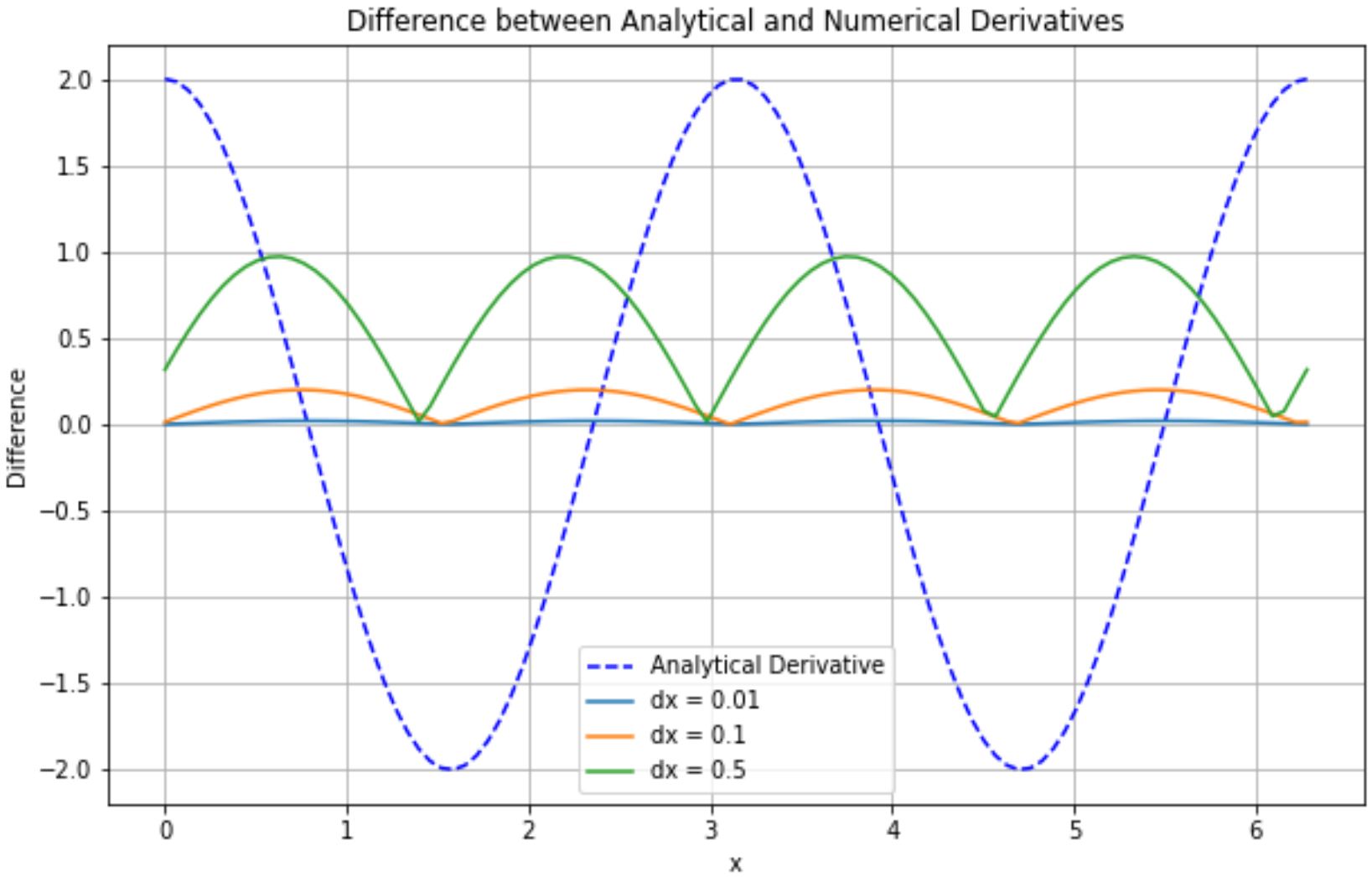
