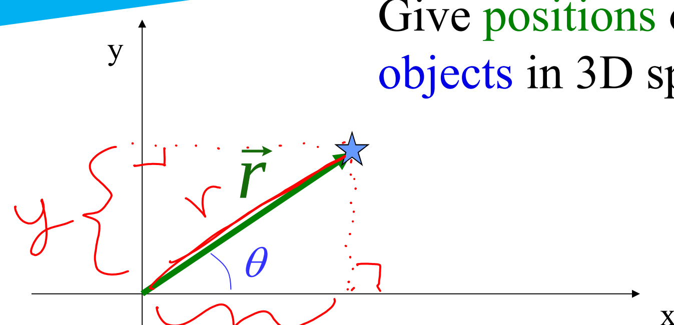
Vectors!

Vectors

- **Geometric interpretation**
- Magnitude & direction
- Components
- Unit vector notation

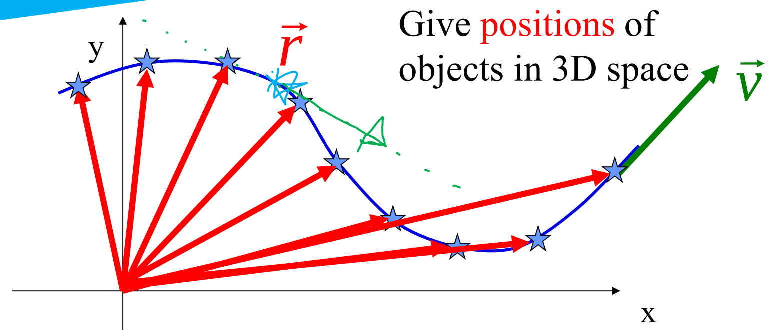
Position vectors

Give positions of objects in 3D space



- The length of the position vector is called its magnitude
- One MUST define a coordinate system for position vectors!

Position vectors



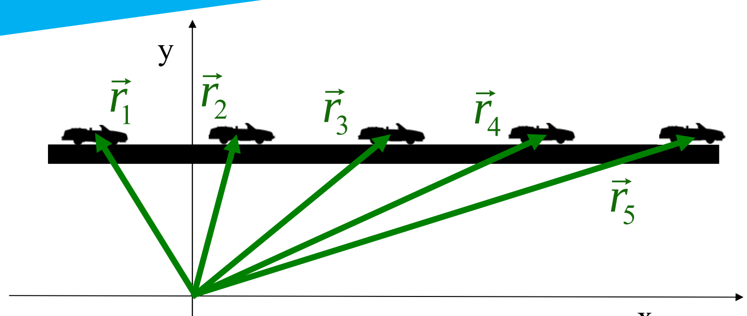
Give positions of objects in 3D space

Position vectors trace out paths of objects in 3D space

Velocity vectors are tangent to the paths

(so, they point in the direction of motion)

Position vectors



- One MUST define a <u>coordinate system</u> for position vectors!
- The "tail" of a position vector is at the origin.

Average Speed and Velocity

- Average Speed is distance traveled divided by elapsed time

$$\bar{v} = \frac{\text{distance traveled}}{\text{elapsed time}} = \frac{\Delta x}{\Delta t} = \frac{\Delta r}{\Delta t}$$

- Average velocity is the rate of change of position

$$\vec{v} = \frac{\Delta \vec{x}}{\Delta t} = \frac{\Delta \vec{r}}{\Delta t}$$

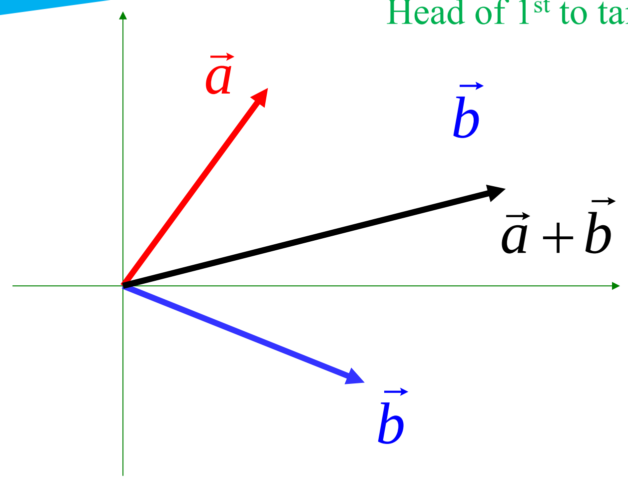
Vectors

- Geometric interpretation
- Magnitude & direction
- Components
- Unit vector notation

not just yet!

