MOTION

Notes on Motion

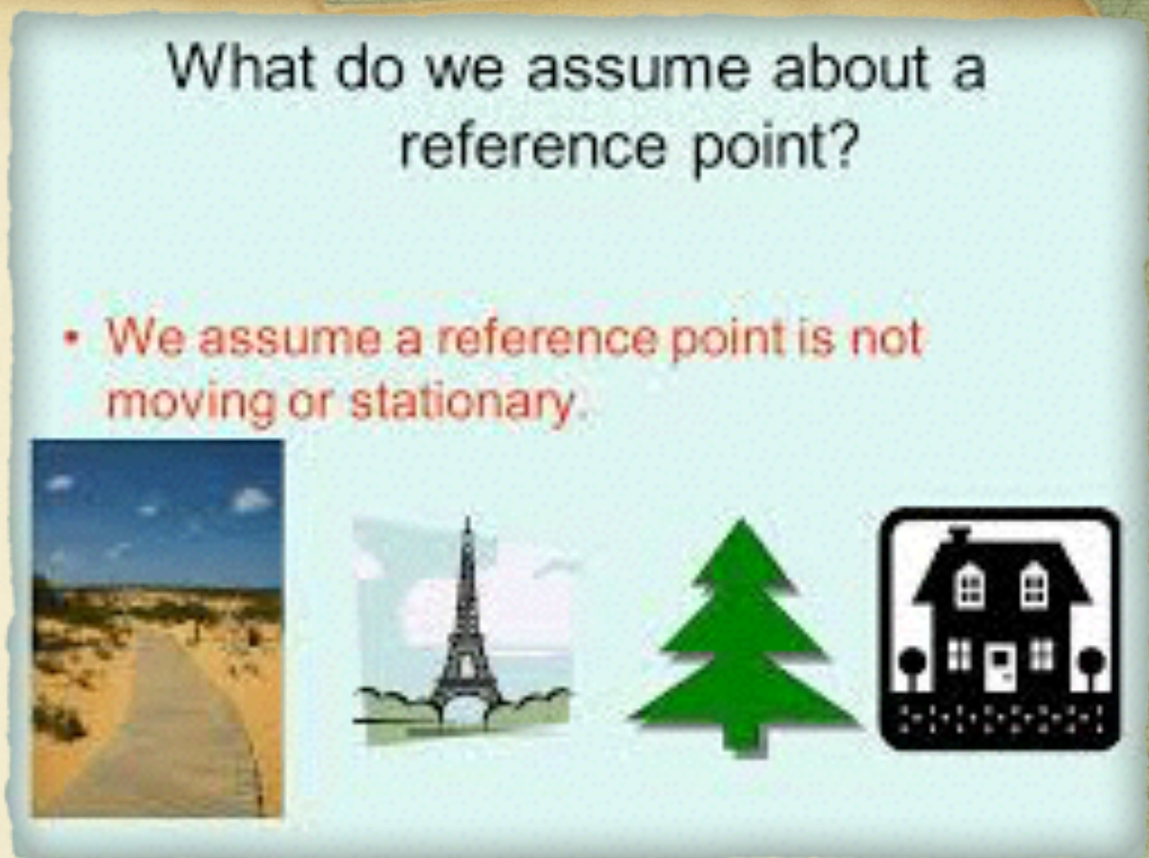
KJHS Science

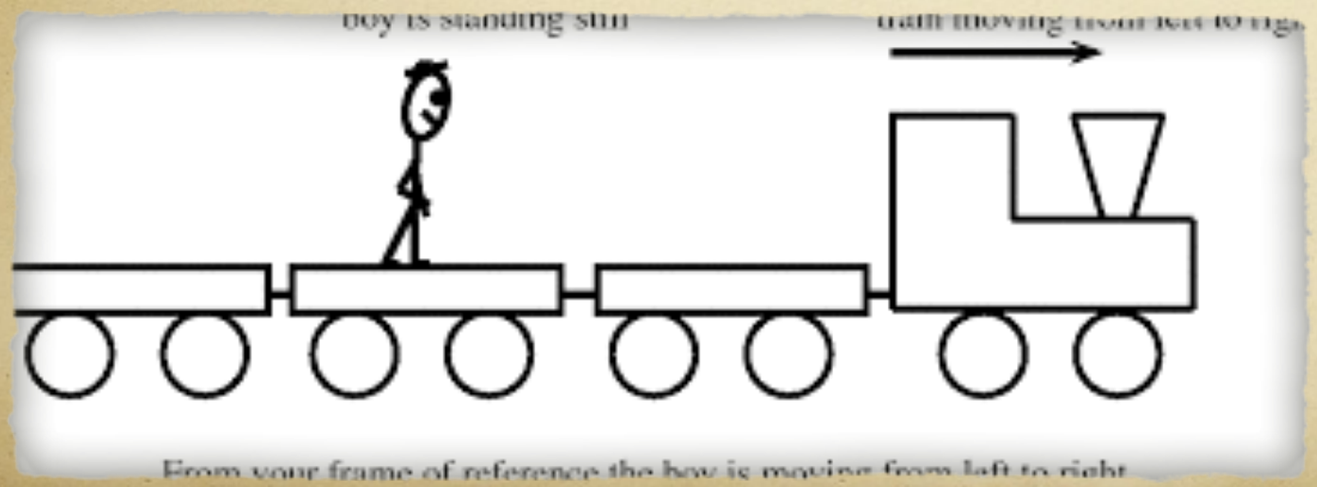
1)Motion:

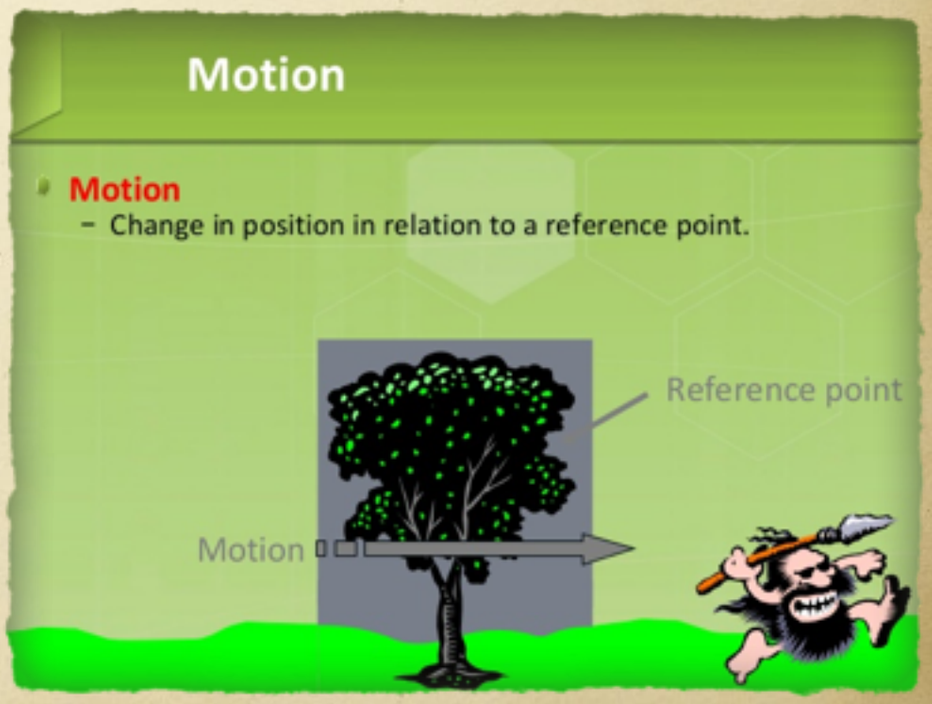
- an objects change in distance from another point.
- 3 types of Motion:
  - speed
  - velocity
  - acceleration

