

Projectile Motion Problems Worksheet 1

- 1) A baseball is hit from a height of 3 feet with initial speed 120 feet per second and at an angle of 30 degrees above the horizontal. Find a vector-valued function describing the position of the ball t seconds after it is hit. To be a home run, the ball must clear a wall that is 385 feet away and 6 feet tall.
Determine if this is a home run.
- 2) Repeat question 1 if the ball is launched with an initial angle of 31 degrees.
- 3) A baseball pitcher throws a pitch horizontally from a height of 6 feet with an initial speed of 130 feet per second. Find a vector-valued function describing the position of the ball t seconds after release. If home plate is 60 feet away, how high is the ball when it crosses home plate?
- 4) A tennis serve is struck horizontally from a height of 8 feet with initial speed of 120 feet per second. For the serve to count (be "in"), it must clear a net, which is 39 feet away and 3 feet high, and must land before the service line 60 feet away. Find a vector function for the position of the ball and determine if this serve is in or out.
- 5) Repeat question 4 if the ball is struck with an initial speed of a) 80 ft/s or b) 65 ft/s.
- 6) Determine the maximum height and range of a projectile fired at a height of 3 feet above the ground with an initial velocity of 900 feet per second and at an angle of 45° above the horizontal.
- 7) A baseball, hit 3 feet above the ground, leaves the bat at an angle of 45° and is caught by an outfielder 300 feet from home plate. What is the initial speed of the ball, and how high does it rise if it is caught 3 feet above the ground?
- 8) A baseball player at second base throws a ball 90 feet to a player at first base. The ball is thrown at 50 miles per hour at an angle of 15° above the horizontal. At what height does the player at first base catch the ball if the ball is thrown from a height of 5 feet?
- 9) Eliminate the parameter t from the position function for the motion of a projectile to show the rectangular equation is

$$y = -\frac{16 \sec^2 \theta}{v_0^2} x^2 + (\tan \theta)x + h.$$

- 10) The path of a ball is given by the rectangular equation $y = x - 0.005x^2$. Use the result from question 9 to find the position function. Then find the speed and direction of the ball at the point when it has traveled 60 feet horizontally.