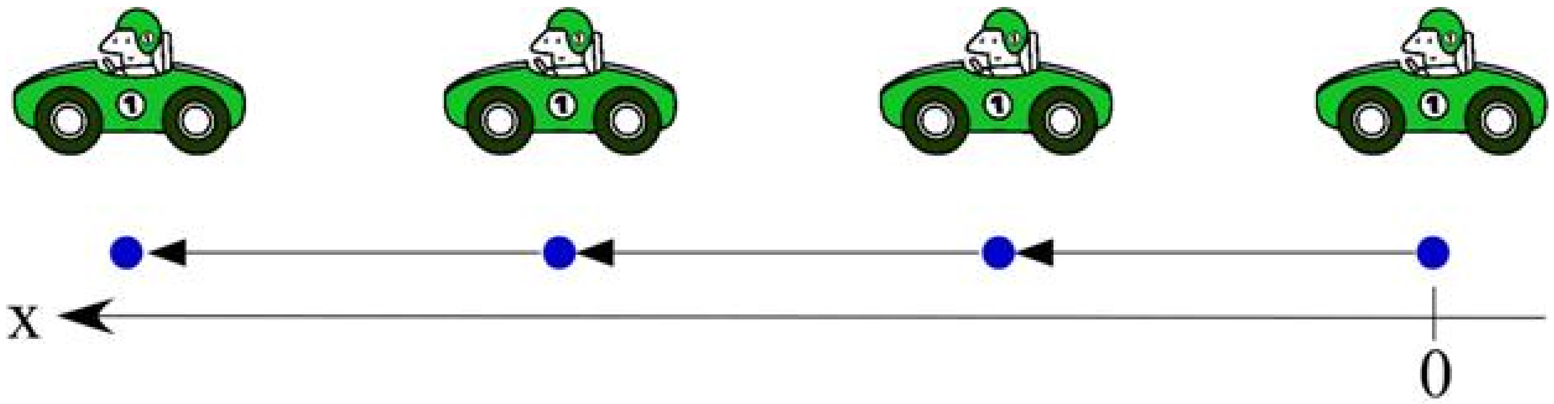
Graphing Uniform Motion



Outcomes:

S2-3-01 Analyze the relationship between displacement, time, and velocity for an object in uniform motion.

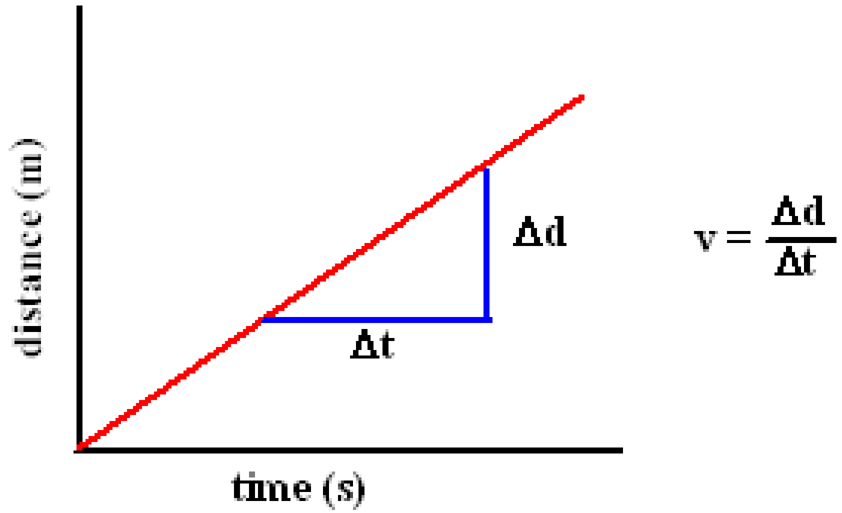
Uniform Motion…

All of the motion we have studied so far has been **UNIFORM** (**CONSTANT**),
→ without any **ACCELERATION** or **DECELERATION**.

We can draw graphs to represent **DISTANCE**, **DISPLACEMENT**, **VELOCITY** and **ACCELERATION**.

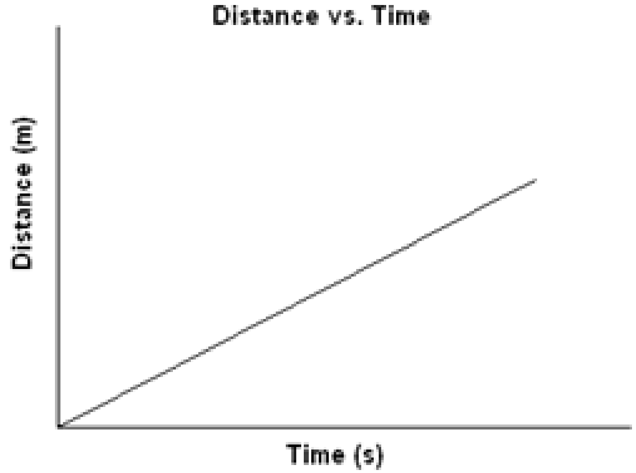
Notes on Graphs:

- use a line of best fit or a smooth curve to connect points
- include title, axis labels, scales, etc
- Use a ruler!