2)Reference Point

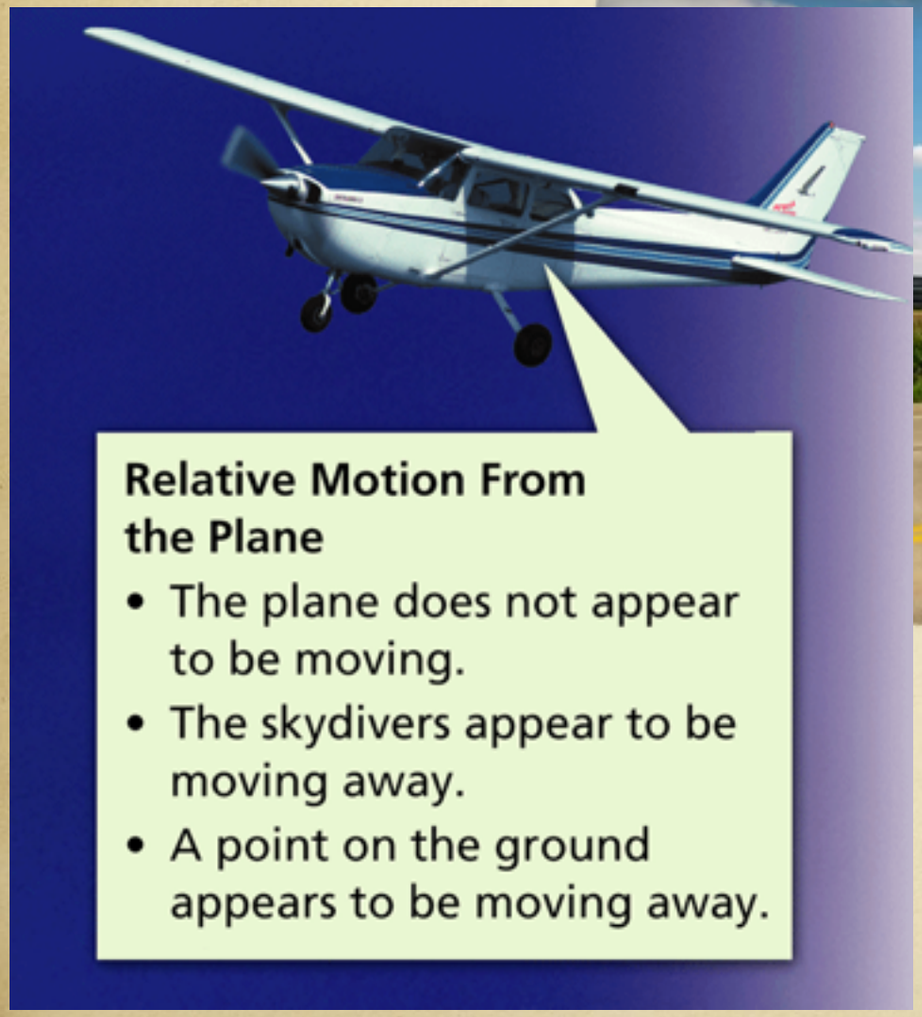
- A stationary object used to compare a moving object to







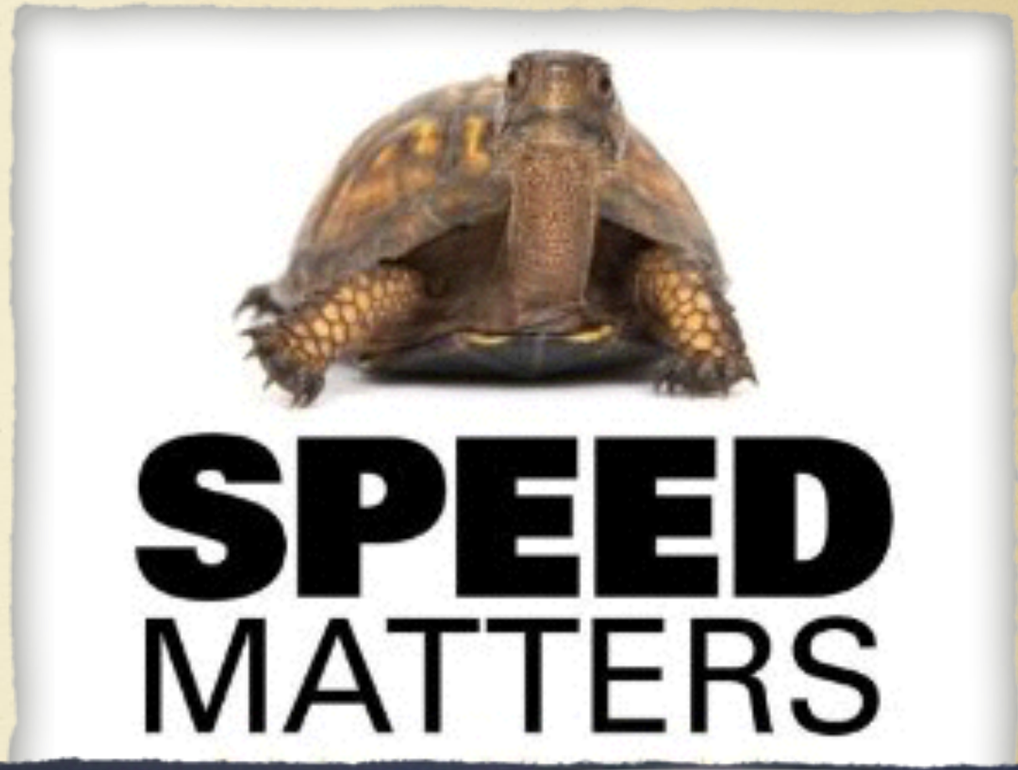
- Have you ever watched a *large truck* pass you on the highway and felt like you were **going backwards**?
- Whether or not an object is in motion *depends* on the **reference point** you choose & if the **distance between** the object and the reference point is **changing.**

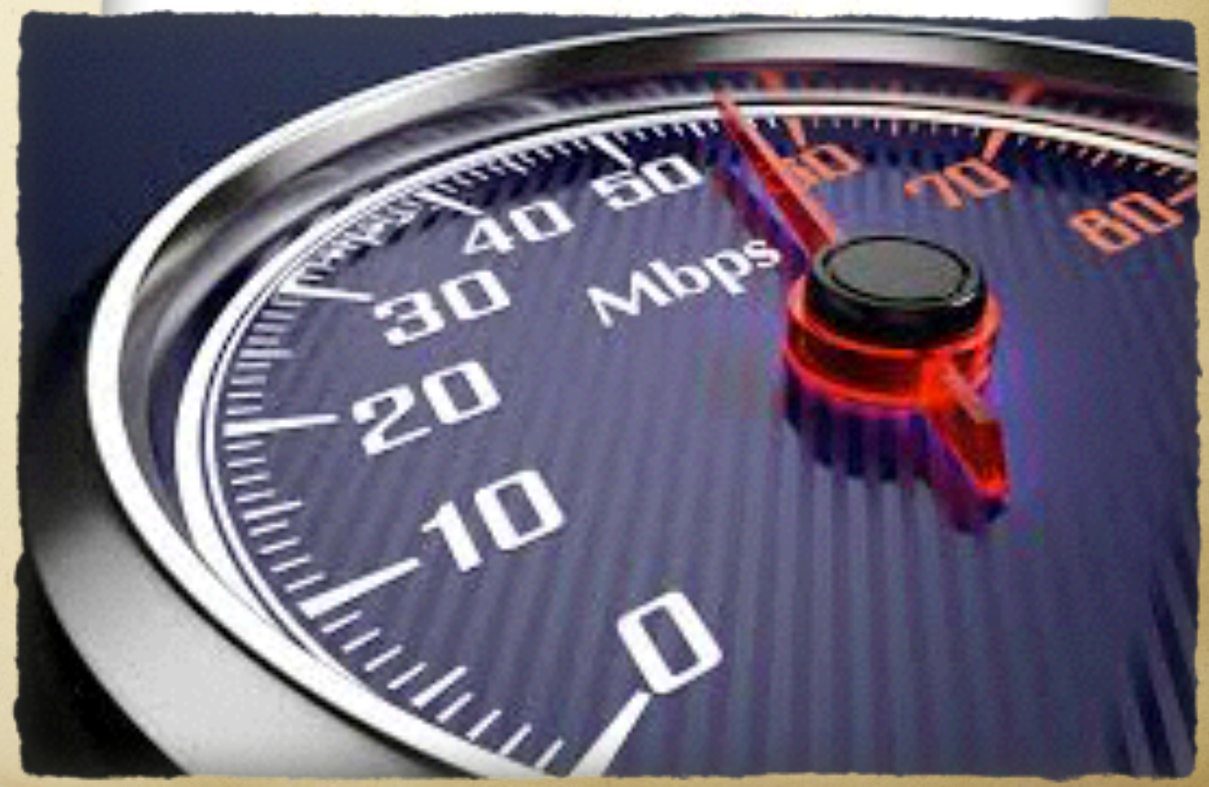


- **Question:** Can a distance be negative relative to a reference point?
- **Football Example:** *Reference point* in football (below), *positive play* (left), *negative play- sacked for a loss* (bottom right)

