Study Guide (Midterm I)

1. Intro and Math Concepts

A. Units and SI

1. Precisely descript quantities.
2. SI units (m, kg, s, K, A, cd, mole)
3. Metric System: Prefixes

tera10^{12} giga10^{9} mega 10^{6} kilo 10^{3} centi10^{-2} milli 10^{-3} micro 10^{-6} nano 10^{-9} pico 10^{-12}

4. Precision and significant figures.

Unit conversion doesn't change precision, ALWAYS use scientific expression.

B. Units conversion:

1. Do not adding or subtracting quantities with **different** units.
2. Multiplying or dividing is okay.
3. Orders of magnitude,

C. Read and draw graphs.

Plot with graphic paper or Excel.

2. Scalars and Vectors

A. Definition of a vector.

What's the difference of a scalar and a vector?

Notation of the vector. $\vec{V}$, unit vector $\widehat{e_v}$

What math rules does the scalar algebra have to follow?

What about the vector algebra?

B. Vector calculation (Adding/subtracting two vectors):

Graphically: (parallel shifting, triangle)

Project into components: How to project a vector into components? What is the magnitude of a vector?

Subtracting

3. Kinematics (motions):

A. Displacement, speed and velocity, acceleration.

1. How are they defined? What are their units? What is average velocity (acceleration) and instant velocity (acceleration)?

2. What are position vs time graphs, velocity vs time graphs, and acceleration vs time graphs? What is the relation between those graphs?

3. Special case: for the constant acceleration:

$$v = v_0 + at$$

$$x = x_0 + v_0 t + \frac{1}{2} a t^2$$

4. Applications:

Free fall, projectile motion, uniform circular motion

Side topics: Centripetal acceleration and tangential acceleration, linear speed and angular speed

5. Relative motions

4. Newton's Law and forces:

a. Forces: Drawing free body diagram.

Balancing with multiple forces.