# Problem 2

Aerospace engineers sometimes compute the trajectories of projectiles such as rockets. A related problem deals with the trajectory of a thrown ball. The trajectory of a ball thrown by a right fielder is defined by the (x, y) coordinates as displayed in Fig. 1. The trajectory can be model

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A diagram of a curve

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1. Find the appropriate initial angle θ0, if v0 = 30 m/s, and the distance to the catcher is 90 m. Note that the throw leaves the right fielder’s hand at an elevation of 1.8 m and the catcher receives it at 1 m. Use 𝜀𝑠 = 0.01%

Given:

v0 = 30/ms

y0 = 1.8m

y = 1m

g = 9.81 m/s2

We can use the following code to find our first initial angle for θ0:

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Using these as our θ0:

[xL, xu] = [0.661967, 0.663540]

For the Bisection method, we get the following:

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We can se here that both the root and the error are able to converge.

For the False Position method, we get the following: A screenshot of a computer

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For the fixed-point iteration method, we have to derive our g(x) first before using the method. The following code is used for the g(x) of the equation:

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This equation will then be used for the fixed-point iteration method, along side the same initial value for x0:

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Moving on, for the newton method, we first need to find the derivative of the equation. After that, we can plug it into code like so:

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Then, we just pass the same initial guess as always:

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1. Repeat part a using different initial guesses (3 different values where applicable).
2. Plot a graph of the approximation percentage error for all the used algorithms in part a.
3. Which algorithm is the fastest?