3) Speed

- the distance an object travels divided by the time takes to travel

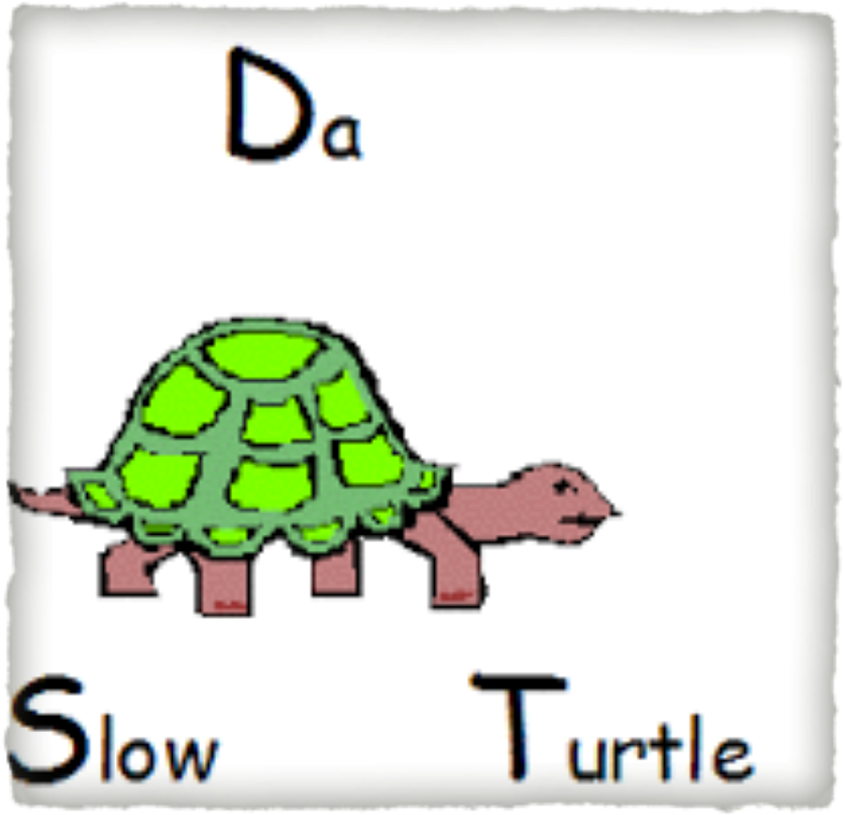




COPY THE SPEED TRIANGLE

What Is Speed?

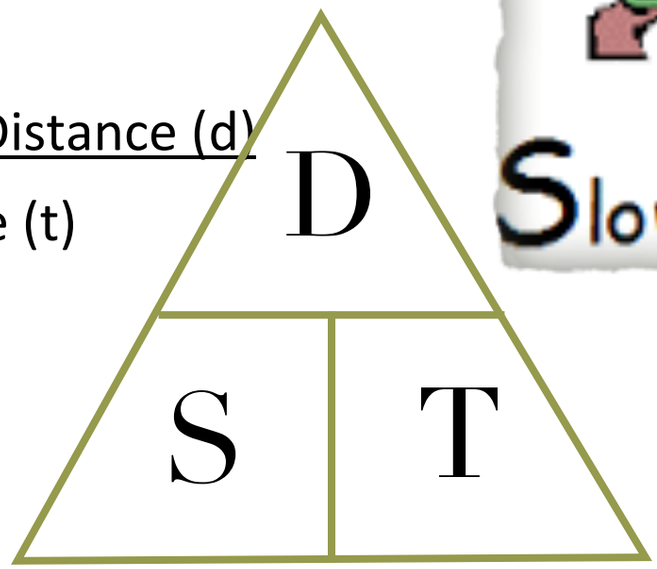
•Speed is the distance an object travels in a certain amount of time.



•To calculate speed, you use the following formula:

•Speed (s) = Distance (d)

• Time (t)



DO NOT COPY ANYTHING

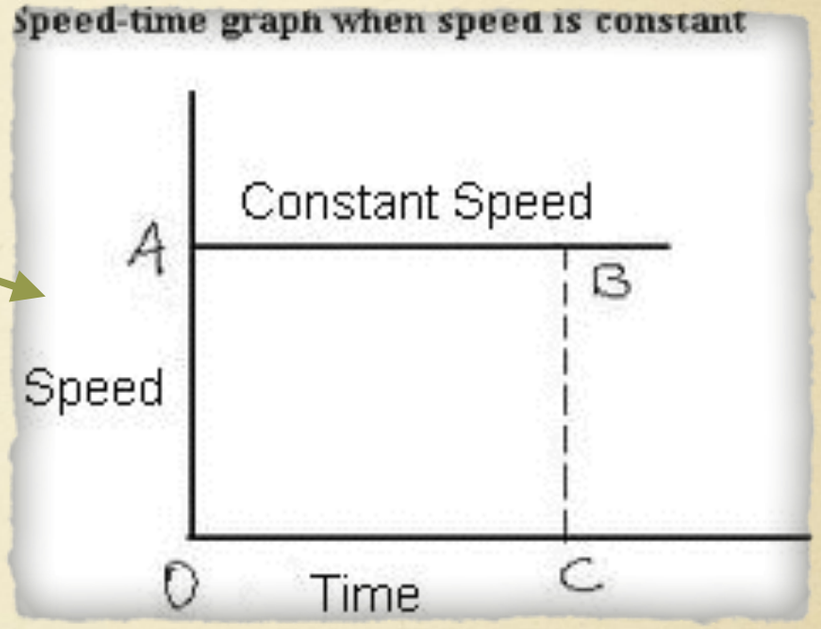
Ways To Calculate Speed

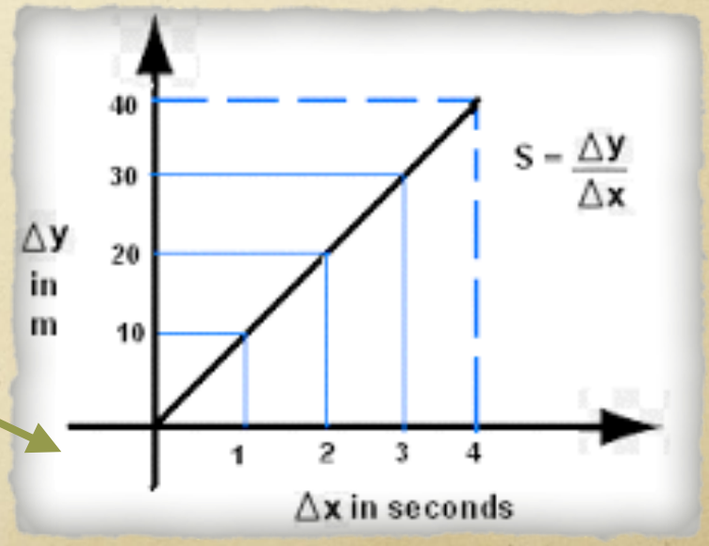
•Constant speed is when you are traveling at the same rate of speed, such as 55 mph constantly on a highway.

•Average speed is taking the total distance traveled, and dividing by the total time it takes. Used for calculations that involve changing speed.

4)Constant Speed

- Zero Acceleration
- (acceleleration graph)
- moving at the same exact speed in a straight line
- speed graph

