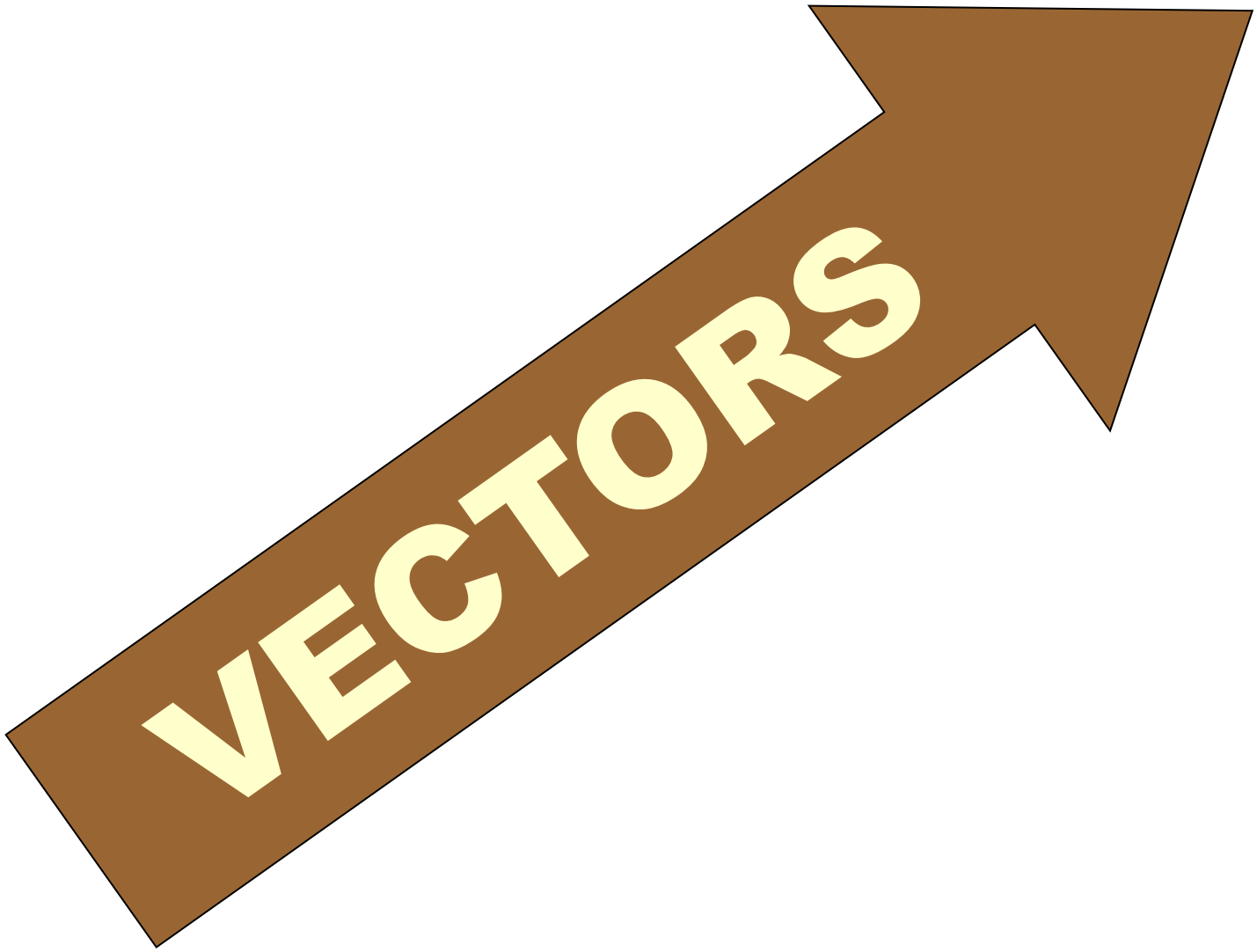

VECTORS

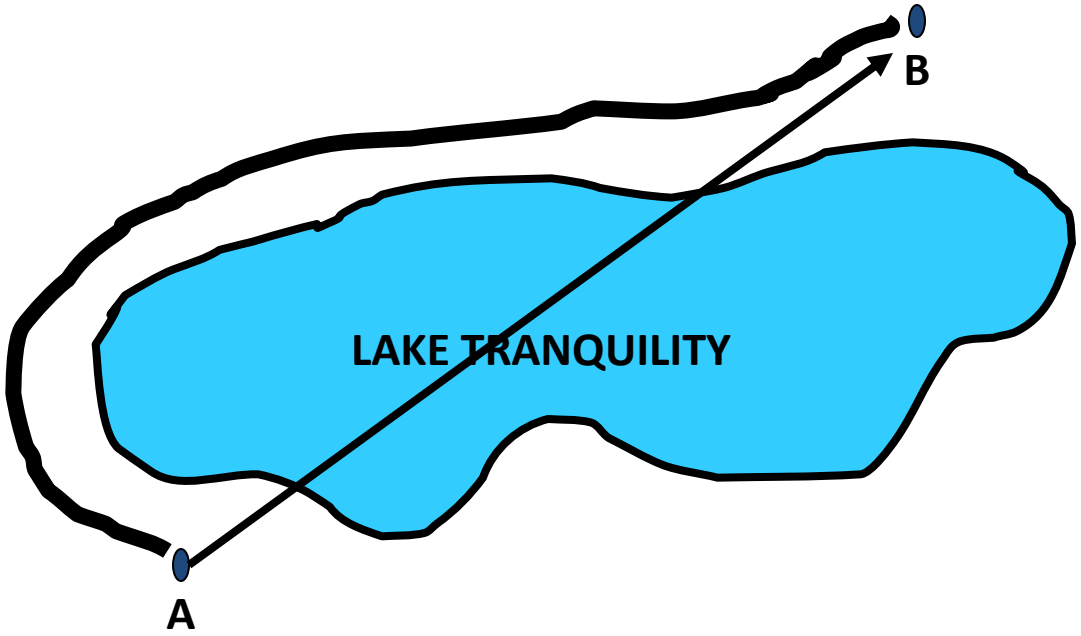
- Speed and Velocity

SCALARS AND VECTORS

- **Vectors have magnitude and direction (ex. 50 m, North)**
- **When you combine two or more vectors the sum is called the resultant.**

Comparing Vector & Scalar Values

