

Lesson 21 - Motion in Space I**Objectives**

- Find a position function when acceleration, initial velocity, and initial position are all known.
- Understand the derivation of the physics equations of motion (the so-called kinematics equations).
- Use parametric equations to describe the motion of a projectile.

READ

- Stewart, Chapter 13.4, pages 838-842.

THINK ABOUT

- What does the size of a vector mean? How does this relate to acceleration and velocity?
- What assumptions are made to simplify the projectile motion problem? How would you include the things you assume do not effect projectile motion?

MATHEMATICA COMMANDS AND TASKS YOU NEED TO KNOW

The `Solve` command will be used a lot when solving projectile motion problems. It is designed to work with both “regular” and vector functions but you must be careful. For example, if you know that the position function of a projectile is $\vec{r}(t) = \langle t^2 + 10, t^2 + 10, t^2 + 10 \rangle$, then in order to solve for when the x component is zero you have to use only the x component:

```
Solve[t2 + 10 == 0, t]
```

If you wanted to solve for when the projectile was at the position $\langle 1, 1, 1 \rangle$ you would use:

```
Solve[r[t] == {1, 1, 1}, t]
```