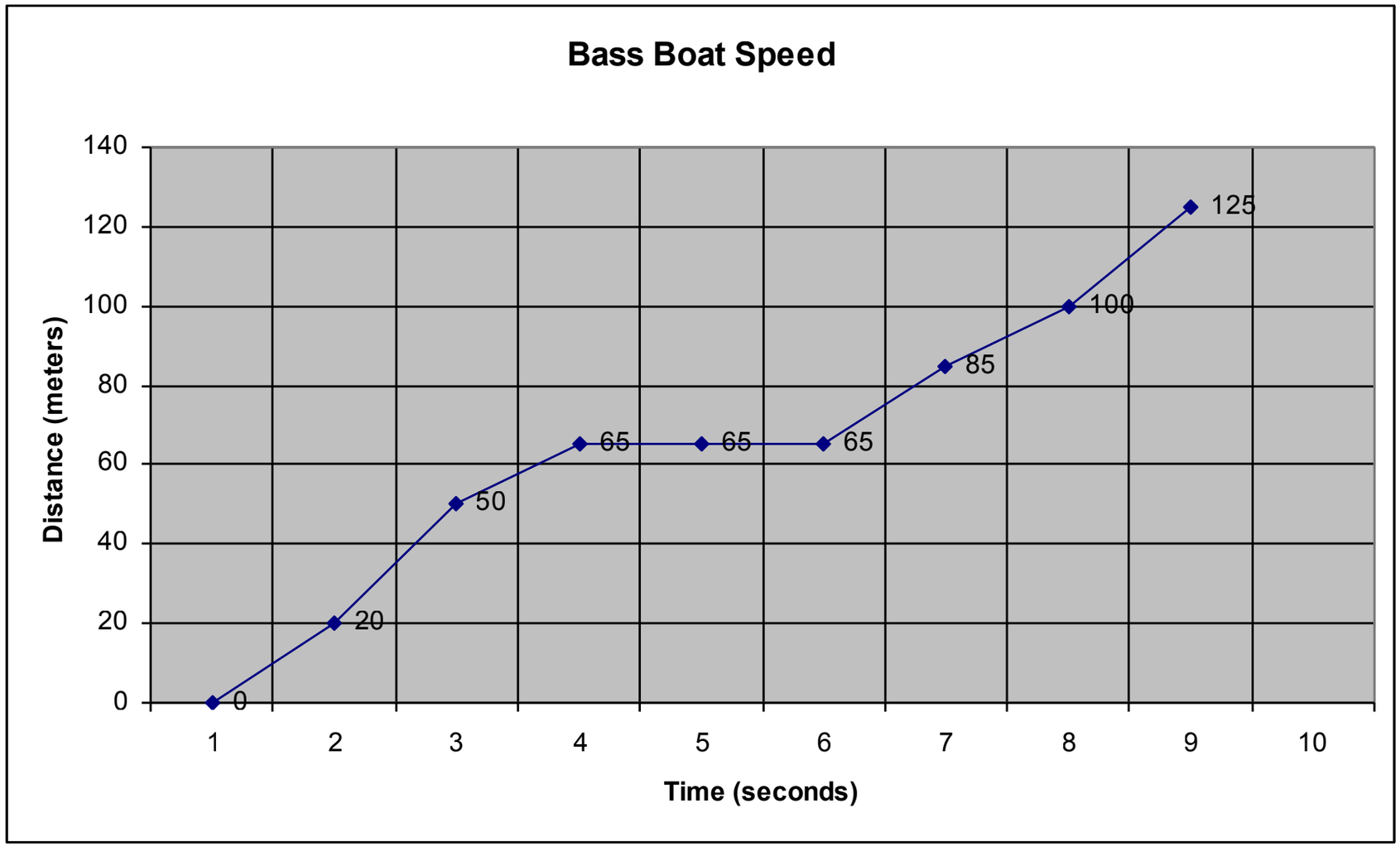




Instantaneous Speed

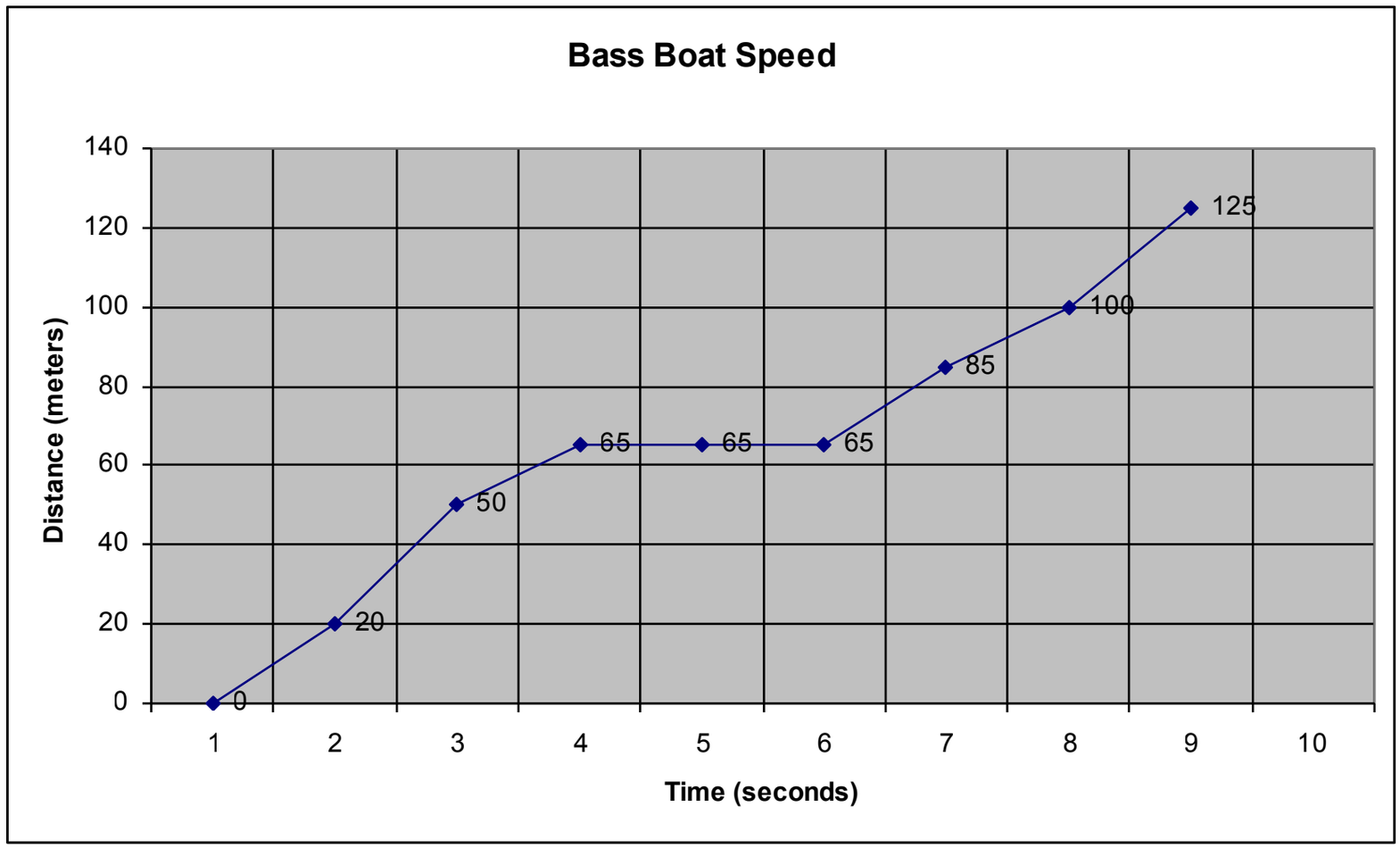
- the speed that an object is moving in a specific instant

Instantaneous Speed



What is the instantaneous speed of the bass boat at t=7 seconds?

Instantaneous Speed

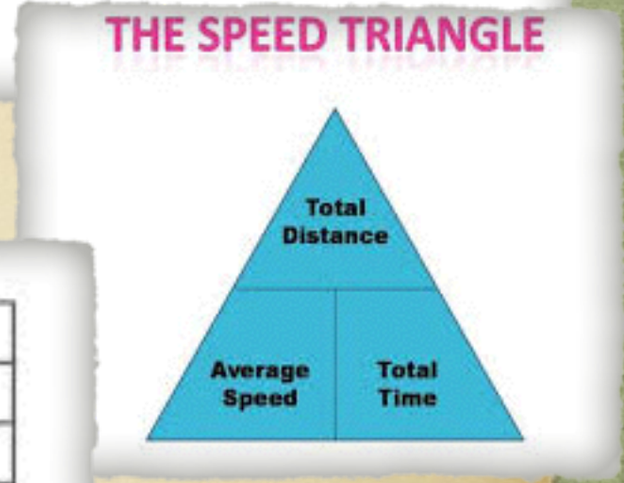


Instantaneous speed is speed at any given point in time. At 7 seconds, the distance is 85 meters; therefore the IS is

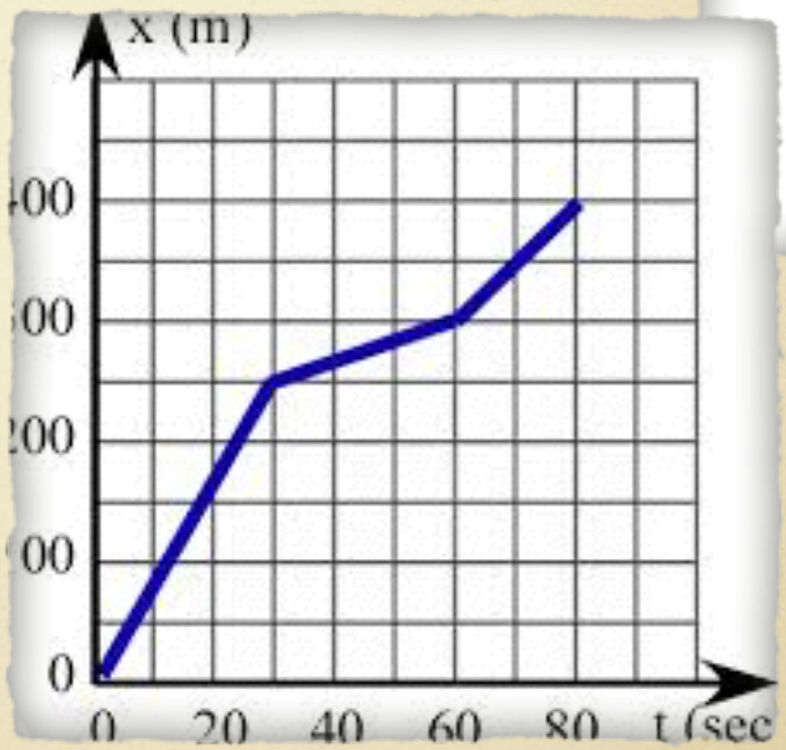
Instantaneous Speed = $\frac{\text{85 meters}}{\text{7 seconds}}$ = 12.1 m/s

