The study of motion

KINEMATICS

SCALAR QUANTITIES AND VECTOR QUANTITIES VIDEO

Play until 2:00

In your group, using your resources (internet and notes) complete the Matching section on your handout.

Speed: _____

Velocity: _____

Displacement: _____

Distance: _____

Acceleration: _____

Density: _____

Mass: _____

Weight: _____

Pressure: _____

Force: _____

Magnitude and Direction: _____

Only Magnitude: _____

In your group, using your resources (internet and notes) complete the Matching section on your handout.

Speed: ___S___

Velocity: ___V___

Displacement: ___V___

Distance: ___S___

Acceleration: ___V___

Density: ___S___

Mass: ___S___

Weight: ___V___

Pressure: ___S___

Force: ___V___

Magnitude and Direction: ___V___

Only Magnitude: ___S___

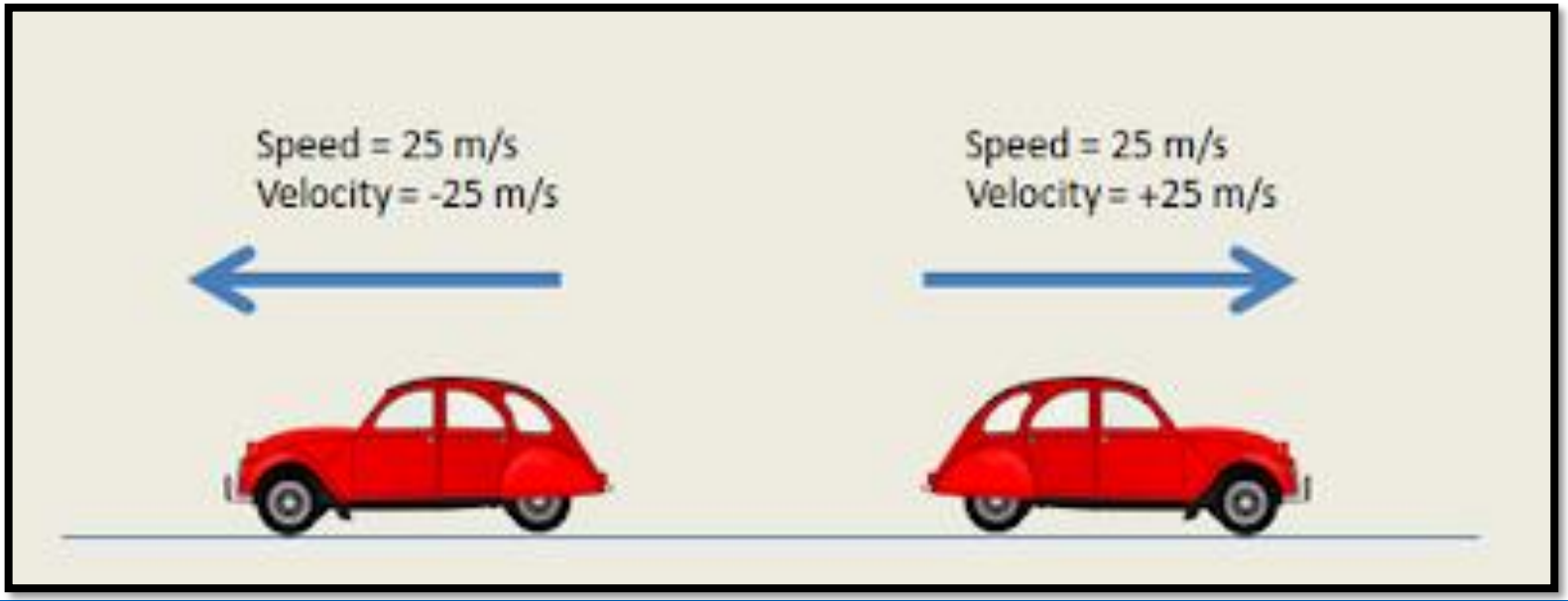
Vector Quantity

A quantity with **magnitude** and **direction**!

Intro Video

Vectors in One – Dimension

- The car drove 25 m/s RIGHT, and has a positive velocity of +25m/s
- The car drove 25 m/s LEFT, and has a negative velocity of -25 m/s



Vector Quantity: Velocity

- **The rate of change of position** with respect to a frame of reference

- **Instantaneous Velocity**: Velocity at a particular instant!

- **Average Velocity**: Calculated with change of position, divided by the time interval for that change.

The most common units are meters/second or kilometers/hour

$$\overrightarrow{v_{av}} = \frac{\overrightarrow{\Delta d}}{\Delta t}$$

Vector Quantity: Velocity

Velocity Video

Video Task 1: Pause at 5:33. Discuss the idea with your elbow-partner. You have 30 seconds!