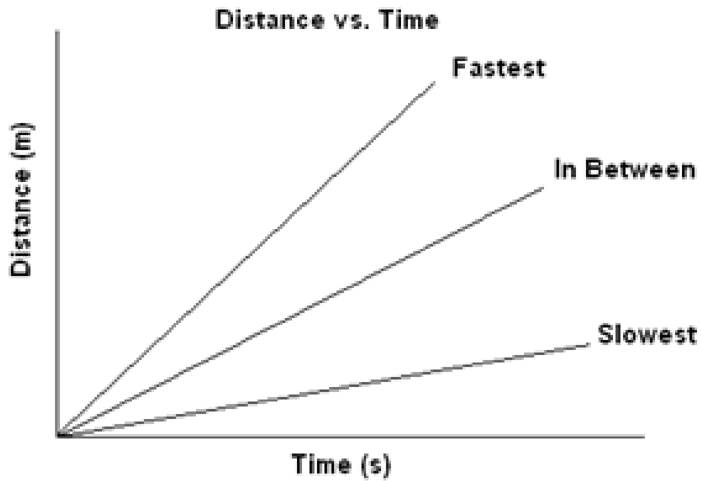


Distance-Time Graphs…

- A typical distance time graph showing **UNIFORM** (constant) motion would look like this:



- The **SLOPE** of the line tells us how **FAST** the object is moving:



Distance-Time Graphs…

- A **STEEPER** slope means you cover **MORE DISTANCE** in **LESS TIME** → **FASTER** speed!
- A **STRAIGHT** line on a distance time curve shows that **SPEED** is uniform (**CONSTANT**).
- A **CURVED** line will indicate that the **SPEED** is **CHANGING**, and is **NON-UNIFORM** (more on this later).

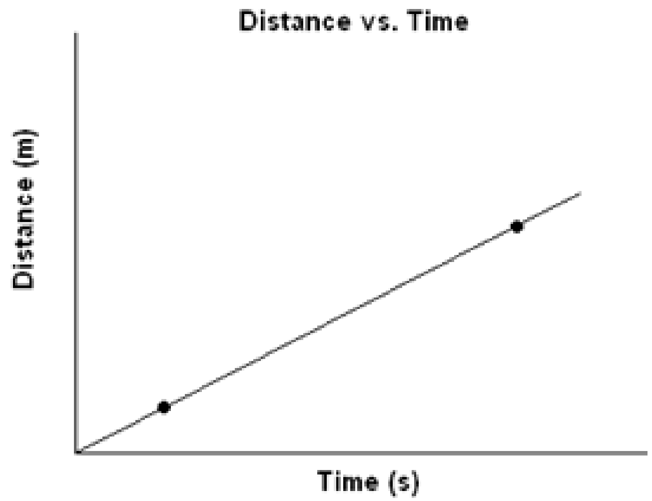
Example:

Sketch a distance-time graph for a walker and a runner who leave the school at the same time and travel in the same direction at different speeds.

Distance-Time Graphs…

<u>Finding Slope (Speed):</u>

- To find the **<u>SLOPE</u>** of a line, choose two **<u>POINTS</u>**, and **<u>DIVIDE</u>** the change in **<u>RISE</u>** (distance) by the change in **<u>RUN</u>** (time) between the points:



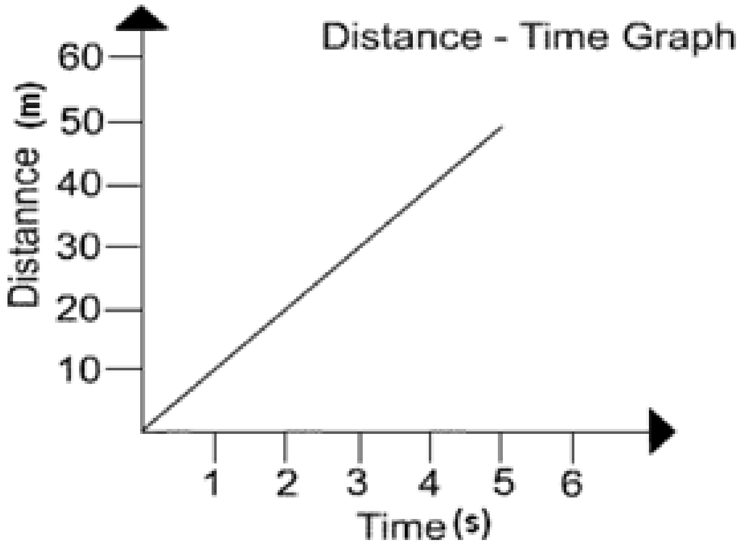
$$Slope = speed = \frac{Rise}{Run} = \frac{\Delta d}{\Delta t}$$

