Section 1.1

<u>Motion</u>:

Everything in our universe, in our existence is in a constant state of motion. People, animals, air, protons, neutrons, electrons ... we are all moving. As you sit at your desk you are currently moving - you at your desk sitting perfectly still, are attached to a giant beach ball, being spun like a basketball, flying throughout our solar system on a year long trip around a flaming ball of gas that makes all life possible.

As you sit perfectly still you are moving at a speed of 107 300 km/h or 67 000 mph.

Challenge - Prove it.

As we begin our discussion of motion, there are a few quick definitions we need to make clear:

Kinematics - the study of motion.

Uniform Motion - movement at a constant speed in a straight line.

Non-uniform motion - movement in which there is a change in speed or direction.

International Systems Units (SI) - Standardized units used in the metric system for measuring and reporting information.

Distance - metre (m)

Speed - metre per second (m/s)

Time - seconds (s)

Mass - kilograms (kg)

Acceleration - metres per second squared (m/s^2)

Average Speed - assumes that an object is moving and always has been moving at the same constant speed. Ignores starts, stops , speeding up and slowing down. Great for a general reference to the motion taking place.

An athlete runs five laps of a 400 metre track in 16 minutes, calculate their average speed.

Sol'n - speed is the distance traveled divided by the time taken. $s = \frac{d}{t}$

<u>givens</u> (need in SI)

d = 400 x 5 = 2000 m $\qquad s = \frac{2000\ m}{960\ s}$

t = 16 x 60 = 960 s $\qquad s = 2.08\ m/s$

This implies that the athlete was always moving at 2.08 m/s, never slowing when tired, not sprinting to the finish to get the best time. We acknowledge that this is not completely accurate, but also understand that when comparing this to another athlete that can run the same distance with an average speed that is greater than 2.08 m/s, the second athlete is the faster runner over this distance.

We could also use this average value to estimate the time it would take the athlete to run other distances, or if we knew the distance to be ran, we could estimate the time that would be needed to complete the course.

Instantaneous speed - the speed of an object at a specific instance in time. Think of the speedometer on a car or stationary bike. Constantly updating from second to second, recalculating how fast you are traveling.

Question - Is it possible for the instantaneous speed to be the same, or approximately the same as the average speed? If so, under what conditions?

Scalar Quantities vs. Vector Quantities

Scalar quantities - values that are measured with a size or quantity but have no direction.

Include :	distance	10 km
	speed	15 m/s
	time	12 s
	mass	22 kg

These are the most common and the ones that most people use every day.

Vector quantities - vales that are measured with a size, but also depend highly upon the direction assigned. Think of GPS, "you are 15 miles from your destination", nice to know, but what direction do I need to go to get there?

Include :	displacement	10 km [N]
	velocity	15 m/s [20° S of W]
	acceleration	0.5 m/s^2 [E]

Vector quantities are always measured with respect to a reference point. The most difficult part for students to adapt to is seeing positive and negative numbers as direction relative to the reference point, not as gains and losses.

Example   if 10 km [E] means ten kilometres to the right of the reference point

then -10 km [E] means ten kilometres to the left of the reference point, which could also have been written as 10 km [W]

Assigned questions - page 6 - Practice problems 1, 2, 3

- page 8 - Practice problems 6 to 11

- page 11 - Section problems 1 to 5