Jer
Feb. 13

Physics 11

Section 2.4: Acceleration

	Vector or Scalar?	Symbol and Units	Description/Formula
Distance	Scalar	d m	How far something traveled ***along the path it took.***
Displacement	Vector	$\vec{d}$ m	• Change in position. • Straight arrow from start to finish.
Speed	Scalar	v m/s	$v_{av} = \frac{d}{\Delta t}$
Velocity	Vector	$\vec{v}$ m/s	$\vec{v}_{av} = \frac{\vec{d}}{\Delta t}$
Acceleration	Vector	$\vec{a}$ $\frac{m/s^2}{m/s/s}$	$\vec{a}_{av} = \frac{\Delta \vec{v}}{\Delta t}$

*The formulas above are for *average* speed/velocity/acceleration or for when speed/velocity/acceleration is constant.

We describe acceleration as the rate of change of velocity.

We describe velocity as the rate of change in position.

Example: starts at 0 velocity

A car starts from rest and accelerates at 15 m/s^2 for 3 s. What is its top speed?

$\vec{a}_{av} = \frac{\Delta \vec{v}}{\Delta t}$

$\vec{a}_{av} \Delta t = \Delta \vec{v}$

$(15)(3) = \Delta \vec{v}$

$45 \text{ m/s} = \Delta \vec{v}$

Remember
Δ = final - initial

$\Delta \vec{v} = \vec{v}_f - \vec{v}_i$

$\Delta \vec{v} = \vec{v}_f - 0$

$\vec{v}_f = 45 \text{ m/s}$

The Direction of Acceleration:

The direction of acceleration is the direction of the push or pull (force) on the object.

All vectors have direction. If an object moves along a straight line (i.e. 1D kinematics) then we say a vector's direction is

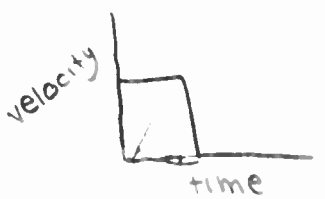
- Positive if it's right, up, north, east, or forward.
- Negative if it's left, down, south, west, or backward.

Example: Fill out the table below by putting + or – in each box.

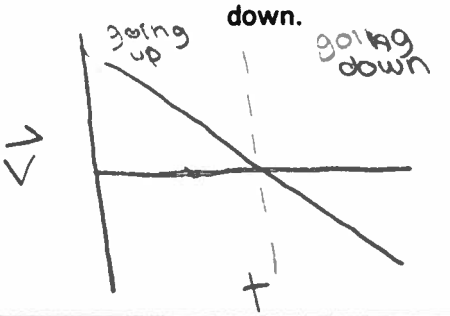
	Velocity	Acceleration
A car sitting at a stop light hits the gas	+	+
From rest, you back out of your driveway	–	–
A car hits the brakes and comes to a stop	+	–
You drop a rock off a cliff	–	–
You throw a rock straight up (while the rock is in your hand)	+	+
You throw a rock straight up (after the rock leaves your hand)	+	–

Example: Sketch velocity-time graphs of the following situations:

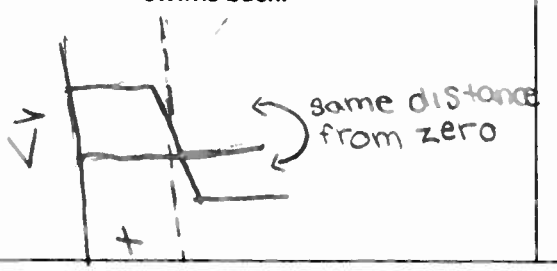
A hockey player skates at full speed, then comes to a sudden stop.



A football is kicked straight up, then falls back down.



A swimmer swims the length of a pool at a constant speed, then quickly turns around and swims back.



A skydiver jumps from a plane, speeds up to terminal velocity, falls for a while, then pulls the chute and slows down.