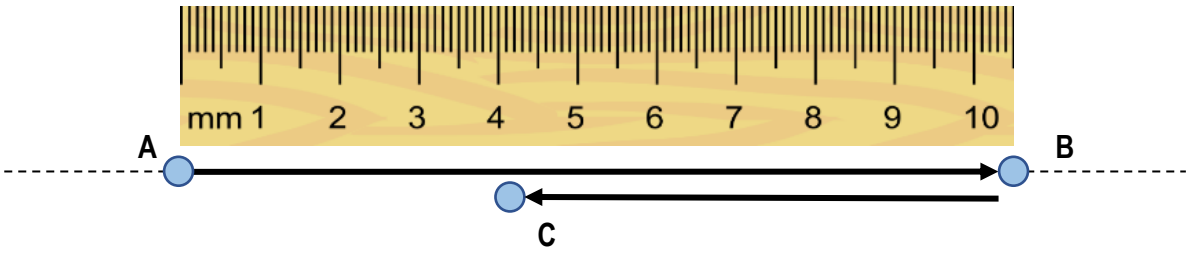
CONCEPT: INTRO TO VELOCITY AND SPEED

● Remember: Distance & Displacement describe **how FAR** something moves:



DISTANCE d = _____
[SCALAR | VECTOR]

DISPLACEMENT Δx = _____
[SCALAR | VECTOR]

● Like Distance vs. Displacement, there are two terms to describe **how FAST** something moves:

SPEED

$$= \frac{\text{_____}}{\text{time elapsed}} = \text{____} \left[\frac{\text{m}}{\text{s}}\right]$$

→ **[SCALAR | VECTOR]**

- Speed *always* ___ or ___ (**cannot** be negative)

VELOCITY

$$= \frac{\text{_____}}{\text{time elapsed}} = \text{____} \left[\frac{\text{m}}{\text{s}}\right]$$

→ **[SCALAR | VECTOR]**

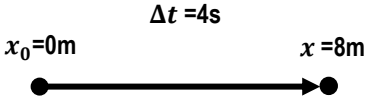
- Velocity can be _____
  - Negative Velocity: _____ to positive direction

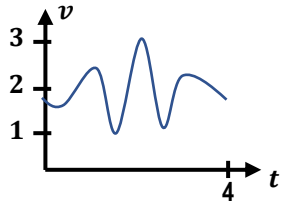
EXAMPLE: You jog 15m in 2s, then 9m backwards in another 2s. Calculate your speed & velocity for the total trip.

PRACTICE: Beginning from a signpost, you run 60m to the right, then 60m back. The entire trip takes 24 seconds. What is your speed and velocity for the whole trip?

CONCEPT: SOLVING CONSTANT AND AVERAGE VELOCITY PROBLEMS

● Velocity is measured between two points (initial → final), so it is often called an _____ velocity.

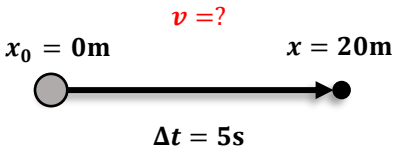


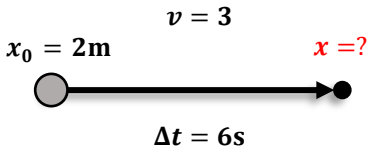


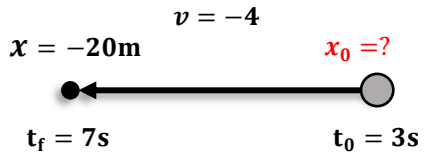
- Average velocity *behaves* like a _____ velocity (**NO acceleration**), so there's only 1 equation:

$$v_{avg} = v = \frac{\Delta x}{\Delta t} \rightarrow \Delta x = v_{avg}\Delta t \rightarrow$$ _____

EXAMPLE: Solve for the unknown variable in each of the following diagrams:







PRACTICE**:** A baseball pitcher can throw a baseball at 44 m/s**.** How long does it take for the baseball to travel the roughly 18.5 m to the home plate?

CONCEPT: CONSTANT VELOCITY WITH MULTIPLE PARTS

● Many problems will have an object moving with *different*, but **constant** velocities in multiple parts**.**

- Remember**:** For constant velocity, there's only ONE equation $\Rightarrow \boldsymbol{v} = \frac{\boldsymbol{\Delta x}}{\boldsymbol{\Delta t}}$

EXAMPLE**:** A car travels at a constant 50 m/s forward for 10s, and then at 30m/s for 600m**.** Calculate**:**

a) the total distance traveled
b) the average velocity from start to finish

STEPS
1) Draw diagram & list variables
2) Write equations for each interval
3) Solve

PRACTICE**:** You walk to the right at 3m/s for 8s, then turn around and walk backwards at 2m/s for some unknown time**.** You end up 16m to the right from where you started**.** For long (in seconds) did you walk backwards?

STEPS
1) Draw diagram & list variables
2) Write equations for each interval
3) Solve

EXAMPLE**:** A runner hopes to complete a 100-m race in 20s**.** After running at a constant 4m/s for 14s, the runner realizes they need to run faster to win**.** What must the average velocity of the runner be for the rest of the race to complete it in 20s?

STEPS
1) Draw diagram & list variables
2) Write equations for each interval
3) Solve