Projectile Motion Worksheet

$$x = (v\cos\theta)t + x_0$$

$$y = -\frac{1}{2}gt^2 + (v\sin\theta)t + y_0$$

CONSIDER THE FOLLOWING PROBLEM SITUATION AND ANSWER THE QUESTIONS THAT FOLLOW. USE THE QR CODE ON THE LAST PAGE TO CHECK YOUR ANSWERS.

You are a goalie in a soccer game. You save the ball and then drop kick it as far as you can down the field. Your kick has an initial speed of 100 feet per second at 50^{O} and starts at a height of 2.5 feet.

1) Write a set of equations that model the horizontal and vertical position of the ball at time *t*.

2) Find the horizontal position of the ball after 1.2 seconds.

3) Find the vertical position of the ball after 1.2 seconds.

4) Use the vertical position equation to find the time when the ball lands.

5) Use your solution to #4 to find the horizontal distance between the goalie and the landing point.

6) Find the horizontal velocity of the ball at the moment when it is kicked.

7) Find the vertical velocity of the ball at the moment when it is kicked.

8) Write a set of equations for the horizontal and vertical velocity of the ball at time *t* by finding the derivatives with respect to *t* of the position equations.

9) Find the horizontal velocity of the ball at 1.2 seconds.

10) Find the vertical velocity of the ball at 1.2 seconds.

11) Find the actual velocity of the ball at 1.2 seconds.

12) Find the ratio of the vertical velocity of the ball to the horizontal velocity of the ball at 1.2 seconds.

13) Use the ratio from #12 and the coordinates of the ball at 1.2 seconds to write an equation for the line that the ball would follow if gravity ceased to exist at 1.2 seconds.

14) Use the vertical velocity equation to find the amount of time that it takes the ball to reach its maximum height.

15) Use the solution to #14 to find the maximum height that the ball reaches.