Study Guide for Test 1

Fundamental definitions:

\[
\vec{v} = \frac{\Delta \vec{r}}{\Delta t} = \frac{\vec{r}_f - \vec{r}_i}{t_f - t_i} \quad \text{(definition of velocity)}
\]

\[
\vec{a} = \frac{\Delta \vec{v}}{\Delta t} = \frac{\vec{v}_f - \vec{v}_i}{t_f - t_i} \quad \text{(definition of acceleration)}
\]

For constant acceleration only:

\[
v_x(t) = v_x(0) + a_x t
\]

\[
x(t) = x(0) + v_x(0) \cdot t + \frac{1}{2} a_x t^2
\]

(and similarly for \( y, z \))

For a freely flying projectile, \( \vec{a} \) points straight down and has magnitude \( g = 9.8 \text{ m/s}^2 \).

For circular motion at constant speed, \( \vec{a} \) points directly toward the center of the circle and has magnitude

\[
|\vec{a}| = \frac{|\vec{v}|^2}{R}
\]

You should be able to do the following:

- Express numerical quantities using correct units and an appropriate number of significant figures. Convert units as needed.

- Draw and interpret graphs of \( x, v_x, \) and \( a_x \). Compute slopes and areas as necessary to determine position, displacement, velocity, and acceleration.

- Add, subtract, negate, and scalar-multiply vectors, both graphically and in terms of components.

- Compute vector components from magnitude and direction, and vice-versa.

- Draw velocity and acceleration vectors for any type of motion.

- Solve constant-acceleration problems.

- Understand and compute relative velocities.

- Solve other problems, as in the homework, covering material outlined on this page.