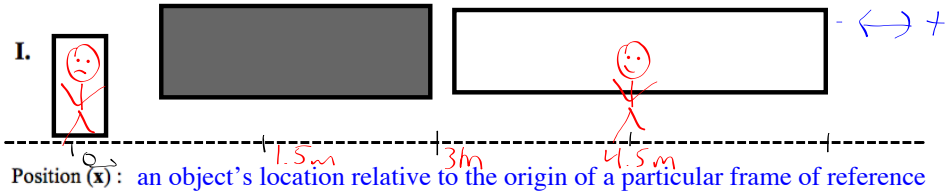
Motion in One Dimension (One Dimensional Kinematics)

Essential idea: Motion may be described and analysed by the use of graphs and equations.

I.



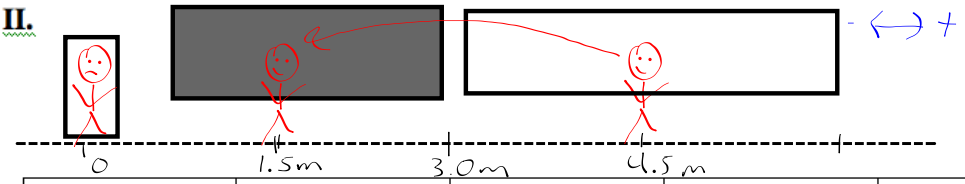
Position ($\vec{x}$): an object's location relative to the origin of a particular frame of reference

Initial Position	Final Position	Change in Position
$\vec{X}_0 = 0m$	$\vec{X}_f = 4.5m$	$\Delta\vec{X} = \vec{X}_f - \vec{X}_0 = 4.5m - 0m = 4.5m$

Distance (d): the actual distance traveled by the object without regard to direction

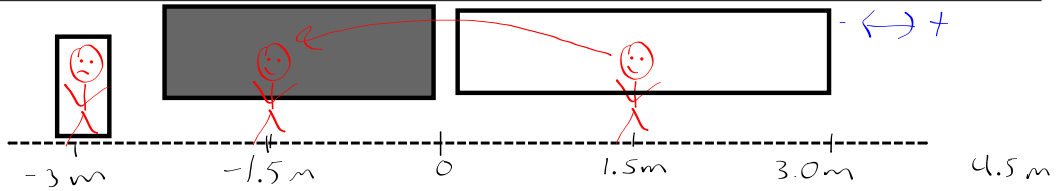
Displacement ($\vec{\Delta x}$ or $\vec{d}$): the change in position of an object (distance traveled in a particular direction)

II.



Initial Position	Final Position	Change in Position	Displacement	Distance
$\vec{X}_0 = 4.5m$ X_i	$\vec{X}_f = 1.5m$	$\Delta\vec{X} = \vec{X}_f - \vec{X}_0$ $1.5m - 4.5m$	3m East $-3.0m$	3m

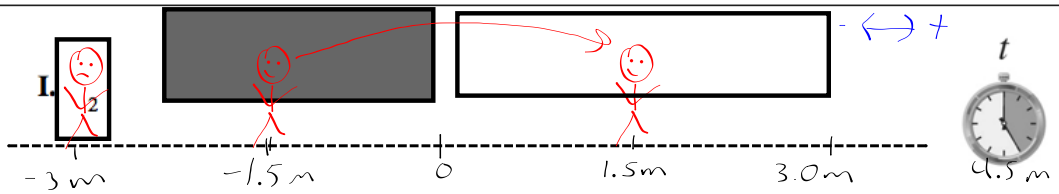
III.



Initial Position	Final Position	Change in Position	Displacement	Distance
1.5m	$-1.5m$	$\vec{X}_f - \vec{X}_0$ $-1.5m - 1.5m$	3m East	3m

Speed and Velocity

I.

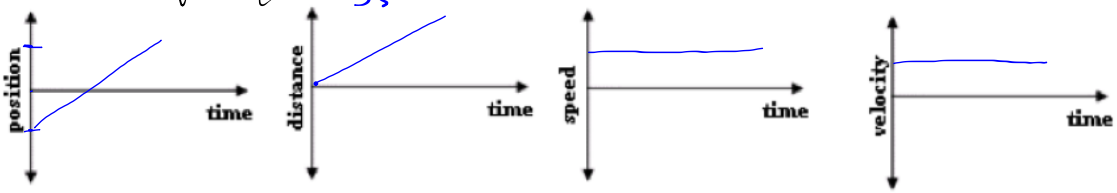


Speed (v) : distance traveled per unit time

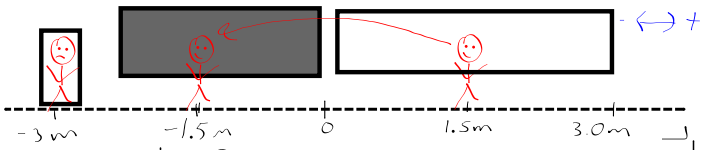
$$V = \frac{d}{t} = \frac{3m}{5s} = 0.6 m/s$$