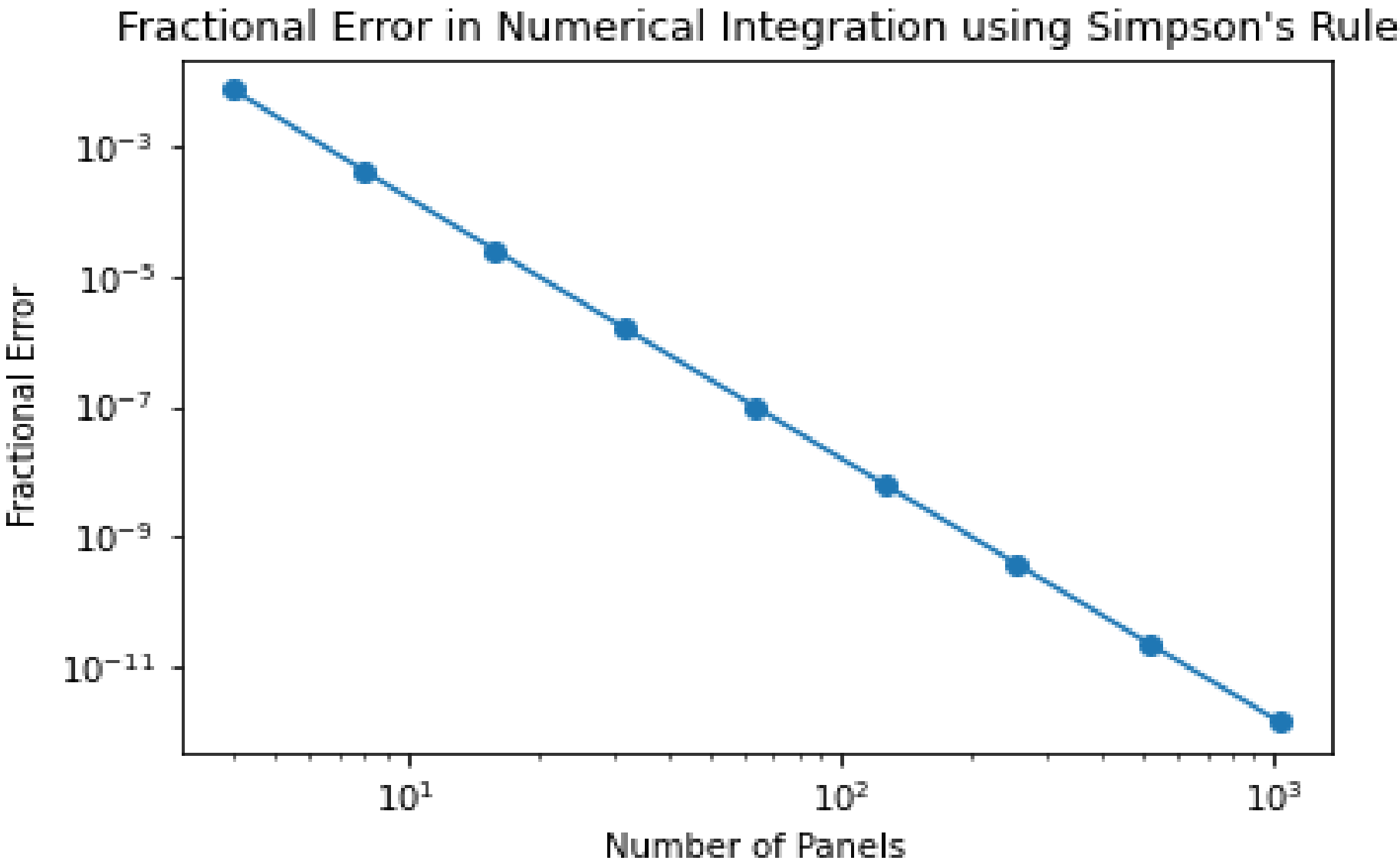
