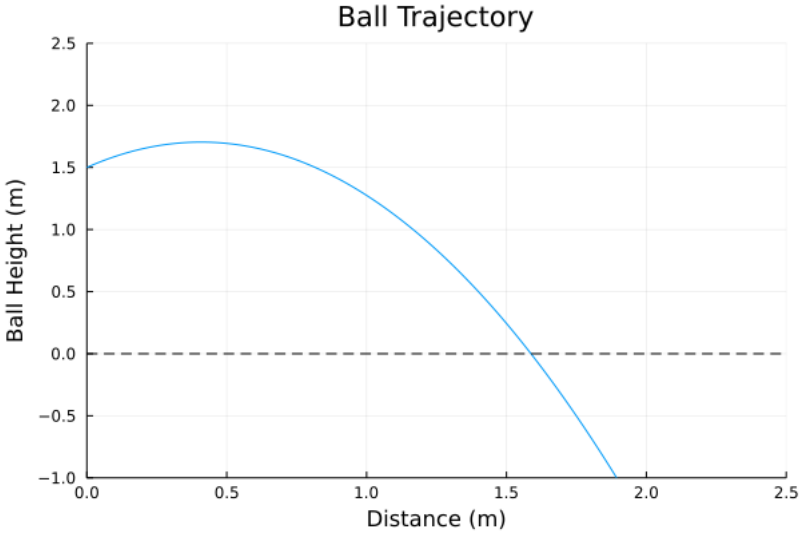
Throwing a Ball

Assignment 1: MAT2319 – Introduction to Julia

September 16, 2021



Below are all the steps you need to follow to do this assignment.

1. Start a new script file in Julia or a new notebook (either in Pluto or in Jupyter), save it as `throwBall.jl`.
2. At the top of the file, define some constants with your own variable names:
   (a) Initial height of ball at release = 1.5 m;
   (b) Gravitational acceleration = 9.8 m/s^2;
   (c) Velocity of ball at release = 4 m/s;
   (d) Angle of the velocity vector at time of release = 45 degrees.
3. Next, make a time vector that has 1000 linearly spaced values between 0 and 1, inclusive.
4. If x is distance, y is height, the equations below describe their dependence on time and all the other parameters (initial height h, gravitational acceleration g, initial ball velocity v, angle of velocity vector in degrees θ. Solve for x and y:
   (a) $x(t) = v\cos\left(\theta\frac{\pi}{180}\right)t$.
   (b) $y(t) = h + v\sin\left(\theta\frac{\pi}{180}\right)t - \frac{1}{2}gt^2$.

Note that we multiply θ by $\frac{\pi}{180}$ to convert degrees to radians.

5. Approximate when the ball hits the ground.
   (a) Find the index when the height first becomes negative.
   (b) The distance x at which the ball hits the ground is value of x at that index.
   (c) Display the words: "*The ball hits the ground at the distance of X meters.*, where X is the distance found previously.
6. Plot the ball trajectory:
   (a) Plot the ball's height on the y axis and the distance on the x axis;
   (b) Label the axes meaningfully and give the figure a title.
   (c) Plot the ground as a dashed black line. This should be a horizontal line going from 0 to the maximum value of x. The height of this line should be 0.
7. Run the script in the command window or on Pluto and verify that the ball hits the ground at the estimated distance.
8. Change the initial velocity of the ball to a different value, compare and plot two trajectories.