iclicker : 23

CHAPTER 1: Concepts of Motion

Enero 29, 2019

I-clickers: Me: 23, Melissa: 30, Maureen: 38, Cris: 56

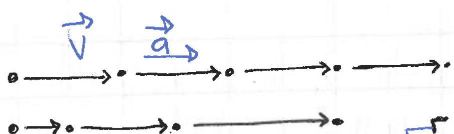
4 basics kinds of Motion:
- Linear motion
- Circular motion
- Projectile Motion

} Translational motion

- Rotational motion
  - ↳ object as a whole doesn't change position

Translational Motion: Object that moves through space
- ↳ we can represent translational motion using a motion diagram
  - ↳ image showing an object's position at equally spaced intervals of time

Particle Model (center of mass) → Object is treated as if all the mass were located at a single point in space (particle)



Constant Speed

[Moving to right w/ increasing speed
[Moving to left w/ decreasing Speed

Need to give indication of direction of motion
→ 1) Numbering points
→ 2) labeling where it begins and where it ends

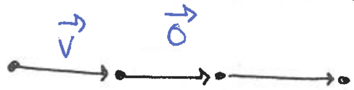
$\vec{v}$ ⟶ velocity Vector → direction of arrow represents direction of motion
→ length of arrow represents the speed

⇒ We will draw motion diagrams using velocity & acceleration vectors

CH 1

Enero 29, 2019

If acceleration = 0 $\rightarrow \vec{0}$



*If $\vec{v}$ and $\vec{a}$ are in same direction, object is speeding up

*If $\vec{v}$ and $\vec{a}$ are in opp. direction, object is slowing down.

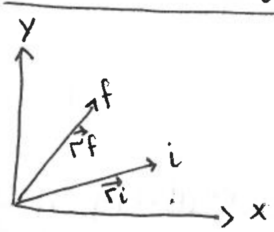
Car moving to the left at $-35\,m/s$. It accelerates at $+5\,m/s^2$. What is the speed after $2.0s$? $\vec{v} = -25\,m/s$

Position, Time & Displacement

Position $\rightarrow$ where an object is relative to a reference point called the origin

place where measurements are made from

Position Vector $(\vec{r})$ $\rightarrow$ vector pointing from the origin to the object's position



Position vector depends upon the coordinate system; if origin changes then position changes.

Detour into Vectors & Scalars

Scalar $\rightarrow$ physical quantity that can be completely described by a single number and a unit

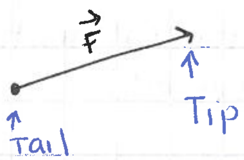
magnitude

Ex Time, mass, distance, speed, temperature, volume, energy

Vectors → a physical quantity that has both a magnitude and a direction

Ex Position, displacement, velocity, acceleration, force, momentum, ...

⇒ Vectors are represented with arrows

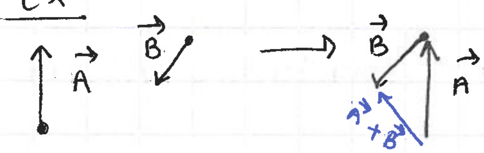


→ direction of vector is indicated by the direction of the arrow

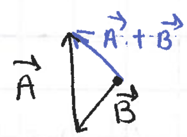
→ magnitude of the vector is indicated by the length of the arrow.

VECTOR ADDITION → Tip-to-tail method

Ex



or

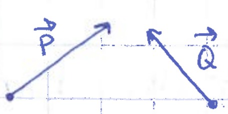


(B first drawn)

Note: doesn't matter where you draw the vector; what matters is length of vector & what direction it points

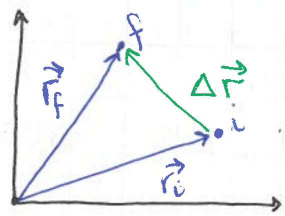
Note: The opposite of a vector is a vector of the same length but opposite direction

Enero 31, 2019



a) $\vec{P}+\vec{Q}$ Straight up
b) $\vec{P}-\vec{Q}$ Straight to the right
c) $\vec{Q}-\vec{P}$ straight to the left
d) $-\vec{Q}-\vec{P}$ Straight down

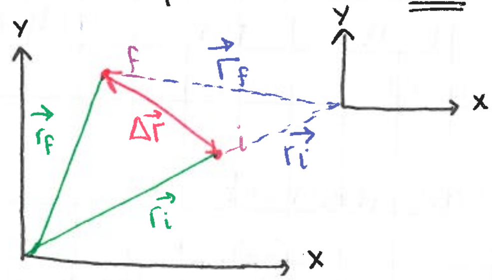
Enero 31, 2019

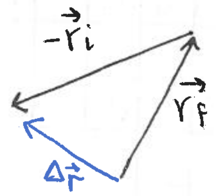


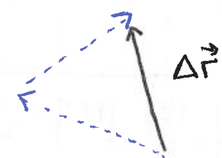
Displacement ($\Delta\vec{r}$) → net change in position of an object

$$\boxed{\Delta\vec{r} = \vec{r}_f - \vec{r}_i}$$

* direction of $\Delta\vec{r}$ points from initial to final position
* Magnitude of $\Delta\vec{r}$ is the distance between initial & final positions (NOT the distance traveled)







* $\Delta\vec{r}$ and Δt are independent of the coordinate system
↳ Everyone measures the same values for $\Delta\vec{r}$ and Δt (not necessarily, $\vec{r}_f$, $\vec{r}_i$, t_f & t_i)

