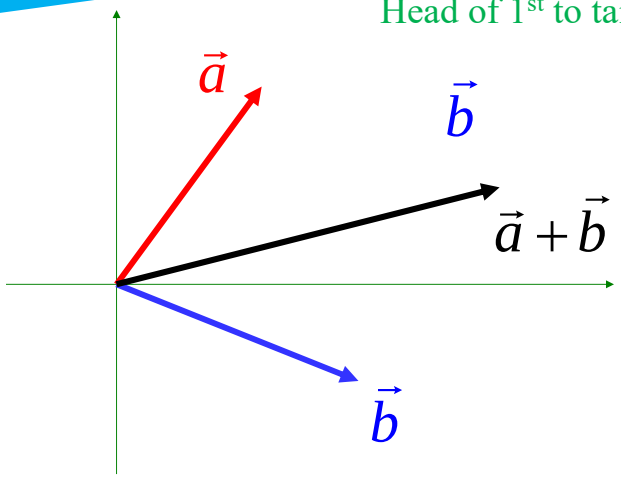
PHYS 210 - General Physics I

- Velocity and calculus
- Average and instantaneous acceleration
- Problem solving
- Example
- Motion at a constant acceleration

13 Sep 19

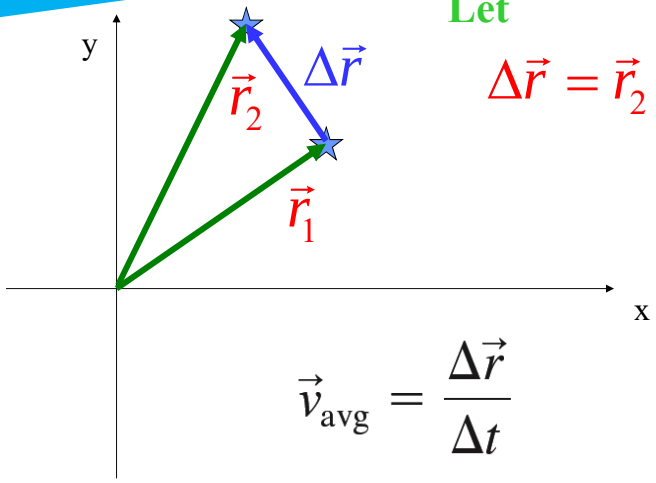
Vector addition (P.3.16)

Head of 1st to tail of 2nd



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

Position vectors



Let

$$\Delta\vec{r} = \vec{r}_2 - \vec{r}_1$$

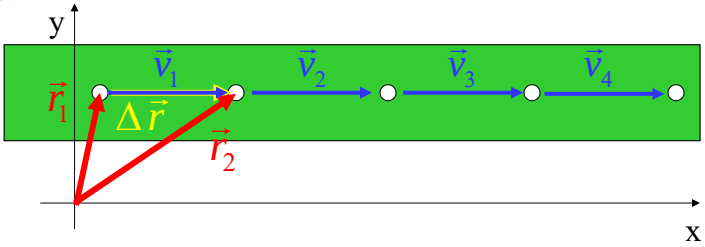
$$\vec{v}_{\text{avg}} = \frac{\Delta\vec{r}}{\Delta t}$$

Position & displacement vectors

- Pair up

- Work out p. 1.3 (section 1.3) #10 and #11 in the Student Workbook!

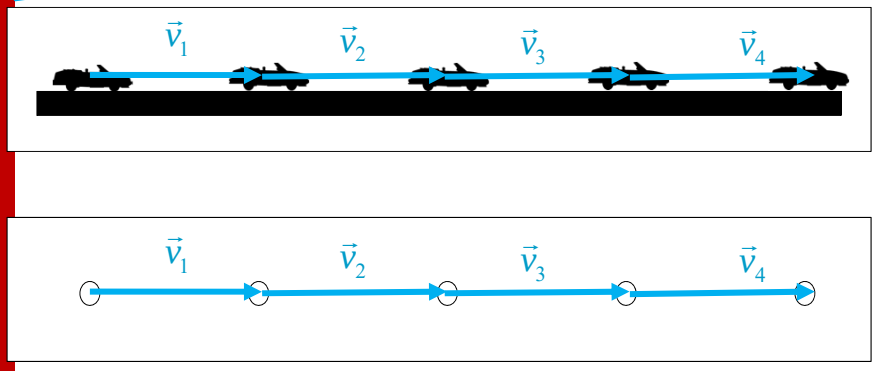
Velocity



Since $\vec{v}_{avg} = \dfrac{\Delta\vec{r}}{\Delta t}$

then, for equal time intervals, velocity vectors are proportional to displacement vectors.

Velocity vectors



Speed and Velocity

Also called "instantaneous" speed/velocity

- Speed is distance traveled divided in an infinitesimal time

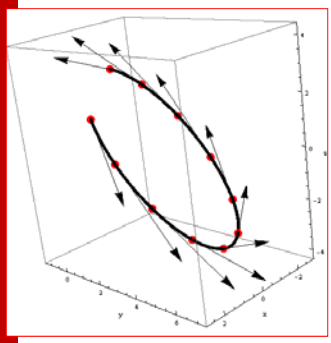
$$v = \frac{\text{distance traveled}}{\text{infinitesimal time}} = \frac{dx}{dt} = \frac{dr}{dt}$$

- Velocity is the rate of change of position

$$\vec{v} = \frac{d\vec{x}}{dt} = \frac{d\vec{r}}{dt}$$

Speed vs. Velocity

- What is the difference?



The magnitude ("length") of a velocity vector is called speed

Velocity vectors are tangent to the path taken by the object
(so, they point in the direction of motion)

Average vs. Instantaneous Speed and Velocity

- Average speed: $v = \frac{\Delta x}{\Delta t} = \frac{\Delta r}{\Delta t}$
- Average velocity: $\vec{v} = \frac{\Delta \vec{x}}{\Delta t} = \frac{\Delta \vec{r}}{\Delta t}$
- Instantaneous speed: $v = \frac{dx}{dt} = \frac{dr}{dt}$
- Instantaneous velocity $\vec{v} = \frac{d\vec{x}}{dt} = \frac{d\vec{r}}{dt}$

Motion at constant velocity: Uniform Motion

- If speed and direction are CONSTANT and since $\vec{v} = \frac{\Delta \vec{r}}{\Delta t}$

  then (dropping the vector notation)

  $s_f = s_i + v_s \Delta t$

  (here, $\Delta r = s_f - s_i$)

ALSO: $x_f = x_i + v \Delta t$ or $x = x_o + v_x \Delta t$

or $y = y_o + v_y \Delta t$

Have a nice weekend!!