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:

\[
v_x = v_{x0} + a_xt
\]

\[
x = x_0 + v_{x0}t + \frac{1}{2}a_xt^2
\]

(and similarly for \(y, z\)). You needn’t memorize these two equations, but you should be able to use them correctly.

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

You should be able to do the following:

- Use units correctly, and convert units when necessary.
- State all answers to an appropriate number of significant figures.
- Use algebra to solve for unknown quantities.
- 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.
- Construct qualitatively accurate velocity and acceleration vectors for any type of motion.
- Solve constant-acceleration problems.
- Understand relative velocities.
- Solve other problems, as in the homework, covering material outlined on this page.