Continue video and pause at 5:55 to discuss as a class!

Video Task 2: Will all race-car drivers that finish the race have the same average velocity?

$$\overrightarrow{v_{av}} = \frac{\overrightarrow{\Delta d}}{\Delta t}$$

Collaborative Problem Solving

A cheetah runs right for 127 m from d1 to d2 in 29.3 s.

1. Calculate the cheetah's average velocity.
2. Provide a rough Position-Time graph for the cheetah's average velocity.

Collaborative Problem Solving

A cheetah runs right for 127 m from d_1 to d_2 in 29.3 s.

1. Calculate the cyclist's average velocity.

We Know:

d = 127 m Right

t = 29.3 s

Required:

v = ???

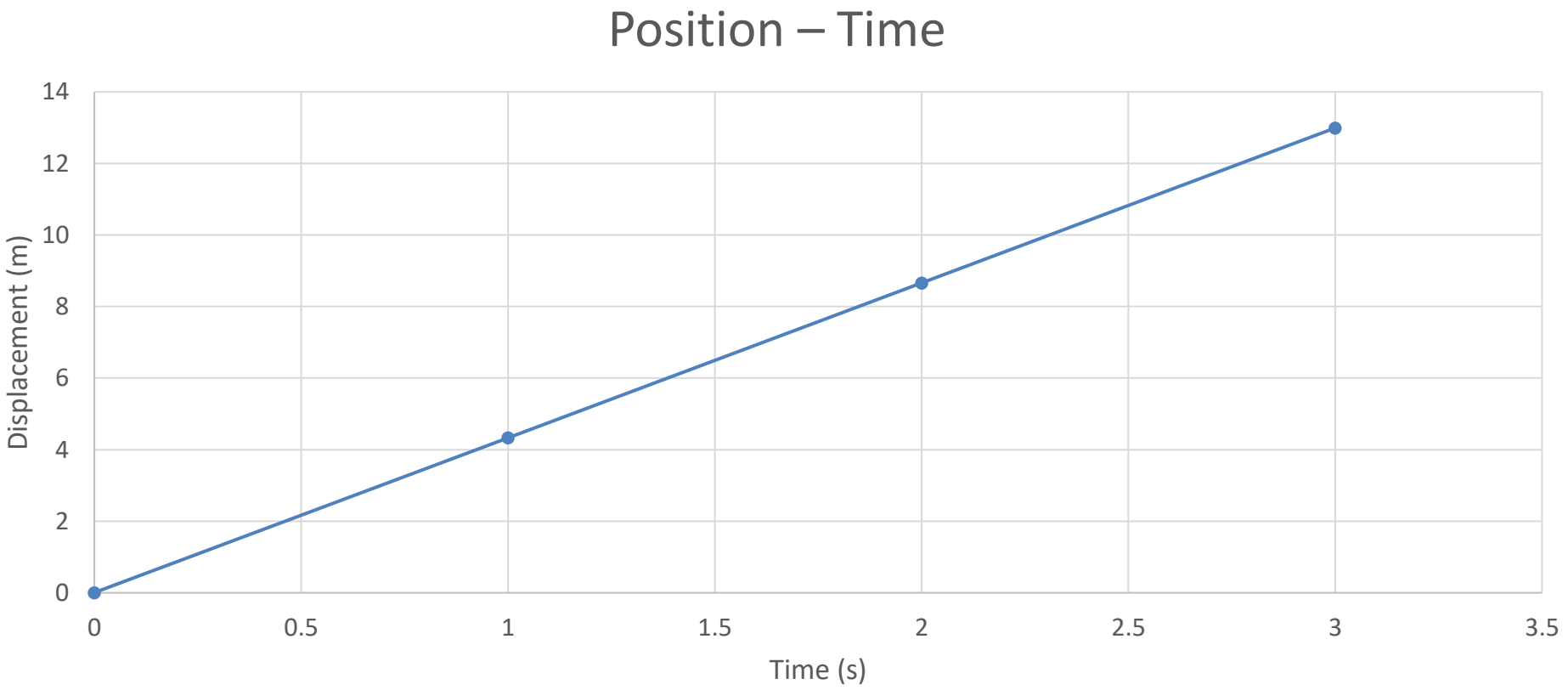
Equation: $\overrightarrow{v_{av}} = \frac{\overrightarrow{\Delta d}}{\Delta t}$

Solve:

$\overrightarrow{v_{av}} = \frac{127\ m\ Right}{29.3}$ $\overrightarrow{v_{av}} = +4.33$ m/s

The cheetah's average velocity is + 4.33 m/s.