***The **<u>SLOPE</u>** of a d-t graph = **<u>VELOCITY</u>**!!!

Distance-Time Graphs…

Try this one…

Find the speed given the following distance-time graph:

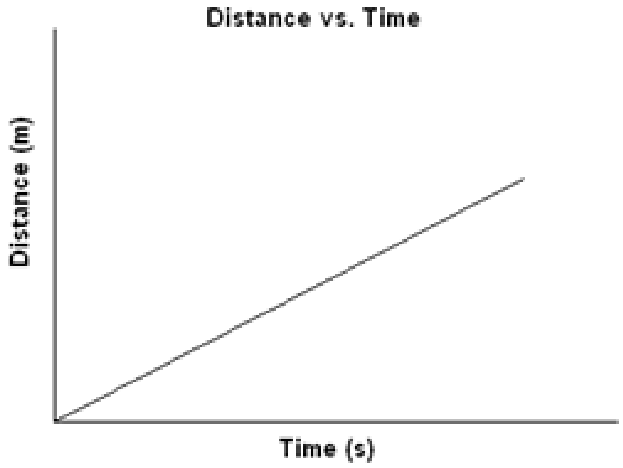


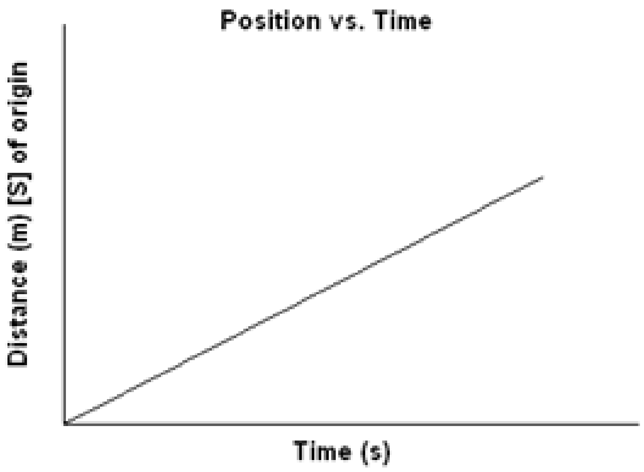
Position-Time Graphs…

Position-Time Graphs (Using Displacement):

A position-time graph is **SIMILAR** to a distance-time graph as long as the motion is in **ONE DIRECTION** only:

Ex) Geese flying south for the winter:





- If the object moves in the **FORWARD** and the **REVERSE DIRECTION**, the graphs will appear **DIFFERENT**.

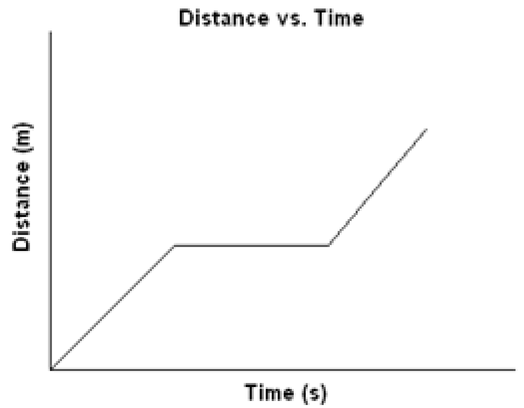
Position-Time Graphs…

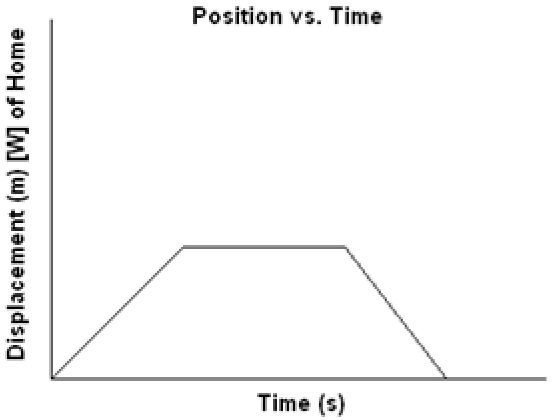
Remember:

- Distance is the **<u>TOTAL</u> <u>DISTANCE</u>** covered → must always **<u>INCREASE</u>**!
- Displacement is the **<u>POSITION</u>** relative to the **<u>ORIGIN</u>**!
- This means that **<u>POSITION</u>**-**<u>TIME</u>** graphs can have a **<u>NEGATIVE</u> <u>SLOPE</u>**, because the position can **<u>DECREASE</u>**!

