


---

---

---

---

---

---

---

---

### DISTANCE VS. DISPLACEMENT

- \* **Distance:** the total length of the path taken to move from a starting point to an ending point, regardless of how many turns and changes of direction occur. (*scalar quantity*)
- \* **Displacement:** The length of a straight line path between a starting point and an ending point. (*vector quantity*)
  - + **The** change in position between an object's initial position and final position.

$$d = x_f - x_i$$


---

---

---

---

---

---

---

---

Distance from Skyline to the airport = 41.2 km, according to Google Maps.

**Displacement** is much less...




---

---

---

---

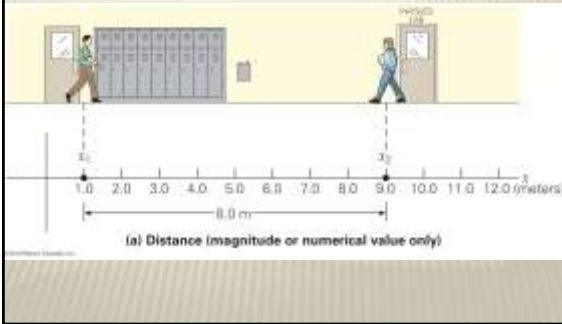
---

---

---

---

### LINEAR DISTANCE:




---

---

---

---

---

---

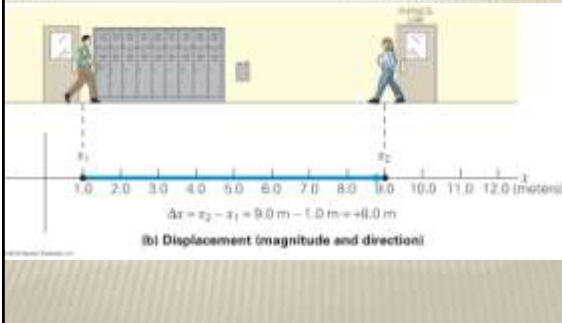
---

---

---

---

### DISPLACEMENT:




---

---

---

---

---

---

---

---

---

---

### SPEED VS. VELOCITY

× **Average Speed:** the rate at which a distance is traveled:

$$\bar{s} = \frac{d}{t}$$

+ In this case, *d* represents a TOTAL DISTANCE covered in a total time, *t*

+ Units for average speed =  $\text{ms}^{-1}$

---

---

---

---

---

---

---

---

---

---

## SPEED VS. VELOCITY

\* **Average Velocity:** the rate of a change in position.

+ **In other words...** the rate at which a DISPLACEMENT is traveled:

$$\bar{v} = \frac{\Delta x}{t} \quad \text{or} \quad \bar{v} = \frac{d}{t}$$

+ **d** in this case represents DISPLACEMENT

---

---

---

---

---

---

---

---

## WHY IS THIS NOT CALLED A VELOCITOMETER?




---

---

---

---

---

---

---

---

## SAMPLE PROBLEM:

\* While chasing an impala, a Cheetah runs **275 m** at an average speed of **70.0 mi/h**. Assuming that the impala is caught at the end of the 275 m, how much time elapses between when the cheetah begins its sprint and when he catches his prey?




---

---

---

---

---

---

---

---

## SAMPLE PROBLEM 2

- × A baseball player hits a home run and takes 35.0 s to jog around the bases. Assume that the total distance he runs is 115 m (he rounds the bases widely).
  - + What is his average speed for his trip around the bases?
  - + What is his average velocity?

---

---

---

---

---

---

---

---

## INSTANTANEOUS VELOCITY

- × **Average** velocity will be used to describe the total displacement traveled in a total amount of time
- × **Instantaneous** velocity describes how fast an object is traveling at one given instant of time.
- × **Examples:**
  - + The most common instantaneous velocities we will be using this year are:
    - × Initial Velocity ( $v_i$  or  $v_o$ )
    - × Final Velocity ( $v_f$  or  $v_f$ )

---

---

---

---

---

---

---

---

## RELATIVE VELOCITY

- × The velocity of one object relative to another's point of view
- × **Reference Frame:** the frame of reference for the observer's point of view—the observer will always be **at rest** in his/her frame of reference
- × **Relative velocity** of an object moving relative to an observer is determined by **subtracting vectors**

---

---

---

---

---

---

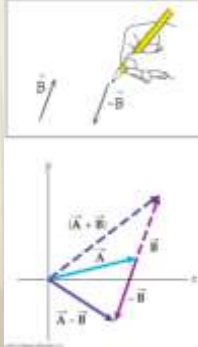
---

---

### SUBTRACTING VECTORS

$$\vec{A} - \vec{B} = \vec{A} + (-\vec{B})$$

- ✦ The second vector quantity's direction is 180° from it's given direction
- ✦ Once you've altered the direction, it becomes basic vector addition




---

---

---

---

---

---

---

---

### SAMPLE PROBLEM 1:



- ✦ What is the velocity of:
  1. Car B relative to A?
  2. Car C relative to A?
  3. Car C relative to B?
  4. Car B relative to C?
  5. Car A relative to C?
  6. Car A relative to B?

---

---

---

---

---

---

---

---

### PRACTICE PROBLEM 2:

- ✦ Car P moves to the left with a speed of 40.0 km·h<sup>-1</sup> (with respect to the road) and Car Z moves to the right with a speed of 60.0 km·h<sup>-1</sup> (with respect to the road). Find the velocity of car Z relative to car P.

$$v_{zp} = v_p - v_z$$

$$v_{zp} = (60.0 \text{ km} \cdot \text{h}^{-1}) - (-40.0 \text{ km} \cdot \text{h}^{-1}) = 100.0 \text{ km} \cdot \text{h}^{-1}$$

---

---

---

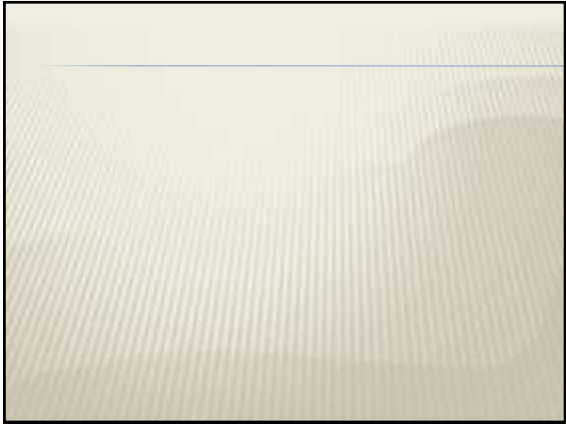
---

---

---

---

---



---

---

---

---

---

---

---

---