5) Average Speed

$$S_{Avg} = \frac{\text{Total distance Covered}}{\text{Total time taken}} = \frac{d_1 + d + d_3 \ldots . d_n}{t_1 + t_2 + t_3 + \ldots . t_n} = \frac{D_{total}}{T_{total}}$$

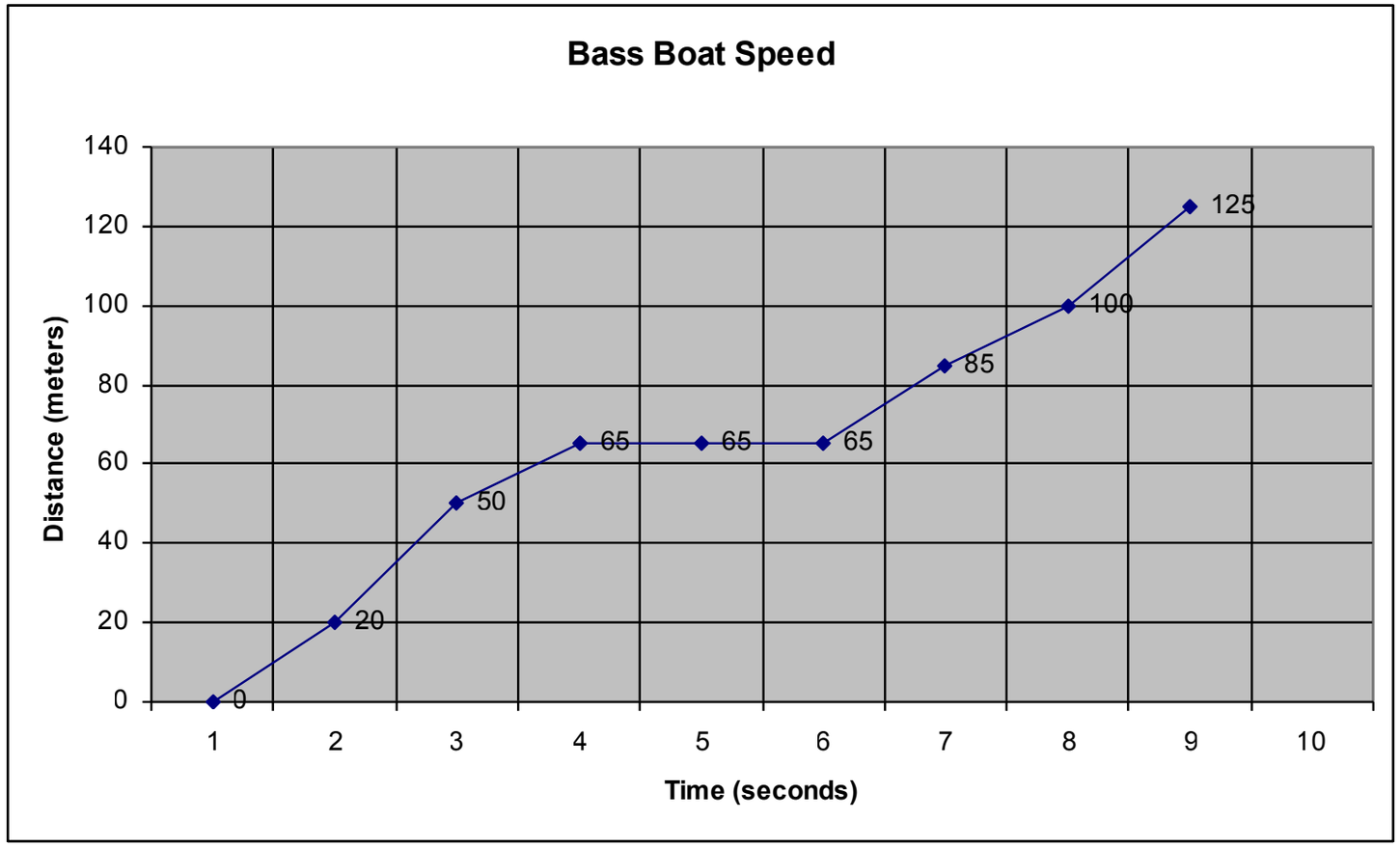


- Total distance divided by total time
- Add up all the distances, and then add up all the time(s), and then divide BOTH.



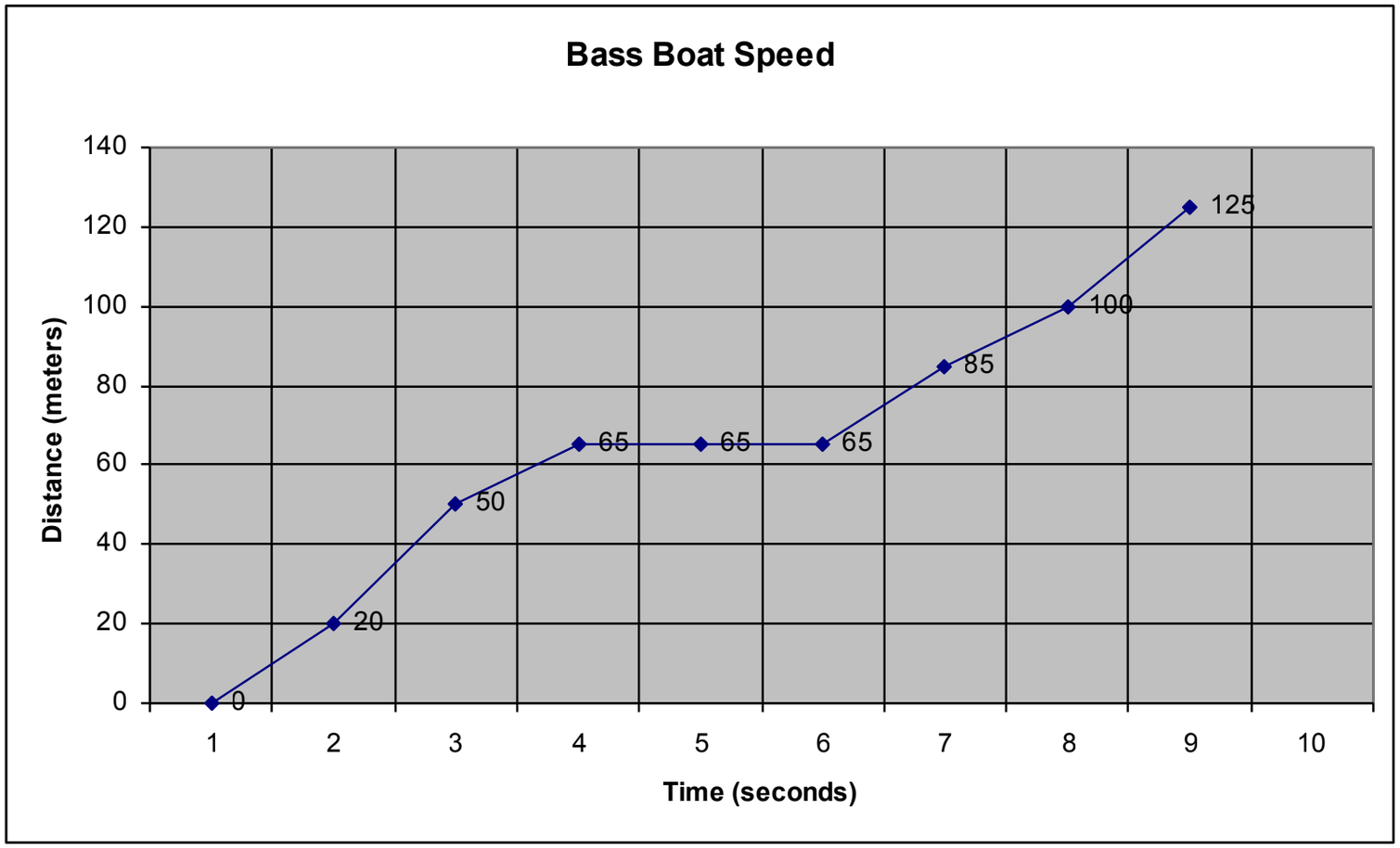
$$\text{Average speed} = \frac{\text{total distance covered}}{\text{travel time}}$$

Average Speed



What is the AVERAGE speed of the bass boat depicted in the graph?