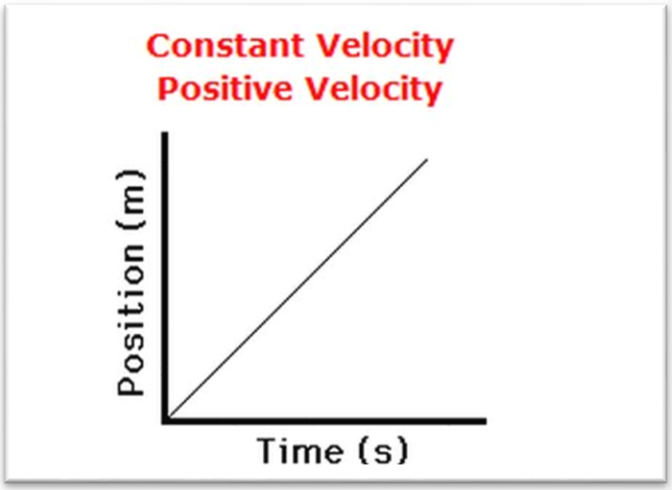
Provide a rough Position-Time graph for the cheetah's average velocity.

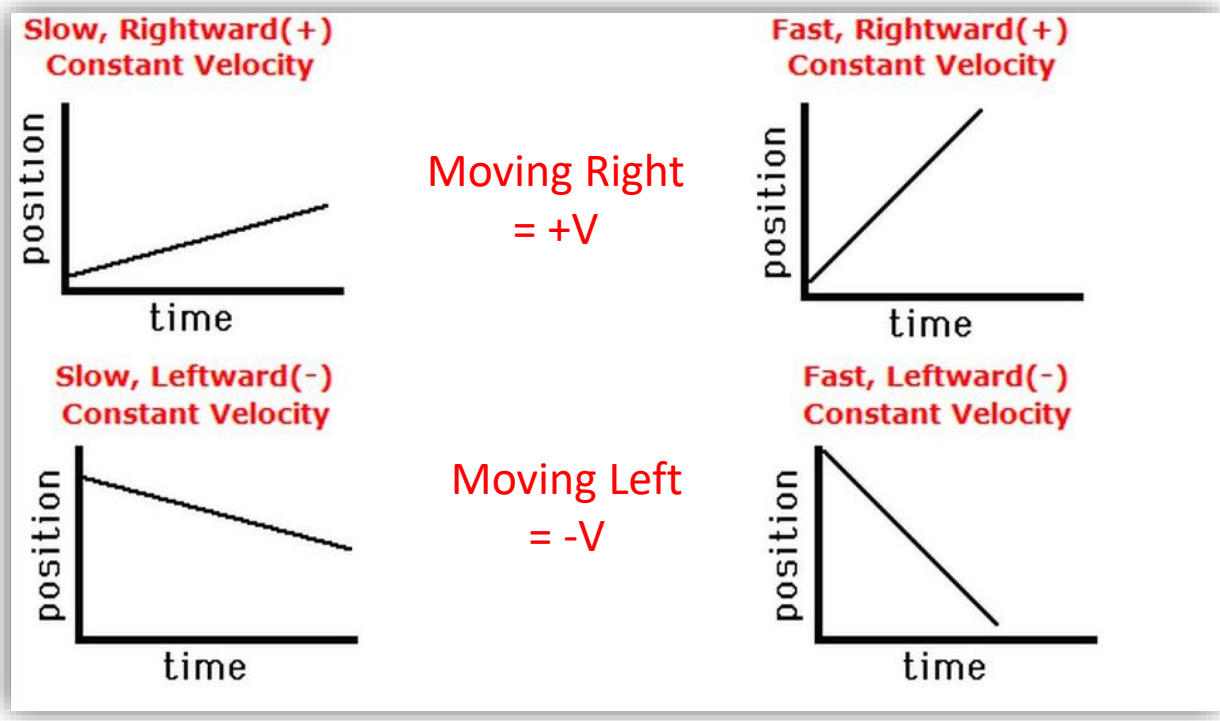


With your group, draw position-time line graphs on how you would represent velocity for an object that is

- Moving right at a high constant velocity
- Moving right at a slow constant velocity
- Moving left at a high constant velocity
- Moving left at a slow constant velocity

