

Objectives: Students will understand the basic concepts of one-dimensional motion

Students will be able to describe the differences between displacement, velocity, and acceleration

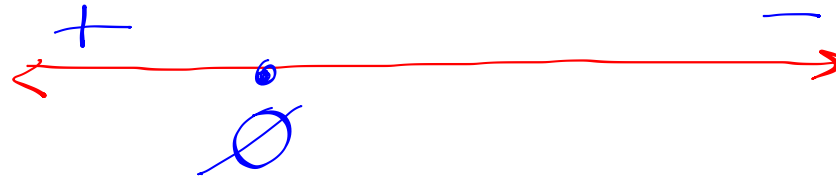
Students will be able to solve physics problems involving displacement, velocity, and acceleration

Introduction to 1-D motion:

- Straight-line motion
- Displacement
- Velocity (formula for average velocity)
- Acceleration (formula for average acceleration)

What is 1-D motion?

Motion in a straight line:



+ / - values:

+ : one way

- : the other way

Frame of reference:

- ① Which direction is +?
- ② Where is position ∅?

Displacement:

- Measures how far something goes and in what direction (vector quantity)

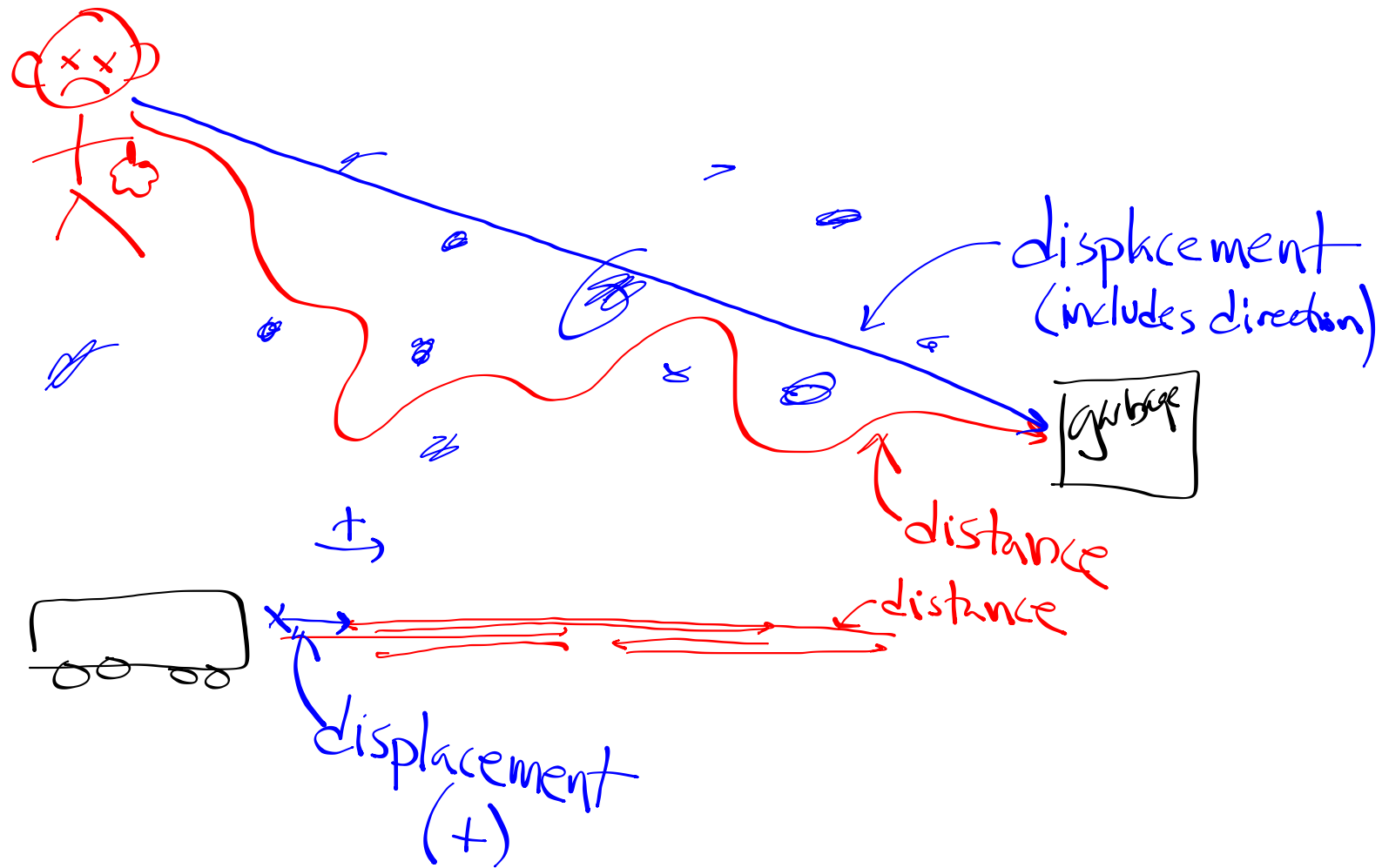
Where did it start? t

Where did it stop? $t + 1$

- Difference between displacement and distance:

→ The shortest length between where an object starts & where it stops along with direction (+/-)

The total length of an object's path.



Velocity:

- Measures how fast something goes and its direction (vector quantity)

how far did something go (§ direction)?
how long did it take?

- Difference between speed and velocity:

$$\text{Speed} = \frac{\text{distance}}{\Delta \text{ time}}$$

$$\text{velocity} = \frac{\text{displacement}}{\Delta \text{ time}}$$

- Difference between average and instantaneous velocity:

$$\bar{v} = \frac{\Delta x}{\Delta t}$$

$$v = \frac{\Delta x}{\Delta t} \quad \text{as } \Delta t \rightarrow 0$$

Acceleration:

- Measures how fast something's velocity changes (no change = uniform velocity); includes direction (vector quantity)

how fast at t ?
 how fast at $t+1$?
 how long?

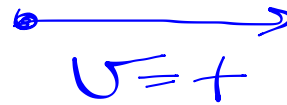
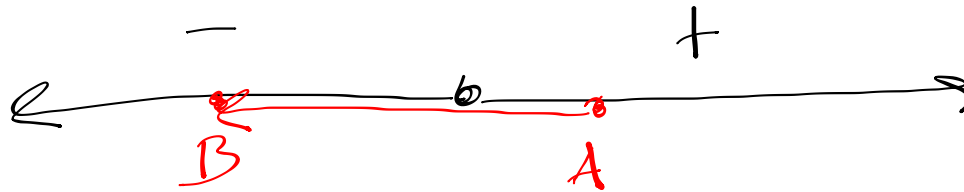
- Anytime velocity changes, acceleration is occurring (3 ways)

→ Speed up (accel + velocity have same sign)
 → Slow down (accel + velocity have opposite signs)
 → Change direction (2D/3D)

- Difference between average acceleration and instantaneous acceleration

$$\bar{a} = \frac{\Delta v}{\Delta t}$$

$$a = \frac{\Delta v}{\Delta t} \quad \text{as } \Delta t \rightarrow 0$$



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