Average Speed

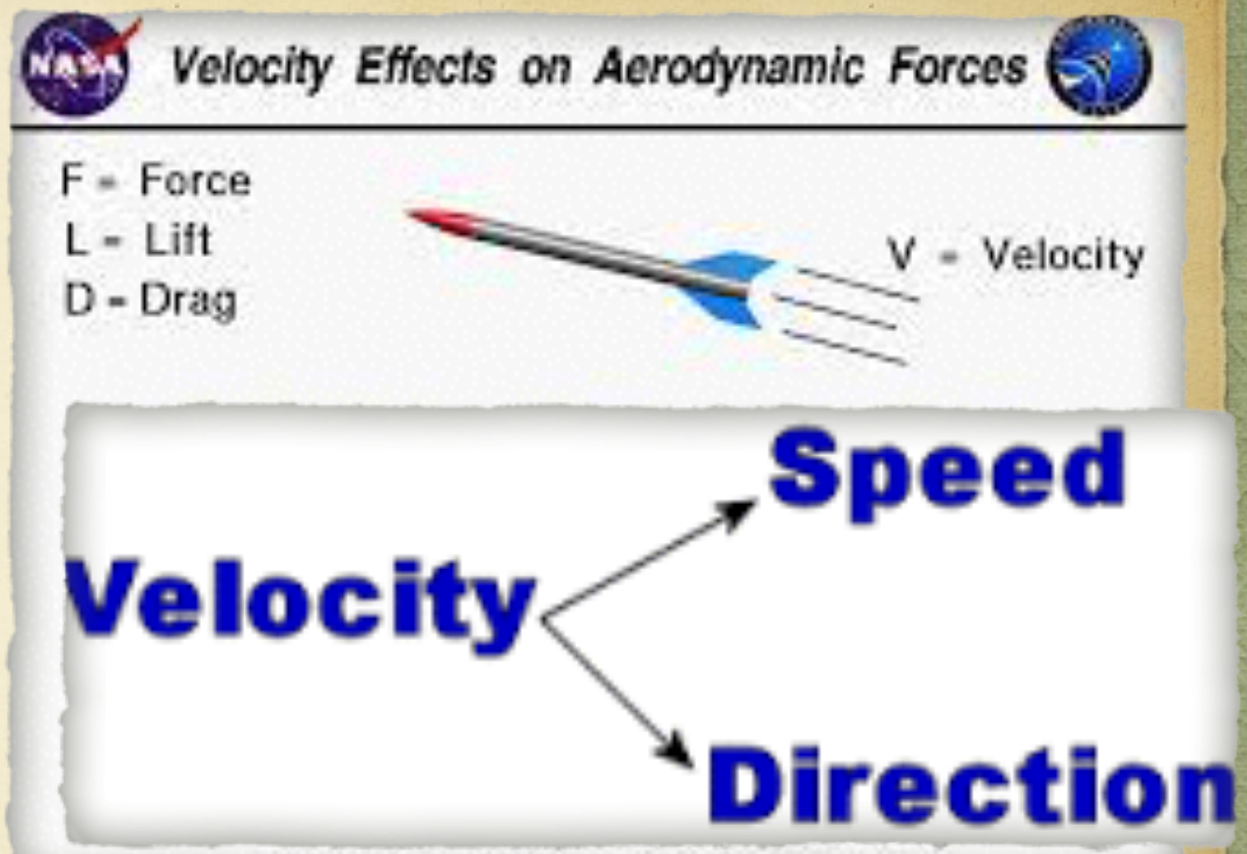


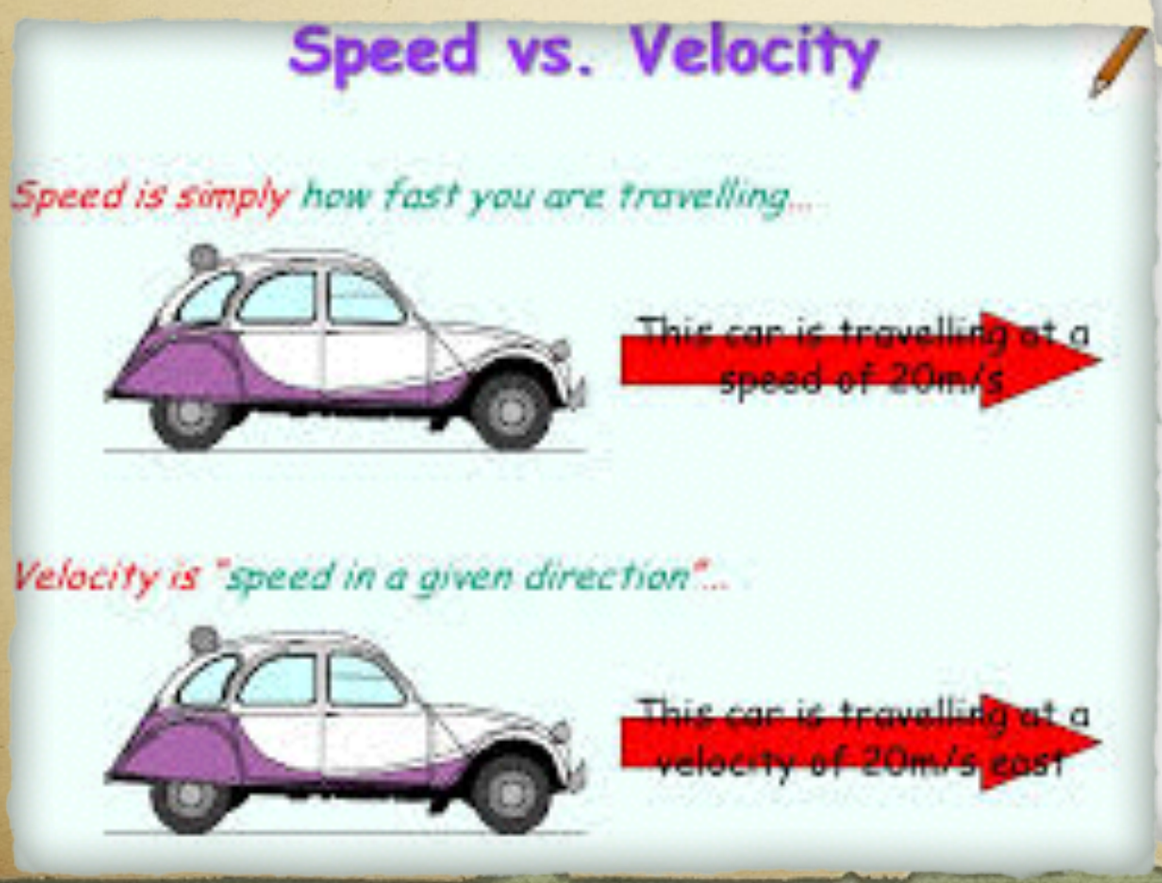
Average speed is taking the total distance traveled (0 to 125 meters), and dividing by the total time (1 to 9 seconds) it takes.

