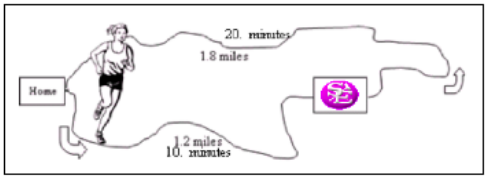
A student runs from home to school and back.



	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)?

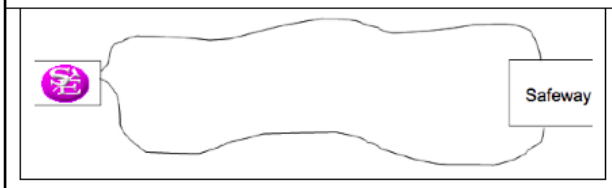
moving in straight line, without changing direction

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

driving around curve

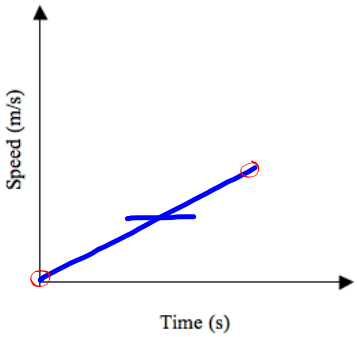
3

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): speed or velocity averaged over some time

2. Instantaneous speed (or velocity): speed (or vel) at some instant

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

if speed is constant

Problem Solving – Smooth Form

-given
- equation to be solved*
- solve equation for unknown
- plug in #'s with units
- answer with units

4. An airplane flies at a constant speed of 300. m/s. How long will it take the plane to fly a distance of 1.2 km?

v d

$v = \frac{d}{t}$ $t = \frac{d}{v}$ $t = \frac{1200\,m}{300.\,m/s} = 4.0\,s$

5. A car travels at an average speed of 30. m/s. How far will the car go in 3.0 hours?

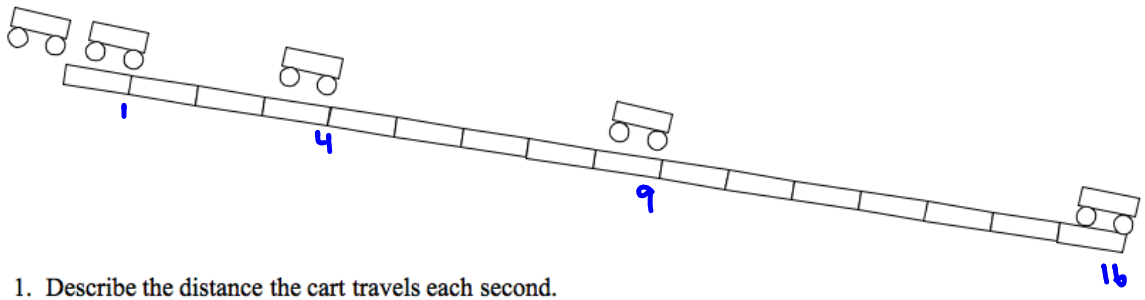
$3 \times 3600\,s$

$v = \frac{d}{t}$ $d = t\,v = 30.\,m/s \times 10{,}800\,s$

$= 3.2 \times 10^5\,m$

Acceleration

A cart is allowed to roll freely down a ramp, as shown below. The position of the cart is marked after each second.



1. Describe the distance the cart travels each second.

increasing at increasing (square) rate

2. Describe any changes in the speed and velocity of the cart as it rolls downhill.

increases directly

Time (s)	Position (m)	Average Velocity (m/s)	Instantaneous Velocity (m/s)	Acceleration
0	0	$\frac{d}{t}$ 0	$\frac{V_f+V_0}{2}=V_{avg}$ 0	2
1	1	1	$V_f=2\times V_{avg}$ 2	2
2	4	2	4	2
3	9	3	6	2
4	16	4	8	2

Instantaneous initial velocity = $\vec{V}_0$

Instantaneous final velocity = $\vec{V}_f$

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

$* = \frac{\vec{V}_0+\vec{V}_f}{2}$ if accl = const.

Acceleration: rate of change of velocity

Formula: $\vec{a}_{avg}=\frac{\Delta\vec{V}}{t}=\frac{\vec{V}_f-\vec{V}_0}{t}$

$\vec{V}_f-\vec{V}_0=\vec{a}t$

$\vec{V}_f=\vec{V}_0+\vec{a}t$

Units: $\left[\frac{m/s}{s}\right]=\left[\frac{m}{s^2}\right]$

Type: vector