Displacement (a vector) versus distance (a scalar)

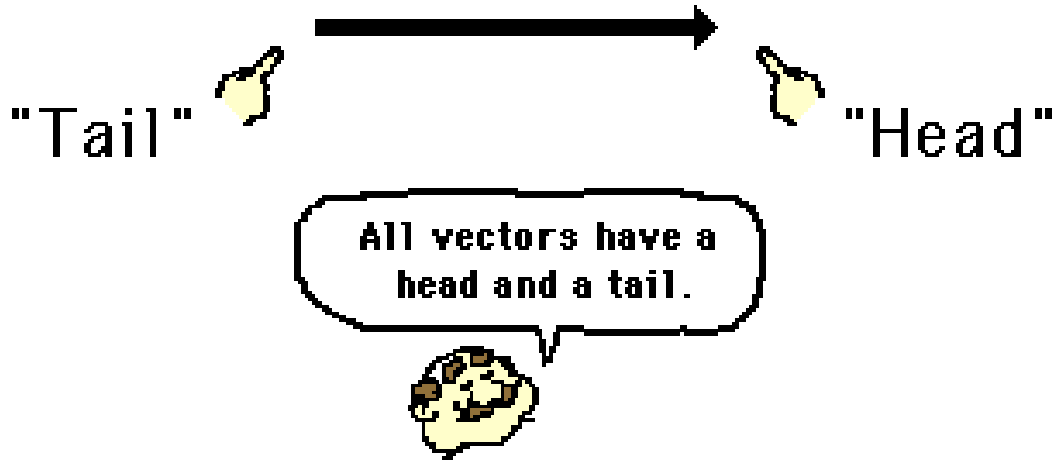


We want to get from point A to point B. If we follow the road around the lake our direction is always changing. There is no specific direction. The distance traveled on the road is a scalar quantity.