Average Speed = 125 meters = 15.6 m/s
8 seconds

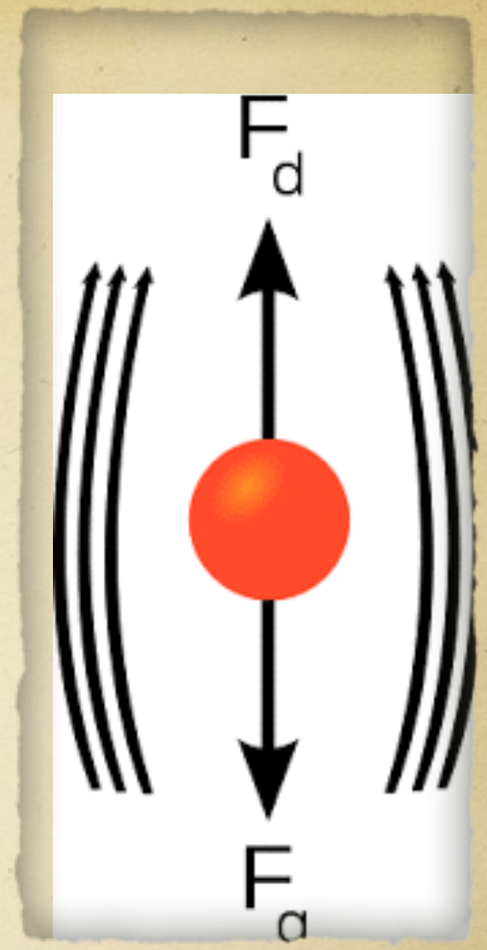
8) Velocity

- Speed with a given direction





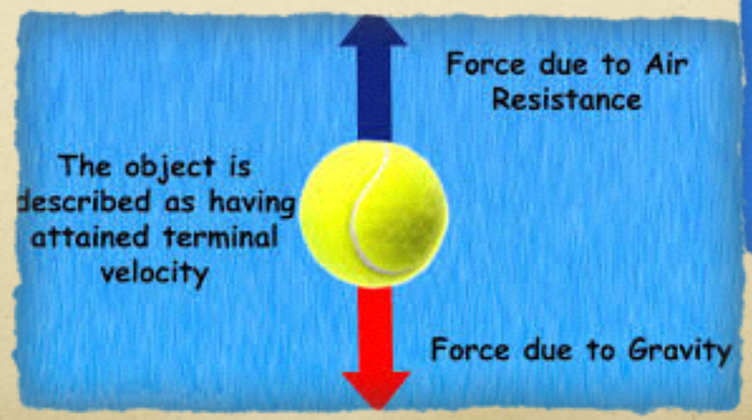
27)Terminal velocity

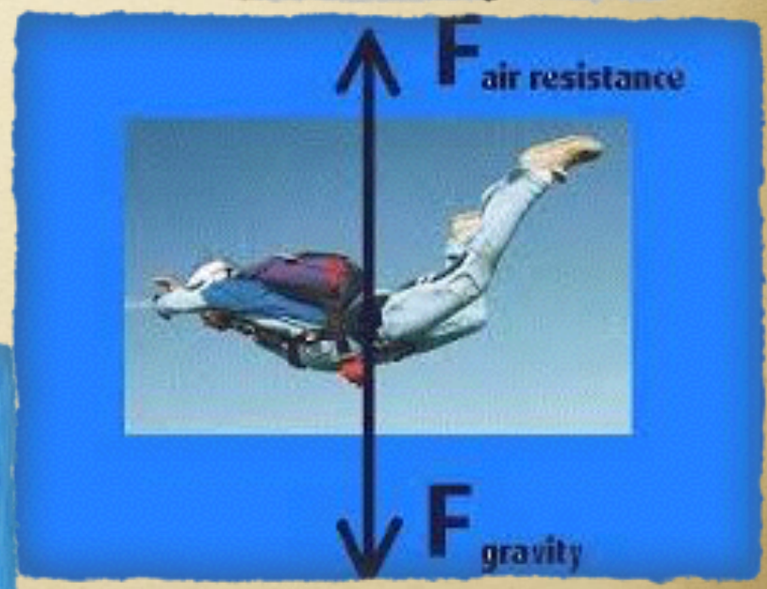


is the highest **velocity** attainable as an object falls through air. It occurs when air resistance equals the downward force of gravity acting on the object.

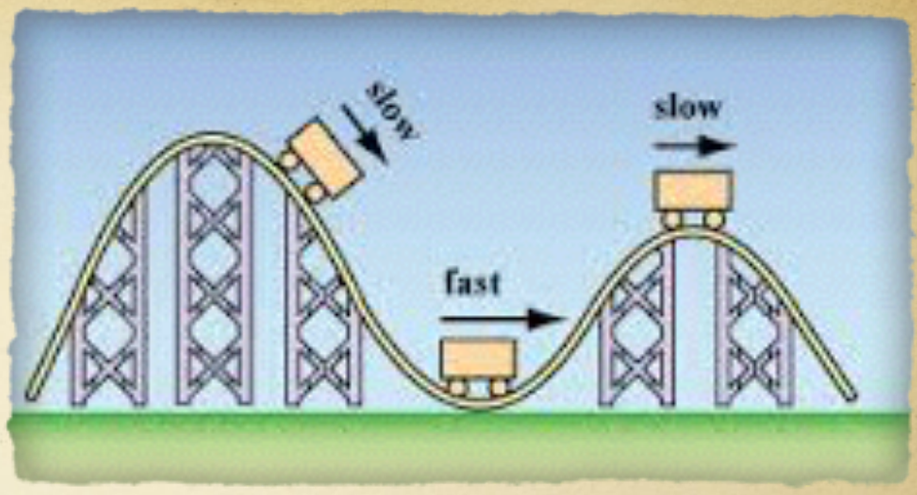
(net force = zero acceleration.)

***about 200 km/h**

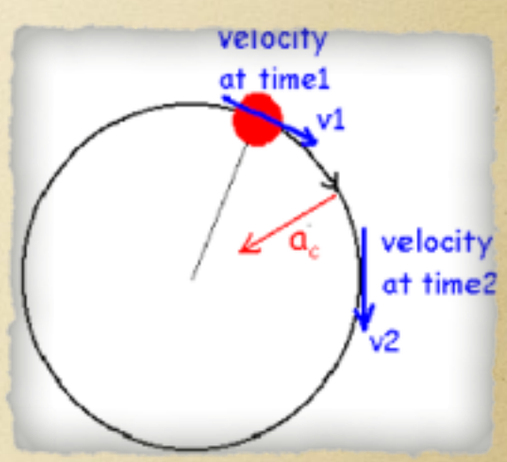




9) Acceleration

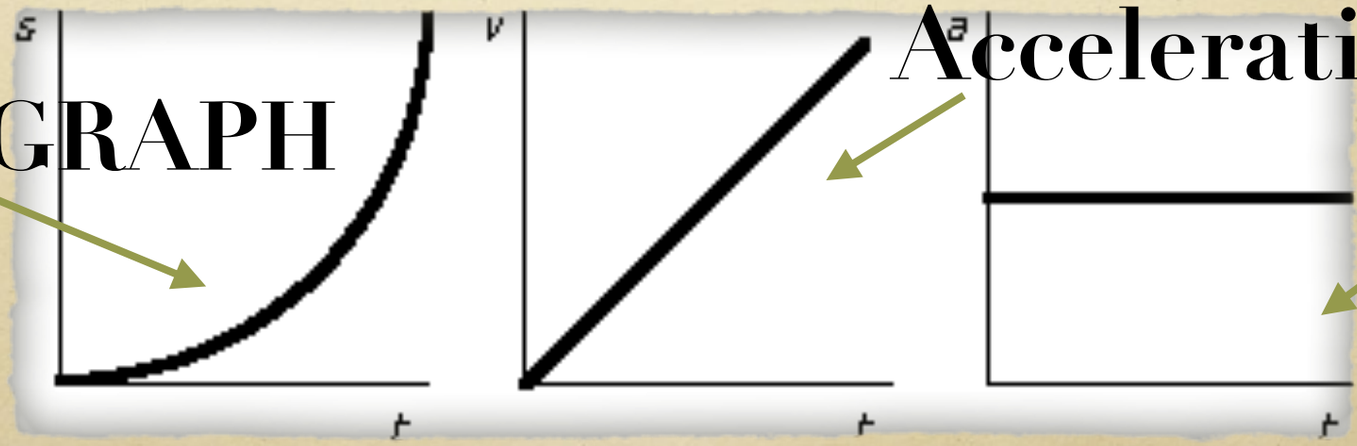


- a change in velocity (either a change speed and/or direction)
- increasing = acceleration
- decreasing = deceleration
- changing direction at the same speed

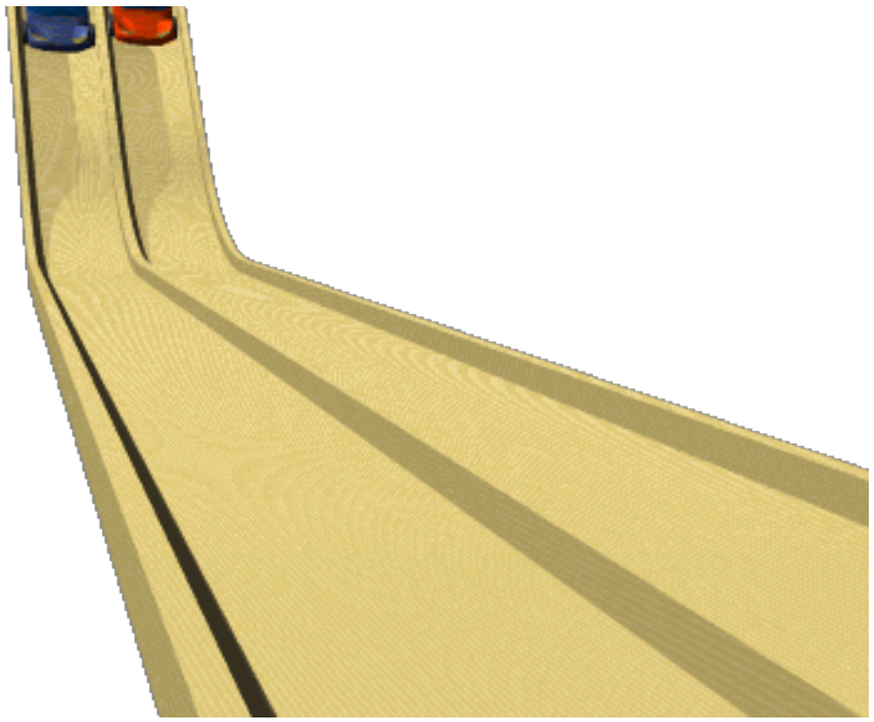


SPEED GRAPH

Acceleration graph



Acceleration



- Acceleration is the rate of change of velocity. A change in velocity can be either a change in speed, or direction, or both.
- Deceleration is when acceleration has a negative value.