SPEED & VELOCITY

avg. speed = $\dfrac{\text{distance traveled}}{\text{time interval spent traveling}} = \dfrac{\Delta d}{\Delta t}$

↳ scalar (NO Direction)

VELOCITY Vector indicating both speed & direction

avg. velocity = $\vec{v}_{avg} = \dfrac{\Delta\vec{r}}{\Delta t} = \dfrac{\vec{r}_f - \vec{r}_i}{t_f - t_i}$

V_{avg} always points in the same direction as $\Delta\vec{r}$

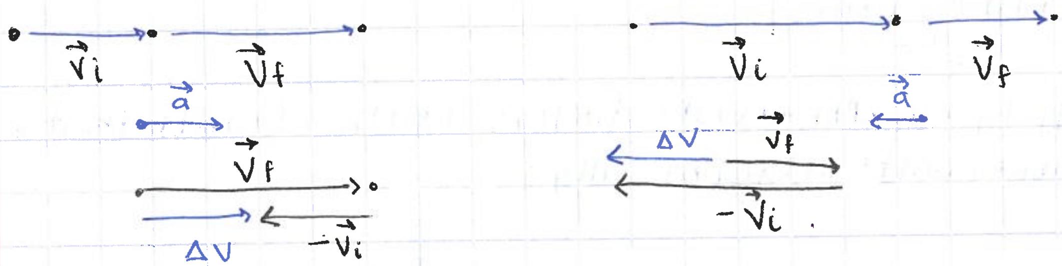
CH1 Enero 31, 2018

Δt is a scalar → No direction

Acceleration → Vector that describes the rate at which velocity changes.
- greater acceleration → more quickly vel. changes

$$\vec{a}_{avg} = \frac{\Delta\vec{v}}{\Delta t} = \frac{\vec{v}_f - \vec{v}_i}{t_f - t_i}$$

* $\vec{a}_{avg}$ always point in the same direction as $\Delta v = \vec{v}_f - \vec{v}_i$



Complete Motion Diagrams:
1) Draw 5-8 points (particle model)
2) Draw the velocity vectors (don't need to label)
3) Draw acceleration vectors anytime the acceleration changes

$\boxed{\text{Motion in One dimension}}$
- Horizontal motion (x, v_x, a_x)
- Vertical Motion (y, v_y, a_y)

Sign Conventions:

$x > 0$ Position is to the right of the origin
$x < 0$ Position is to the left of the origin
$v_x > 0$ Velocity is moving to the right
$v_x < 0$ Velocity is moving to the left
$a_x > 0$ Accelerating to the Right
$a_x < 0$ Accelerating to the left

CH1 + Recap

Enero 31, 2019

Prefixes to known

Mega -	M	10^6
kilo -	K	10^3
Centi -	c	10^{-2}
milli -	m	10^{-3}
micro -	μ	10^{-6}
nano -	n	10^{-9}
Giga -	G	10^9

Converting Units

*multiply by conversion factors (ratio of units that eq. one)
+ cancel units algebraically

RECAP

Febrero 4, 2019

=> Vector addition & Subtraction

↓ tail-to-tip method

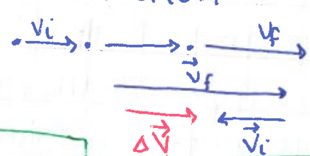
↓ key is $-\vec{B}$ has same length as $\vec{B}$ but opposite direction

=> know how to use vector subtraction to find directions of $\Delta\vec{r}$ and $\Delta\vec{v}$

↓ $\vec{v}$ has same direction as $\Delta\vec{r}$

→ $\vec{a}$ has same direction as $\Delta\vec{v}$

Ex



$\boxed{\text{Avg. Speed: } \frac{\Delta d}{\Delta t}}$

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

$\boxed{\vec{a}_{avg} = \frac{\Delta\vec{v}}{\Delta t}}$

Recap + CH 2: Kinematics in one Dimension — Febrero 4, 2019

* complete motion diagram → label velocity vectors
→ show acceleration vector anytime $\vec{a}$ changes

⇒ Prefixes

⇒ converting units → multiply by conversion factors (ratios of units that equal one) + cancel units algebraically.

END

Physics 4A lectures are 75 minutes? How many micro centuries is this?

$$75\,\text{min} = \frac{75\,\cancel{\text{min}}}{} \cdot \frac{1\,\cancel{\text{hr}}}{60\,\cancel{\text{min}}} \cdot \frac{1\,\cancel{\text{day}}}{24\,\cancel{\text{hrs}}} \cdot \frac{1\,\cancel{\text{yr}}}{365.25\,\cancel{\text{days}}} \cdot \frac{1\,\cancel{\text{century}}}{100\,\cancel{\text{yrs}}} \cdot \frac{1\,\mu\,\text{century}}{10^{-6}\,\cancel{\text{century}}} = 1.426\,\mu\,\text{centuries}$$

$$= \boxed{1.4\,\mu\,\text{centuries}}$$

$$15.5\,\text{km}^2 = 15.5\,\text{km}^2 \left(\frac{10^3\,\text{m}}{1\,\text{km}}\right)^2 = 15.5 \times 10^6\,\text{m}^2 = 1.55 \times 10^7\,\text{m}^2$$

Ex

Show $1\,\text{g}/\text{cm}^3 = 10^{-3}\,\text{kg}/\text{m}^3$

|| Chapter 2: Kinematics in One Dimension ||

Quick Calculus Review

$Y(x)$ → Y is a function of x

Ex $y(x) = 4x^2 - 3x$

$y(x) = 12x^3 - 4x^2 + 7 = 36x^2 - 8x$