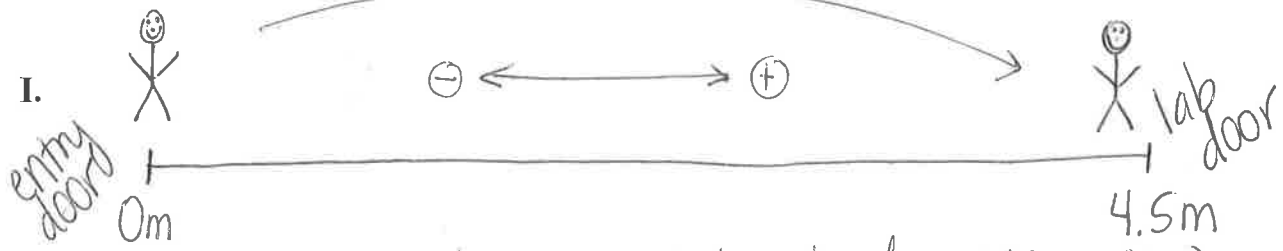
Rosenthal (P.3) Fall 2018

Motion in One Dimension (One Dimensional Kinematics)

I.



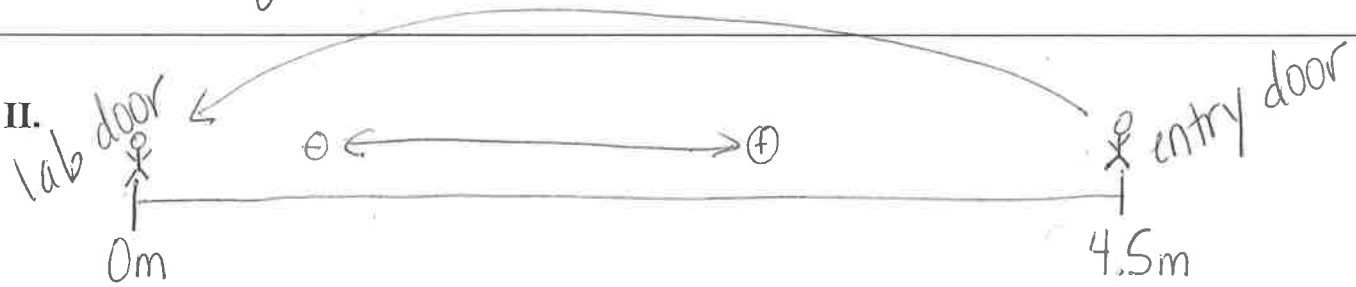
Position (x): an object's location relative to the origin (0m) from a particular frame of reference.

Initial Position	Final Position	Change in Position
$x_i = 0m$ x_0	$x_f = 4.5m$	$\Delta x = x_f - x_i = 4.5m$ $4.5m - 0m = 4.5m$

Distance (d): The actual length traveled by the object.

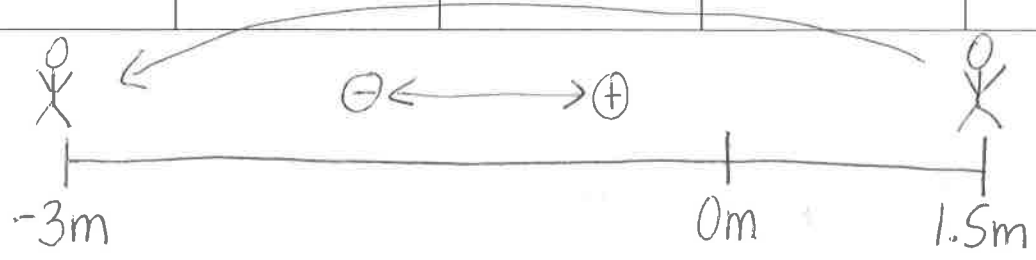
Displacement (Δx or d): The change in position of the object relative to the origin.

II.