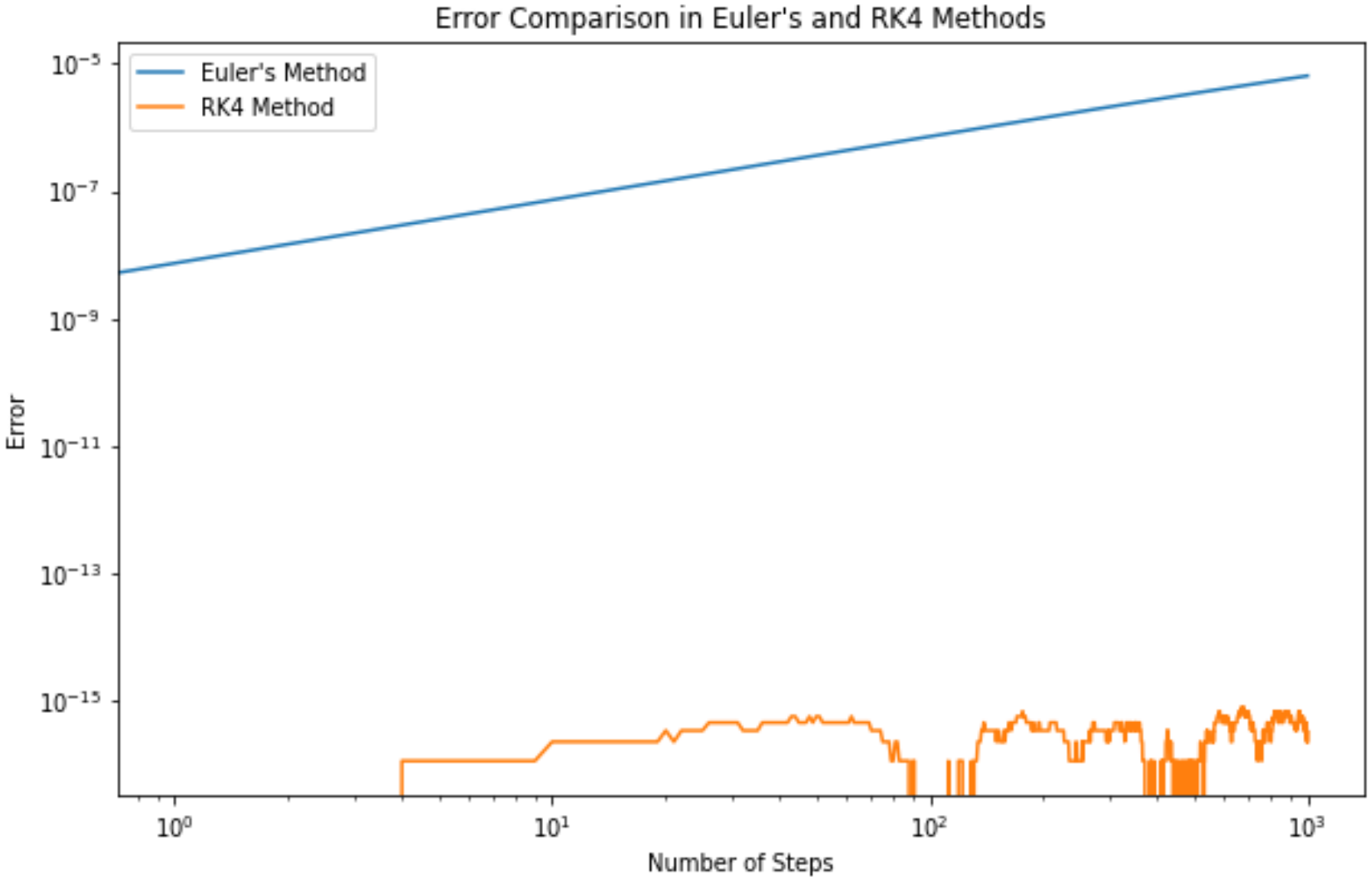