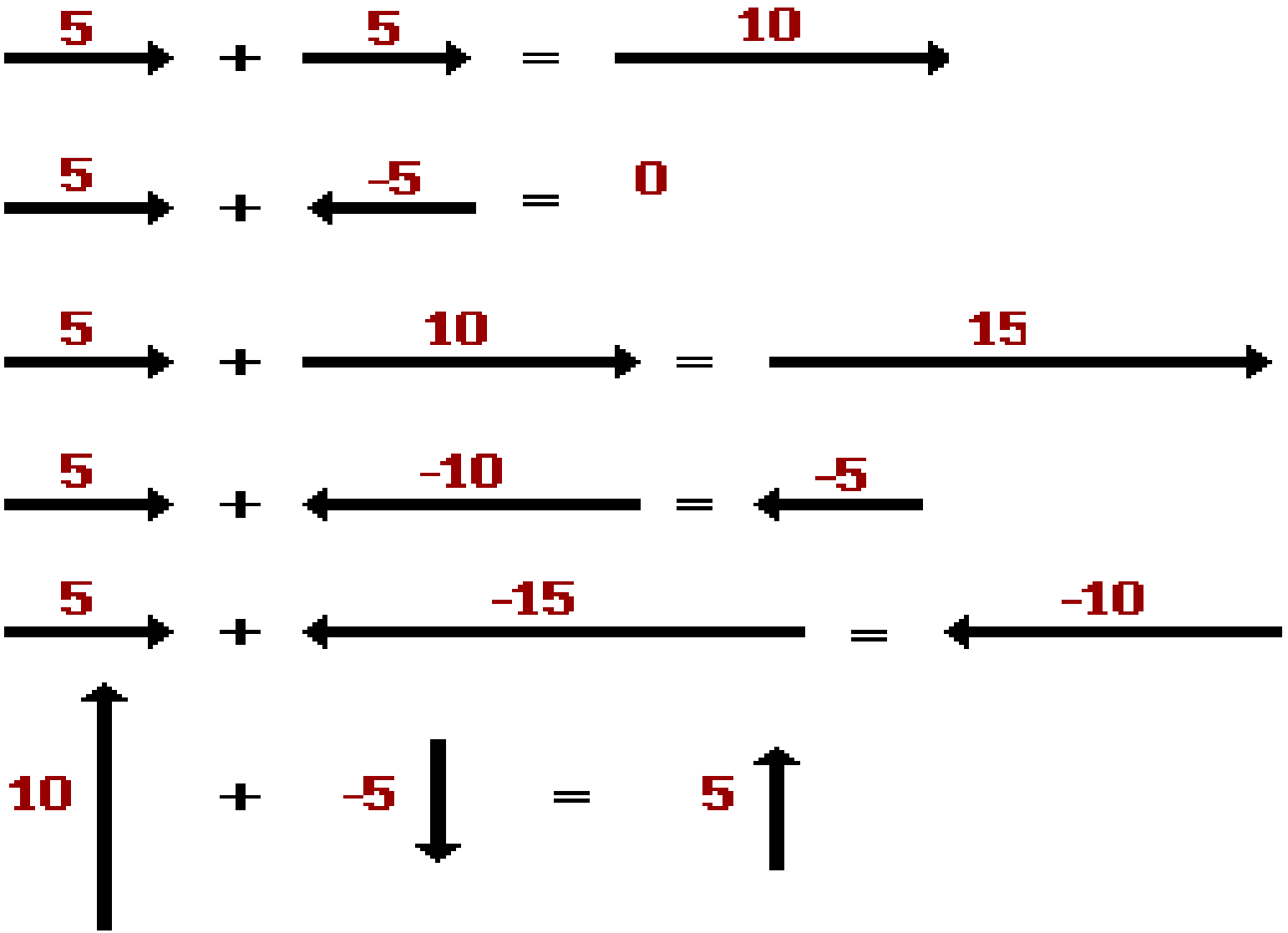
A straight line between A and B is the displacement. It has a specific direction and is therefore a vector.

Vector Representation

1. The length of the line represents the magnitude and the arrow indicates the direction.
2. The magnitude and direction of the vector is clearly labeled.

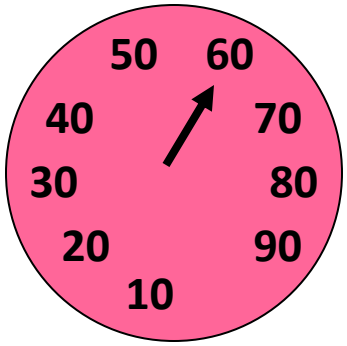


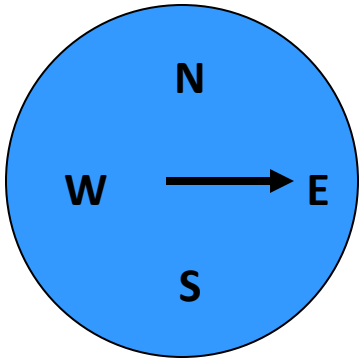
THE RESULTANT IN ONE DIMENSION

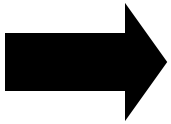


Speed & Velocity

Speed and velocity are not the same.
Velocity requires a directional component and is therefore a vector quantity.
Speed tells us how fast we are going but not which way.
Speed is a scalar (direction doesn't count!)







VELOCITY

SPEEDOMETER

COMPASS

Speed

- **Speed** is the distance traveled divided by the time interval during which the motion occurred
- Average Speed - $\frac{\text{total distance}}{\text{total time}}$
- Unit for speed is m/s or km/h
- What speed did a plane fly if it travelled 1760m in 8 seconds?

Ex. The speed of a cruise ship is 50km/hr. How much time did it take the trip to travel if it travelled 700km?

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?

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 = 16 m/s

Example

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

Examples of Vector

- **A car travels at a constant velocity east.**

That same car slows down as it approaches a stop light.

Acceleration

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

$$\frac{\text{final velocity – starting velocity}}{\text{time}}$$

Or: $A = \frac{Vf - Vi}{t}$

Ways to Accelerate!

- 1. Speed up
- 2. slow down
- 3 change direction

Acceleration

- Example
  - 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?

Deceleration- something slows down (negative acceleration)

A car traveling at 60 mph slams on the brakes to avoid hitting a deer. The car comes to a safe stop 6 seconds after applying the brakes. What is the car's acceleration?

Acceleration and Velocity

- As velocity **increases**, so does acceleration
- As velocity **decreases**, so does acceleration
- When direction changes, so does acceleration
- When there is a **constant velocity**, there is no acceleration