Vector addition (P.3.16)

Head of 1st to tail of 2nd



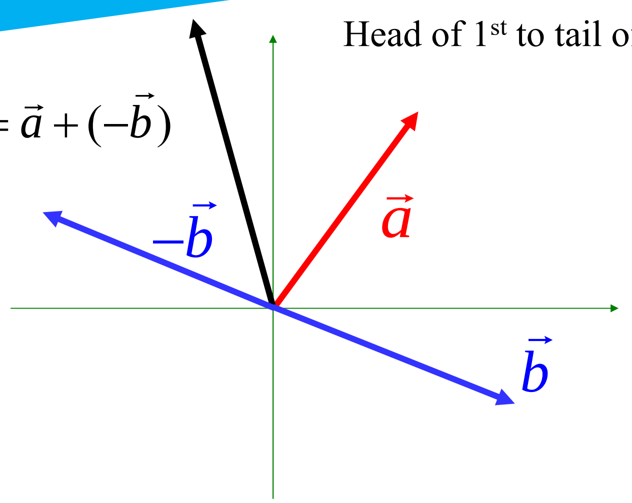
- To add/subtract vectors, we add/subtract like components

Vector subtraction (P.3.16)

(using vector b from previous slide)

Head of 1st to tail of 2nd

$$\vec{a}-\vec{b}=\vec{a}+(-\vec{b})$$



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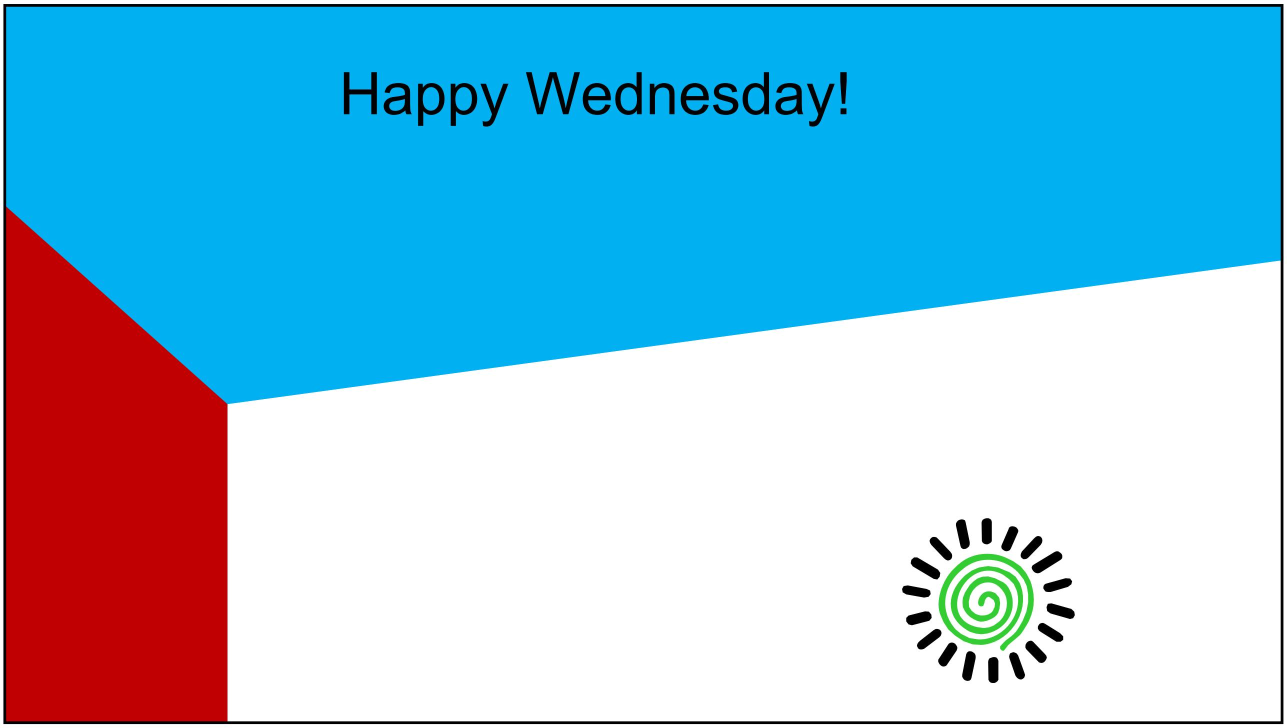
Happy Wednesday!