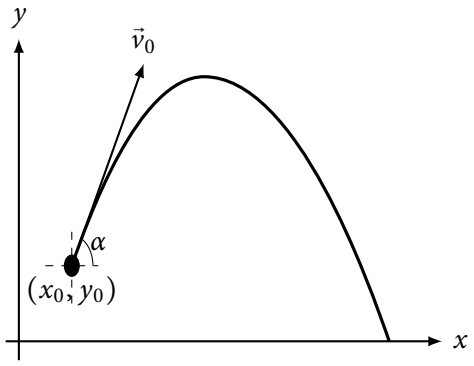
# Lesson 16. Projectile Motion, continued




- $v_0 = |\vec{v}_0|$
- $\vec{a}(t) = \langle 0, -g \rangle$
- $\vec{v}(t) = \langle v_0 \cos\alpha, v_0 \sin\alpha - gt \rangle$
- $\vec{r}(t) = \langle \underbrace{x_0 + (v_0 \cos\alpha)t}_{x(t)}, \underbrace{y_0 + (v_0 \sin\alpha)t - \frac{1}{2}gt^2}_{y(t)} \rangle$

**Example 1.** Drew Brees throws a football at an angle of 45° to the horizontal at an initial speed of 16 m/s. It leaves his hand 2 m above the ground.

(a) Where is the ball 2 seconds later?
(b) How high does the ball go?
(c) Where does the ball land?
(d) What is the speed of the ball when it hits the ground?

**Example 2.** David Ortiz hits a baseball at a 20° angle from 3 ft above the ground, wihch just clears the left end of the "Green Monster," the left-field wall in Fenway Park. The wall is 37 ft high and 315 ft from home plate.

(a) What was the initial speed of the ball?
(b) How long did it take the ball to reach the wall?

**Example 3.** Michelle Wie hits a golf ball off the ground at a 30° angle at 30 m/s. Will it clear the top of a 10 m tree that is in the way, 45 m down the fairway? Explain.