<u>Example:</u>

Going to silver city, watching a movie, and then going home after.

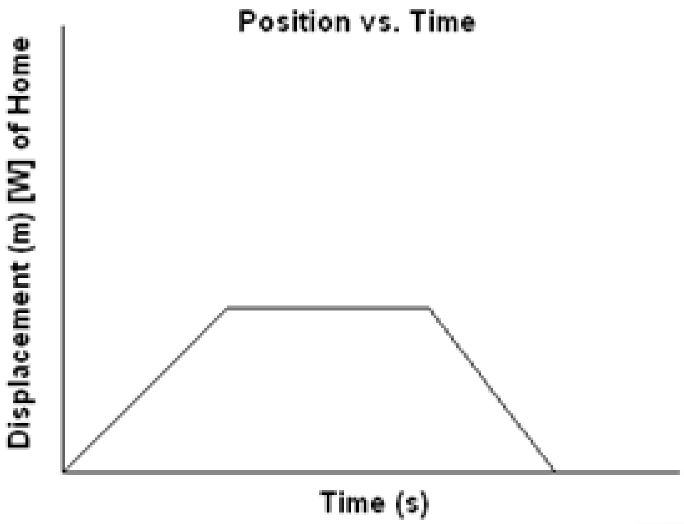




→ ***Distance to and from theatre adds together***

→ ***Trip home returns person to origin (displacement = 0)***

Position-Time Graphs…



Explaining a position-time graph:

- **POSITIVE** slope is **FORWARD** motion, **NEGATIVE** slope is **BACKWARD** motion.
- **HORIZONTAL** line means the object is **NOT MOVING**
- **STRAIGHT** lines mean **CONSTANT VELOCITY**, **CURVES** mean velocity is **CHANGING**.

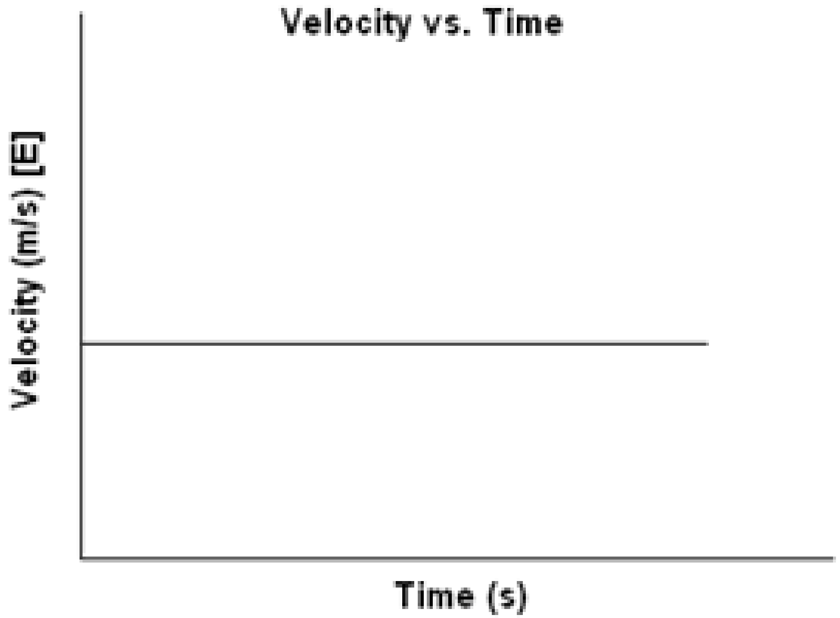
Recall

- **SLOPE** of **DISTANCE**-**TIME** graph = **SPEED**
- Now, **SLOPE** of a **POSITION**-**TIME** graph = **VELOCITY**!

Velocity-Time Graphs…

Velocity-Time Graphs:

- Since we are talking about uniform (constant) velocities, our velocity-time graphs would be a **STRAIGHT**, **HORIZONTAL** line:



Acceleration-Time Graphs…

Acceleration-Time Graphs:

- Again, we are currently looking at constant motion only. Therefore we **CANNOT** have any **ACCELERATION** or **DECELERATION**. So a graph would just be a **HORIZONTAL** line at **ZERO**.