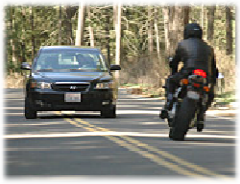
SPH4U UNIVERSITY PHYSICS

DYNAMICS

- Analyzing Motion (A Review) (P.8-35)

Motion

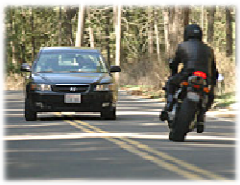
Cars drive by on the street, people walk and cycle past us, and garbage cans blow in a high wind. From quiet suburbs to busy highways, different kinds of motion happen all the time during a normal day. We often take this motion for granted, but we react to it instinctively – we change our motion to avoid hitting objects in our way.



Motion

NOTE!

Kinematics *is the study of motion without considering the forces that produce the motion.* ***Dynamics*** *is the study of the causes of motion. An understanding of kinematics and dynamics is essential in understanding motion.*



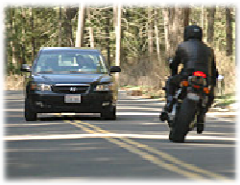
Motion

KINEMATICS

- study of motion without considering the forces causing the motion

DYNAMICS

- study of the causes of motion



Uniform Motion & Uniformly Accelerated Motion

*The two types of motion that we will analyze are **uniform motion** – motion with constant velocity – and **uniformly accelerated motion** – motion under constant acceleration. This is often referred to as **non-uniform motion**.*

UNIFORM MOTION (a=0)

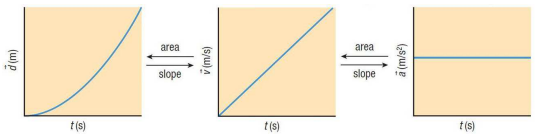
- movement at a constant speed in a constant direction

NON-UNIFORM MOTION (a≠0)

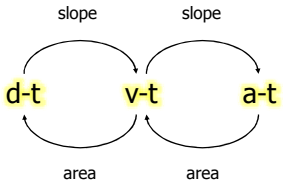
- or uniformly accelerated motion
- movement that involves changes in speed or direction or both

Graphs of Motion

One way to study the motion of an object is to analyze the position-time, the velocity-time, and the acceleration-time graphs for the object.



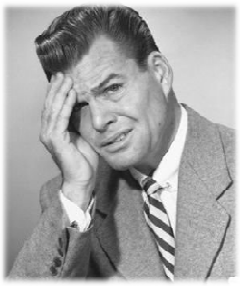
Graphs of Motion



RECALL! ☞ the "area" is **cumulative!**

Kinematics

Another way to study the motion of an object is to use the kinematic equations (or equations of motion) that you learned in SPH3U. Can you remember them? How many were there? Were there different ones for different motion?



Kinematics

UNIFORM MOTION

- $v = \frac{d}{t}$

UNIFORMLY ACCELERATED MOTION

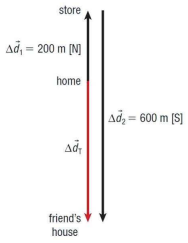
- $d = \left(\frac{v_i + v_f}{2}\right) t$
- $d = v_i t + \frac{1}{2} a t^2$
- $d = v_f t - \frac{1}{2} a t^2$
- $v_f = v_i + at$
- $v_f^2 = v_i^2 + 2ad$

where d is the displacement (m)
t is the time (s)
v is the velocity (m/s) ☞ *i = initial & f = final*
a is the acceleration (m/s/s or m/s^2)

NOTE!
Sometimes 1 and 2 are used as the subscripts instead of i and f.

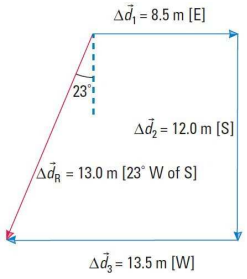
1D & 2D Motion

If you remember, motion can either be in one dimension (up/down, forwards/backwards, left/right, …) or in two dimensions (north and east, right and up, …). With motion in one dimension, + and – signs are used to indicate positive and negative directions (i.e. 200 m[N] = - 200 m[S]). The kinematic formulas can then be used with relative ease to solve for missing information.



1D & 2D Motion

However, with motion in two dimensions, the use of a vector diagram, in addition to the use of + and – signs, is almost always necessary in order to solve for missing information.

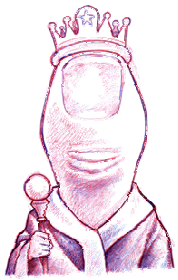


1D & 2D Motion

A good rule of thumb to solving many of the problems in physics (not just motion ones) is:

DON'T BE LAZY!

Write down what you know (value, unit, ...).
Include directions in your solutions.
Draw a picture.
Use your formula sheet.
Check your answers often.
Read ahead.



✔ Check Your Learning

WIKI (DYNAMICS)

- 4U1 - WS#1 (Motion Review – Graphing)
- 4U1 - WS#2 (Motion Review – 1D & 2D)
- 4U1 - QUIZ#1 (Motion Review)