Motion, Speed, Velocity and Acceleration

Motion

Radar Speed Signs

Motion

- **Motion** – an object's change in position relative to a reference point

Reference Point

- The Earth's surface is used as a common reference point

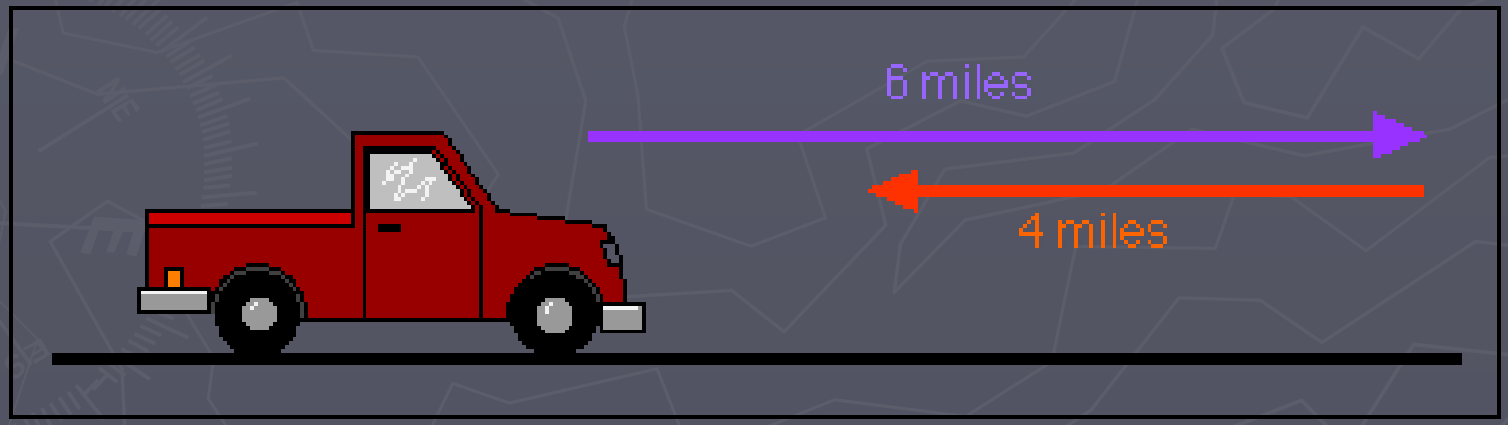
- A moving object can be used as a reference point as well

Speed

- **Speed** is the distance traveled divided by the time interval during which the motion occurred
- Normally, objects do not travel at a constant speed
- Average Speed - $\frac{\text{total distance}}{\text{total time}}$

Which Distance?

- Farmer Jones drives 6 miles down a straight road. She turns around and drives 4 miles back. What was her average speed for this trip if it took 1 hour?

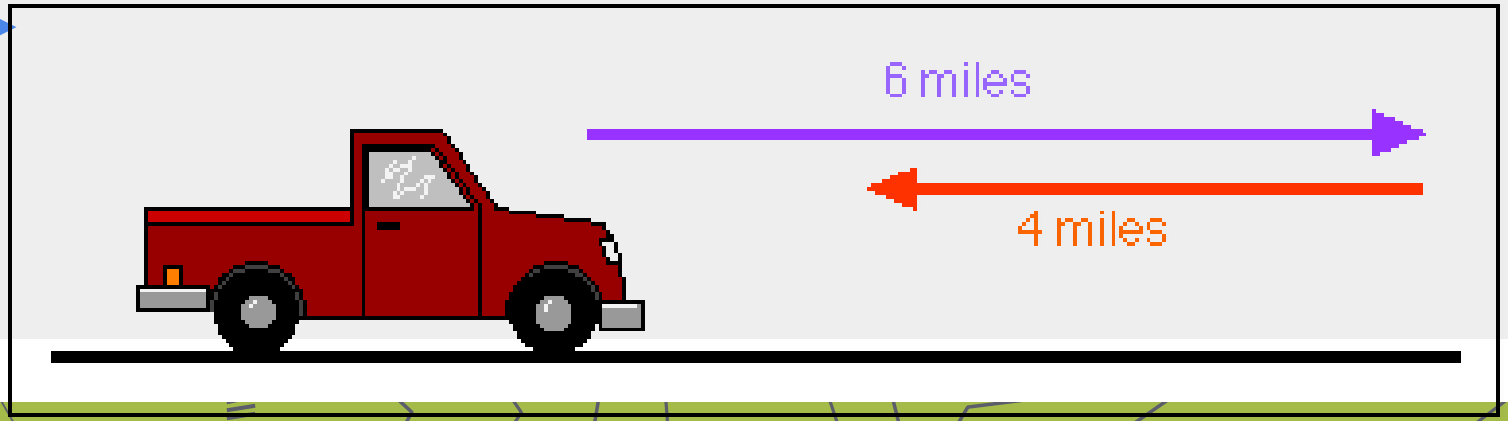


Your answer to this problem depends on your interpretation of "distance traveled". You could say:

- The **total distance** traveled by Farmer Jones is 10 miles. Therefore her average speed is 10 mi/hr.
- The **net distance** traveled by Farmer Jones is 2 miles. Therefore, her average speed is 2 mi/hr.
- There are good reasons to use either interpretation - it's mostly a matter of preference. We will interpret "distance traveled" to be **net distance (**also called **displacement).** Farmer Jones' average speed was 2 mi/hr.

Compare and Contrast

What is the difference between Total distance and displacement?

- The **net distance (displacement)** traveled by Farmer Jones is 2 miles.
- It is how far she is from the starting point .
- 

Students, write your response!

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Velocity

- **Velocity** is the speed of an object in a particular direction
- Imagine two birds leave the same tree at the same time. The both fly at 10km/hr for 5 minutes. Why don't they end up at the same place?

Velocity

- **Velocity** appears to be very similar to speed, however, when describing the velocity of an object you need to provide a magnitude and a direction
- **Magnitude** – the speed of the object
- **Direction** – the direction the object is moving

Velocity

- Ex) A bus has a velocity of 35miles/hr heading west

Resultant Velocity

- An object can have a resultant velocity if it is experiencing more than one motion.
- For example if a person walks down the center of a bus while it is in motion there are two velocities occurring.
  - 1. The movement of the bus
  - 2. The movement of the person inside the bus

Example

15 m/s + 1 m/s = 14 m/s

Drag your dot to how you are feeling:

Keep going, I understand

I’m a little confused

Stop, I need help!

Students, drag the icon!

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Example

15 m/s + 1 m/s = 16 m/s

Velocity Calculation

Bob rides his bicycle on a bike path that is 75 kilometers long to get to his house that is due east of the bike path. If it takes Bob 15 hours then what is his velocity.

Students, draw anywhere on this slide!

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Summarize what you've just learned:

Students, write your response!

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Acceleration

- **Acceleration** is the rate at which velocity changes over time
  - An object accelerates if its speed, direction, or both change
- **Average acceleration =**

$$\frac{\text{final velocity} - \text{starting velocity}}{\text{time it takes to change velocity}}$$

Example Problem

A car on the highway is traveling 55 mi/hr and it passes another car. In order to pass, the car has to accelerate to 65 mi/hr. The car reaches this velocity 40 seconds later. What is the average acceleration of the car?

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