Velocity (v) : rate of change of position (displacement per unit time) – speed + direction

$$\vec{V} = \frac{\vec{d}}{t} = \frac{3m}{5s} = .6 m/s \text{ west}$$

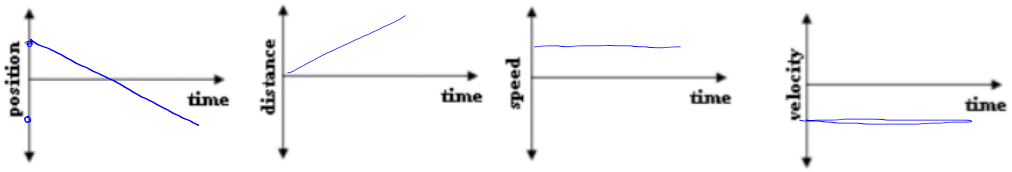


II.



Speed = $\frac{d}{t} = \frac{3m}{5s} = .6 m/s$

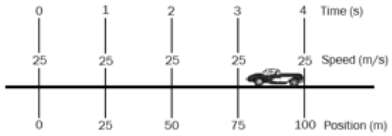
Velocity = $\frac{d}{t} = \frac{-3m}{5s} = -.6 m/s$



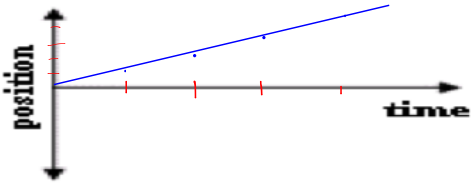
1. If a person is moving in the positive direction, she has a . . . . + velocity, + displacement

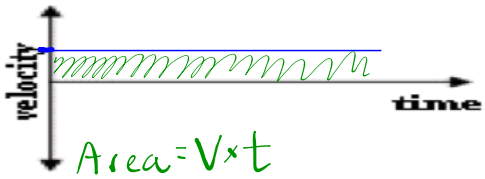
2. If a person is moving in the negative direction, he has a . . . - velocity, - displacement

The following shows a car moving at a constant speed.



Time (s)	0	1	2	3	4
Displacement (m)	0	25	50	75	100
Velocity (m/s)	25	25	25	25	25





1. What does the slope of the position-time graph represent?

slope = velocity

2. What does the area under the velocity-time graph represent?

area = displacement

Essential idea: Some quantities have direction and magnitude, others have magnitude only, and this understanding is the key to correct manipulation of quantities

Magnitude: the value of a quantity (number and unit)

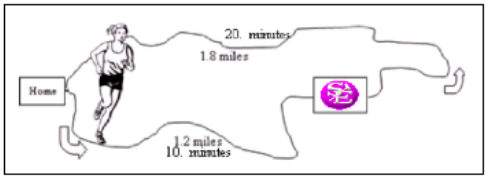
Scalar: a quantity that consists of magnitude only

Examples of scalar quantities: speed, distance, time, mass

Vector: a quantity that consists of magnitude and direction

Examples of vector quantities: displacement, velocity, acceleration, force

A student runs from home to school and back.



	Running from home to school	Round trip
Distance	1.2 mi	3.0 mi
Displacement	~.8 mi	0
Speed	.12 miles/min	0.10 mile/min
Velocity	.08 miles/min	0

3. When is the distance an object travels equal to its displacement (in magnitude)?

moving in straight line, without changing direction

4. When is the speed of an object equal to its velocity (in magnitude)?

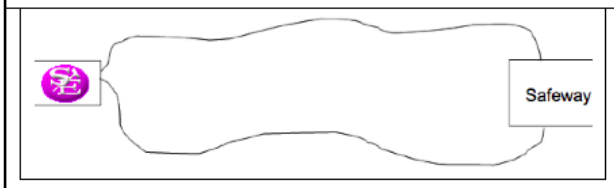
moving in straight line, without changing direction

5. How can you drive at a constant speed but not at a constant velocity?

driving around curve

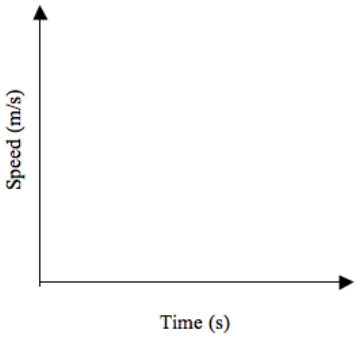
3

Average vs. Instantaneous



Calculate your speed for a trip to Safeway.

Sketch a graph of your speed for your trip.



1. Average speed (or velocity):

2. Instantaneous speed (or velocity):

3. Describe a trip in which a car's average speed equals its instantaneous speed for the entire time.