Initial Position	Final Position	Change in Position	Displacement	Distance
4.5m	0m	$x_f - x_i$ $0m - 4.5m$	-4.5m	4.5m

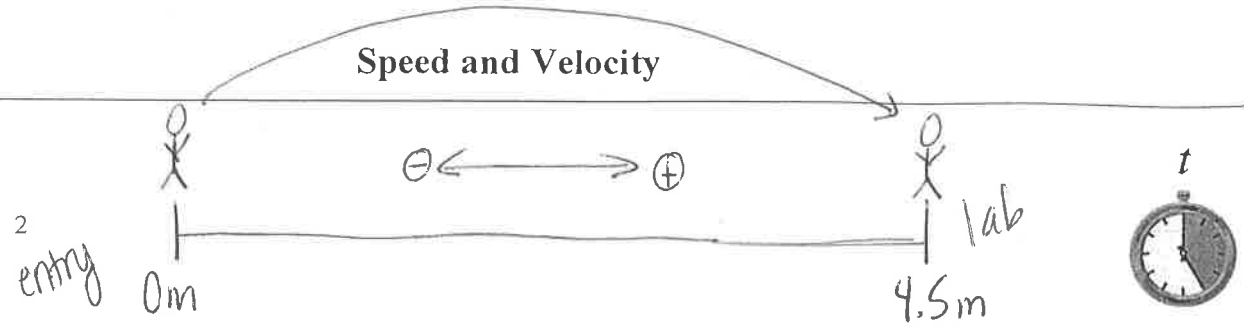
III.



Initial Position	Final Position	Change in Position	Displacement	Distance
1.5m	-3m	$x_f - x_i$ $-3m - 1.5m$	-4.5m	4.5m

Speed and Velocity

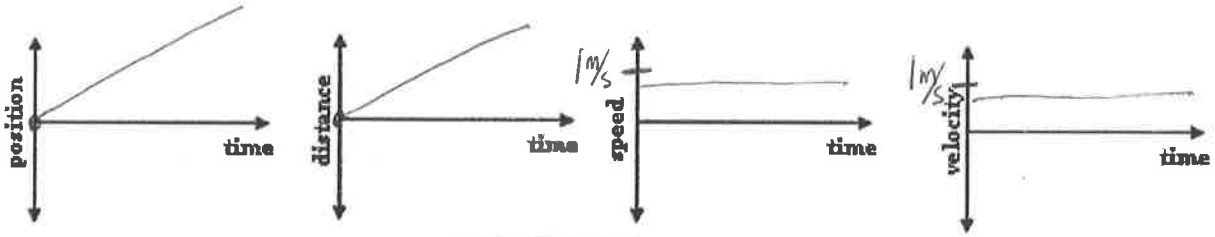
I.



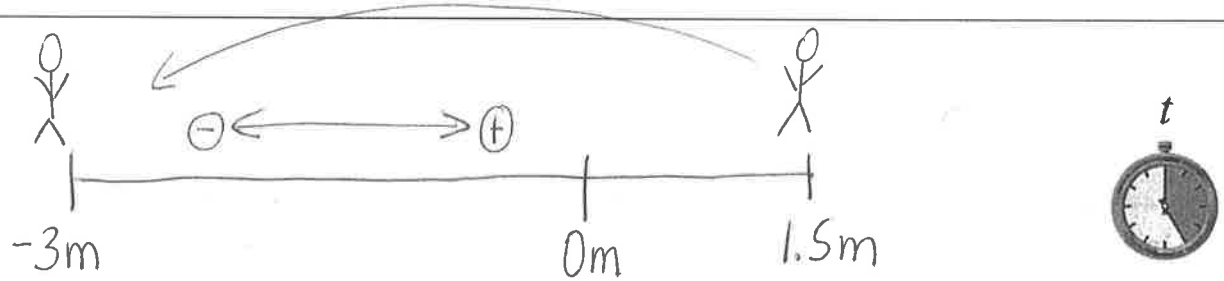
Speed (v): distance traveled per unit time