Acceleration

- The formula for calculating acceleration is:

- Acceleration (a) = $\frac{\text{final velocity } (v_f) - \text{initial velocity } (v_i)}{\text{time (sec)}}$

- The unit for velocity, in this case, is

- m/s/s OR m/s^2

Acceleration Math Problem

- A jet starts at rest at the end of a runway and reaches a speed of 80 m/s in 20 s. What is its acceleration?

Acceleration Math Problem

- A jet starts at rest at the end of a runway and reaches a speed of 80 m/s in 20 s. What is its acceleration?

- Acceleration (a) = $\frac{\text{final velocity } (v_f) - \text{initial velocity } (v_i)}{\text{time (sec)}}$
- $a = \frac{80 \text{ m/s} - 0 \text{ m/s}}{20 \text{ sec}} = 4 \text{ m/s}^2$

Acceleration Math Problem

- A skateboarder is moving in a straight line at a speed of 3 m/s and comes to a stop in 2 sec. What is his acceleration?

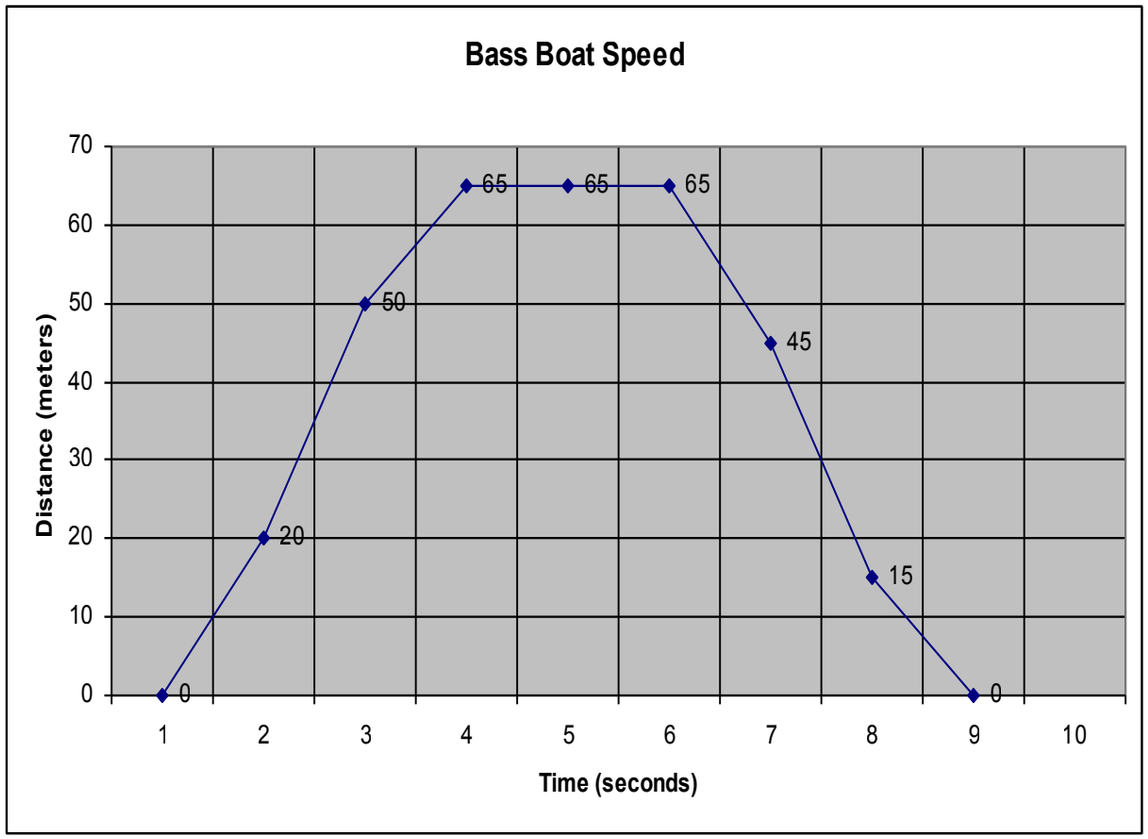
- $a = \frac{0\ m/s\ -\ 3\ m/s}{2\ m/s} = -1.5\ m/s^2$

Graphing Speed

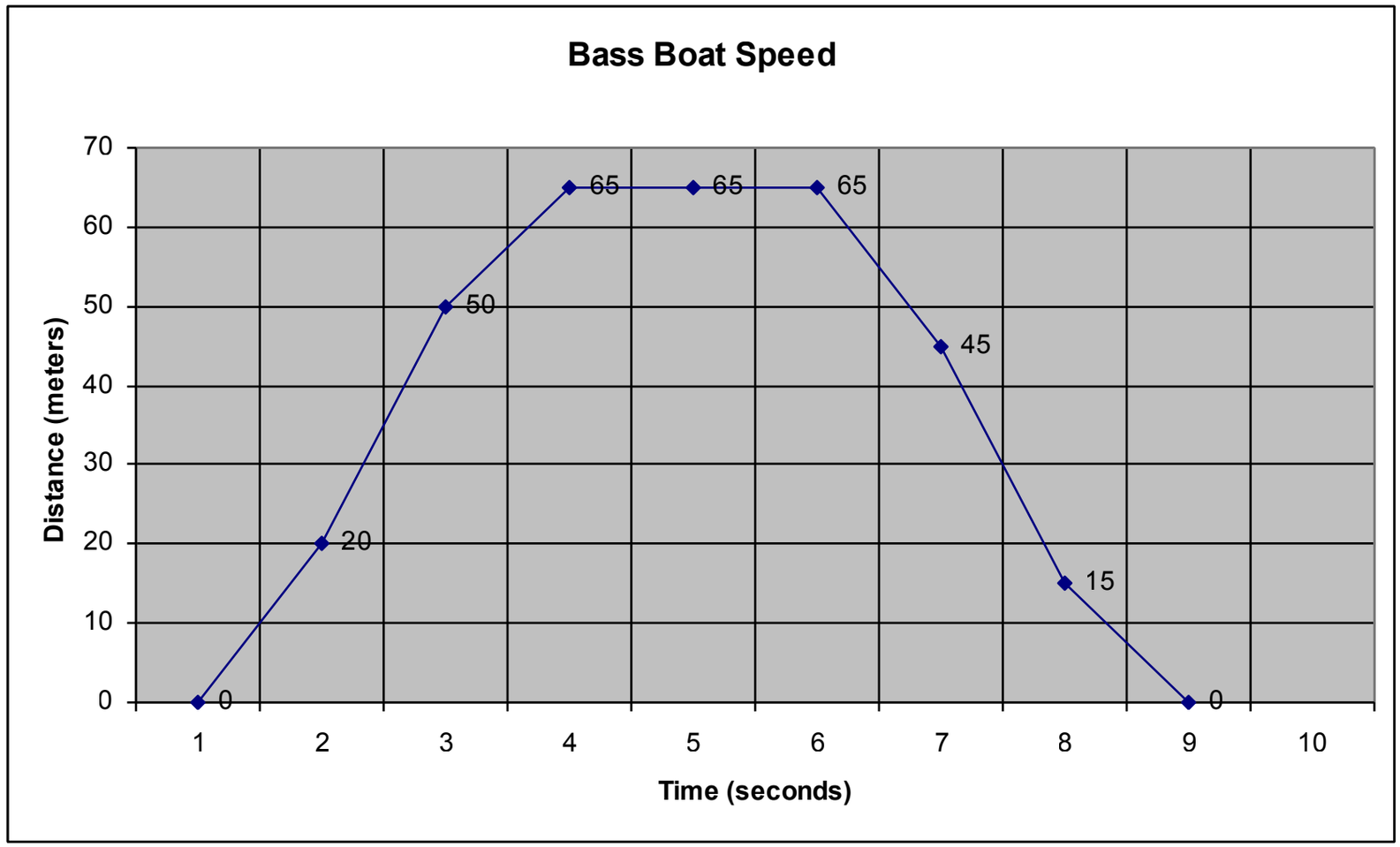
•Speed is usually graphed using a line graph, and it depicts the distance and time.

•Time is the independent variable, and thus is ALWAYS on the x-axis.

•Distance is the dependent variable, and is ALWAYS on the y-axis.



Speed Graphs



- **In what time period is the bass boat speeding up?**
- **In what time period is the bass boat slowing down?**
- **When is the speed NOT changing?**