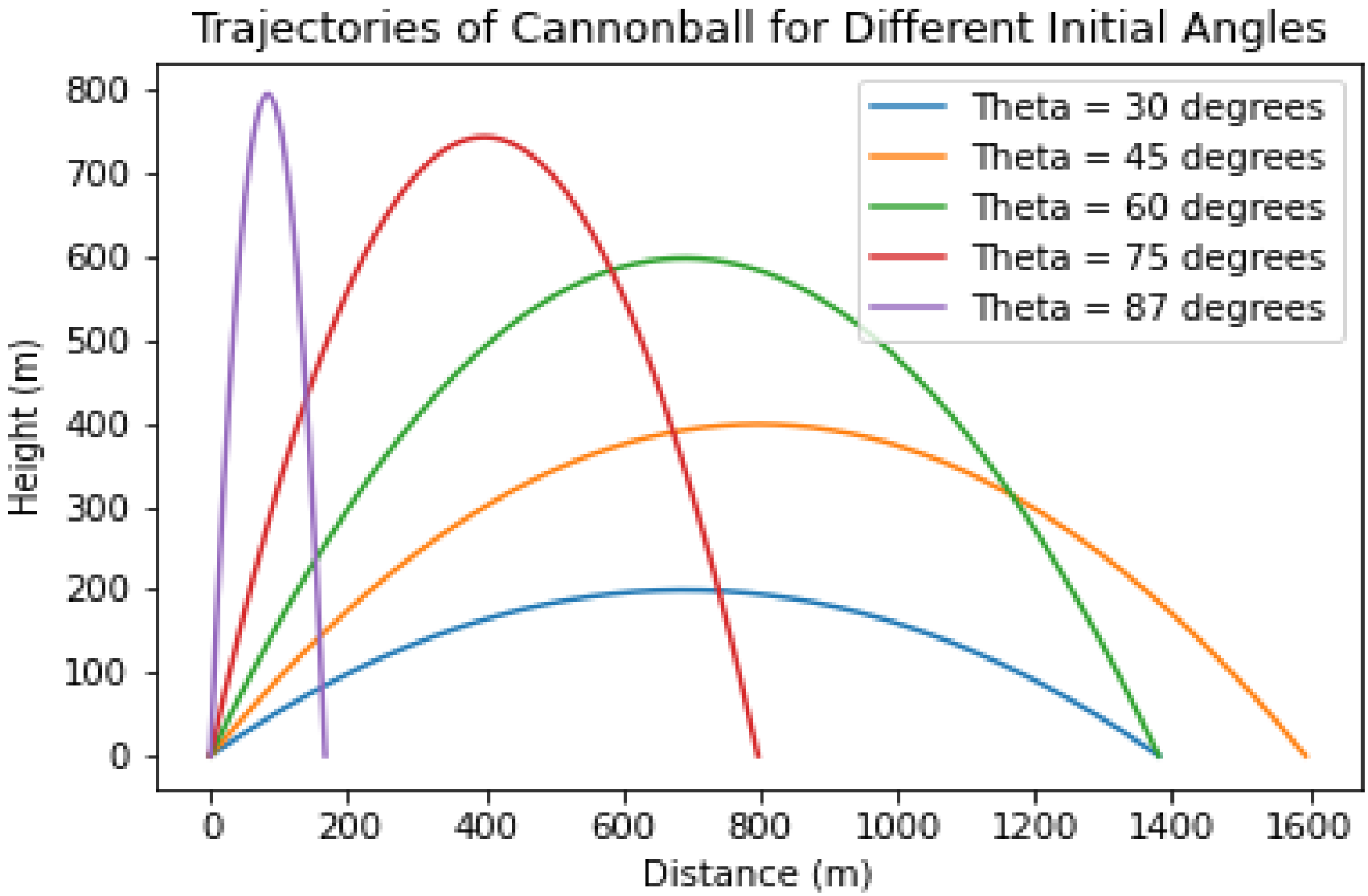