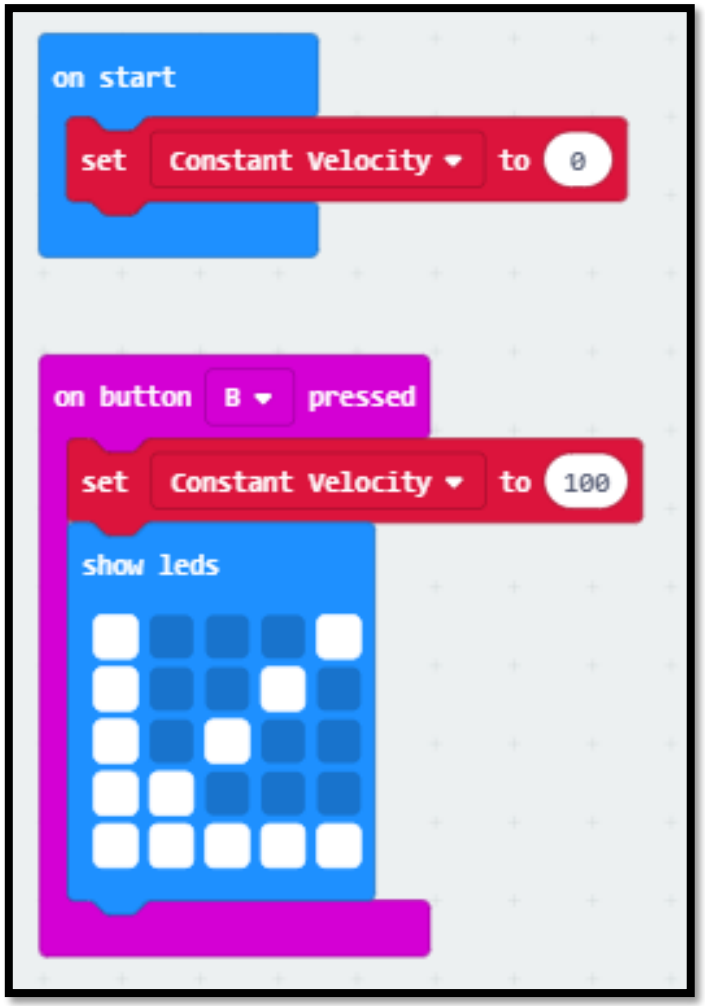
With your group, draw a position-time line graph on how you would represent the velocity





Test your Knowledge:

- View and Try the Example Micro:bit Code
  - What type of velocity is being described in the Position-Time Graph?
- Expand on the Micro:bit code to demonstrate
  - An object that has no velocity
  - An object that has negative velocity
- Optional Challenge
  - Modify code to allow for the demonstration of updates for constant velocity.



Test your Knowledge:

With your coded Micro:bit, create constant velocity scenarios to test your group's knowledge!

1. Individually, each person in the group will create and write down 2 different constant velocity scenarios and the answers.
2. Partner 1 will quiz Partner 2 and 3 with their scenarios, who will then answer by using their coded Micro:bit.
3. Partner 1 will provide Partner 2 and 3 with the answer and complete a discussion on the process for arriving at that answer.
4. Partners will then rotate and continue the process until all scenarios are completed.

Once completed, we will have a class discussion on the created scenarios, the process for answering these scenarios, and the various codes that were utilized to help answer these scenarios.

Additional Questions #3 & 4

A cheetah runs right for 127 m from d_1 to d_2 in 29.3 s.

1. Calculate the cheetah's average velocity.
2. Provide a rough Position-Time graph for the cheetah's average velocity.
3. If the cheetah maintains the same average velocity for 1.00 h, what is the total displacement?
4. If the cheetah turns around at d_2 and travels 435 m left to position d_3 in 63.7 s, what is the average velocity for the entire motion?

Additional Questions #3 & 4

3. If the cheetah maintains the same average velocity for 1.00 h, what is the total displacement?

We Know:

v = 4.33 m/s Right

t = 1 hr.

t = 3600 seconds

Required:

d = ???

Equation: $\vec{d} = \overrightarrow{\Delta v} * t$

Solve:

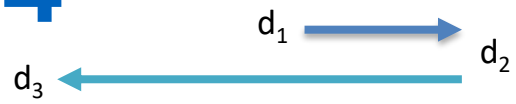
$\vec{d} = 4.33\ {}^{m}/_{s}\ Right * 3600\ s$

$\vec{d} = 15{,}558\ m$

$\vec{d} = 15.56\ km$

If the cheetah maintained the average velocity of 4.33 m/s Right for 1 hour, it would travel 15.56 km.

Additional Questions #3 & 4



4. If the cheetah turns around at d_2 and travels 435 m left to position d_3 in 63.7 s, what is the average velocity for the entire motion?

We Know:

d = 435 m Left -127 m Right

t = 63.7 s + 29.3 s

Required:

v = ???

Equation:

$$\overrightarrow{v_{av}} = \frac{\Delta \vec{d}}{\Delta t}$$

Solve:

$$\overrightarrow{v_{av}} = \frac{308\ m\ Left}{93\ s}$$

$\overrightarrow{v_{av}}$ = -3.31 m/s

The cheetah's average velocity for the entire motion from d_1 to d_2 then to d_3 is -3.31 m/s