PHY371 ProjectII
Graphing a Football Trajectory

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1 Introduction

The goal of this project is to use plotting modules (Pylab and VPython) in Python to study the trajectory of a flying football in the field.

2 Project

A place kicker must kick a football from a point $37.0m$ from the goal post, and the ball must clear the crossbar, which is $3.05m$ high. When kicked, the ball leaves the ground with a speed of $20.0m/s$ at an angle of $53°$ above the horizontal. We assume the air resistance is negligible. Gravitational acceleration is $g = 9.8m/s^2$.

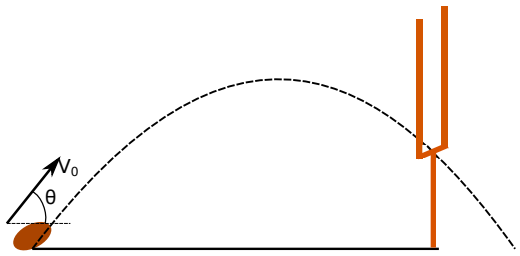

Figure 1: A sketch of the football being kicked off at a distance $37m$ away from the crossbar.

Write a python program to graph the trajectory of the football and determine the following questions:
(a) By how much does the ball clear or fall short of clearing the crossbar?
(b) Does the ball approach the crossbar while still rising or while falling?

(c) At what initial velocity and angle will the ball *barely* pass the crossbar while it is falling? Find the closest answer.

3 The output of your program

If your python script, you should:

1. Plot the trajectory of the football in a line graph.
2. Plot the magnitude of the velocity *versus* time in a line graph.
3. Create an animation to simulate the flight of the football in the field.

For line graphs, please include labels, legend and title for each graph.

4 Report

You are expected to use LaTeX to write a short (less than 3 pages) scientific report. In your report, you should have:

1. Introduction
   Describe the problem that you are working on.
2. Procedures
   Describe how do you solve this problem via coding.
3. Results and Discussions
   Show yours results (graphs, tables, data, snapshots of your animations etc) and explain them in details. Answer all questions with the support of your data.
4. Conclusion
   Summarize your project in a few words.

5 Submission

Please submit your python program (.py file) and your report (.tex and pdf files) to ying.tang at gordon.edu before **11:59pm on Tuesday 9/23**. A late submission will cause a 50% deduction of your grade.