$$v = \frac{d}{t} \qquad \frac{4.5m}{5s} = \overset{\oplus}{0.9}\frac{m}{s}$$

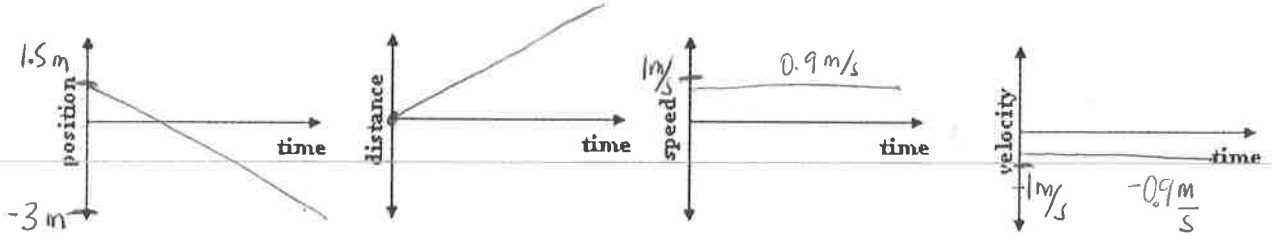
Velocity (v): displacement vs. unit time has magnitude + direction $\vec{v} = \frac{\vec{d}}{t} = \vec{v} = \frac{\Delta \vec{x}}{\Delta t}$



II.



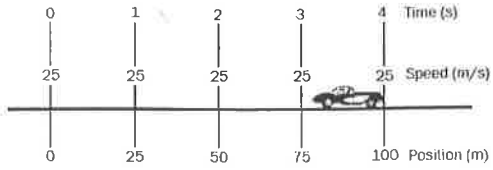
Speed = $v = \frac{d}{t} = \frac{4.5m}{5s} = 0.9\frac{m}{s}$ Velocity = $\vec{v} = \frac{\vec{d}}{t} = \frac{-4.5m}{5s} = -0.9\frac{m}{s}$



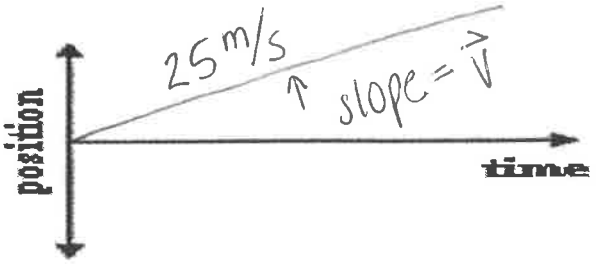
1. If a person is moving in the positive direction, it has a ..... ⊕ displacement and ⊕ velocity

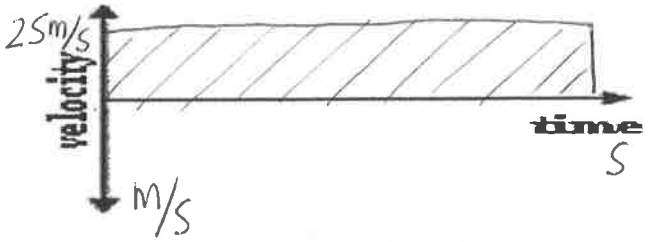
2. If a person is moving in the negative direction, it has a .. ⊖ (negative) displacement and ⊖ velocity

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 = $\frac{\vec{d}}{t}$

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

area represents displacement

$l \times h =$ "y" "x" "x" $= \frac{m}{s} \cdot s = m$ or "d"

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

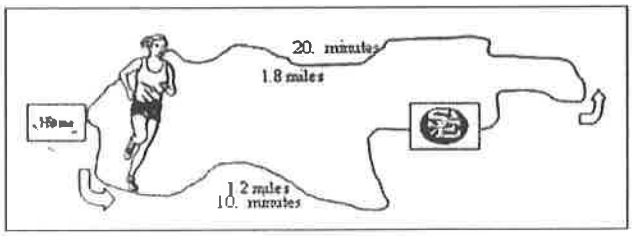
Scalar: quantity consists of magnitude only

Examples of scalar quantities: speed, distance, mass

Vector: magnitude + direction

Examples of vector quantities: velocity, displacement, force

A student runs from home to school and back.



	Running from home to school	Round trip
Distance	1.2 miles	3.0 miles
Displacement	1.0 mile	Ø miles
Speed	$\frac{1.2 \text{ mi}}{10 \text{ min.}} = \frac{0.12 \text{ miles}}{\text{min}}$	$\frac{3.0 \text{ miles}}{30 \text{ min.}} = \frac{0.10 \text{ mi}}{\text{min}}$
Velocity	$\frac{1.0 \text{ mile}}{10 \text{ min.}} = \frac{0.1 \text{ miles}}{\text{min.}}$	$\frac{\text{Ø miles}}{\text{min.}}$

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

travel in a straight line without turning

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

same

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

turning