Basic Notes for One Dimensional Motion

Frames of reference – a point from which a situation is observed.
Ex. Watching a train from the ground./ Being on the train

If a ball were thrown from a person on the train, it would look different depending on which frame of reference you are on. A second person on the train would see the ball go up and down (as if the two people were stationary). A person on a platform would see the people and the ball moving horizontally at the speed of the train. The ball would make an arc.

Distance vs. displacement (p. 41 and 42)
Distance is the length traveled; displacement is the straight line from the starting point to the ending point. Displacement can be negative (you move backwards).

$\Delta x = x_f - x_i$ change of position (displacement) is the final position minus the initial.

Examples: 1) you start at 20 cm and go to 80 cm. 2) you start at 120 m and end at 80 m.

CONVENTION: We will consider right positive and left negative.

Velocity (p. 43) – common units are m/sec (although any distance div. time will do).

$v = \frac{\Delta d}{\Delta t} = \frac{d_f - d_i}{t_f - t_i}$ velocity = change of distance divided by change of time.

Can be positive or negative (time is always positive).

Ex. You go 370 km to the west (left). You leave at 10 a.m. and arrive at 3 p.m. Find the average velocity.

Speed vs. Velocity Scalar vs. Vector
Speed is a**Scalar** **Velocity** is a **Vector**

Speed has no direction; Scalars have no direction.
Velocity has direction; Vectors have direction.

A person walks 4 m/s—speed (no direction). A person walks 2 m/s north— velocity (direction is given).
A car drives 60 mph toward Dallas—velocity. A car drives 30 mph—speed.
A 14 newton force pull 30^o left of north—vector. A boat is pulled by a 53 newton force—scalar.
Vectors have magnitude and direction. Velocity is a vector with magnitude and direction.

Instantaneous speed vs. average speed:

Unless using cruise control, probably didn't drive that speed exactly, so it is an average.

Average speed = Total distance/ total time

Ex. You walk 4 miles in 2 hours, then 3 miles in 2 hours, then stop for an hour. You then walk for another 3 miles in 1 hours. What was your average speed?

Ex.: On your way to Grandmother's house, you drive 40 kilometers in 45 mins. You stop at a roadside rest for 15 minutes. Then you get on the freeway, driving 60 km in one hour. What was your average speed?

Instantaneous velocity – velocity at a particular instant.

Speedometer shows this. In the above examples the individual parts of the journeys could be seen as instantaneous velocities, but more commonly it would be at a particular time. On a graph you find this by taking two adjacent points on a graph, then use the velocity equation for those two points.

An actual instantaneous velocity (for an instant) from a graph is the tangent of a point on a graph.

Acceleration: how fast your speed changes: units are m/s^2 (show mathematically)

Think of a car "speeding up". It is accelerating. A car accelerating from 0 to 60 mph in 5 secs has a Δv of 60 mph and a Δt of 5 secs. So a = 60 m/s/ 5 sec = 12 m/s^2.

$$a = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{t_f - t_i}$$

Has direction and magnitude (can have negative acceleration).
Use examples from worksheet.

Slope, speed, and acceleration.

The slope of a position vs time graph is speed.
The slope of a speed vs. time graph is acceleration.