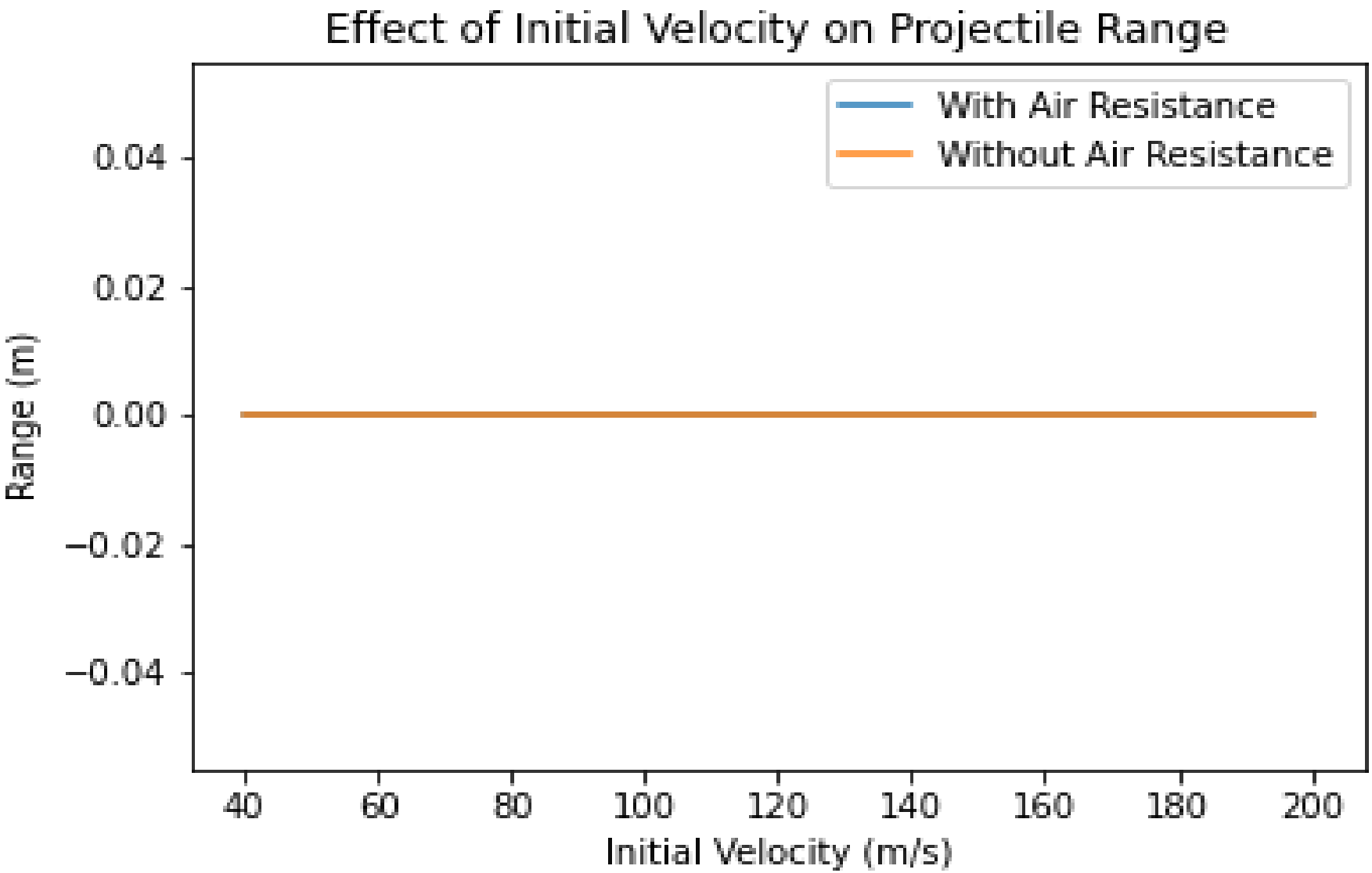
85364

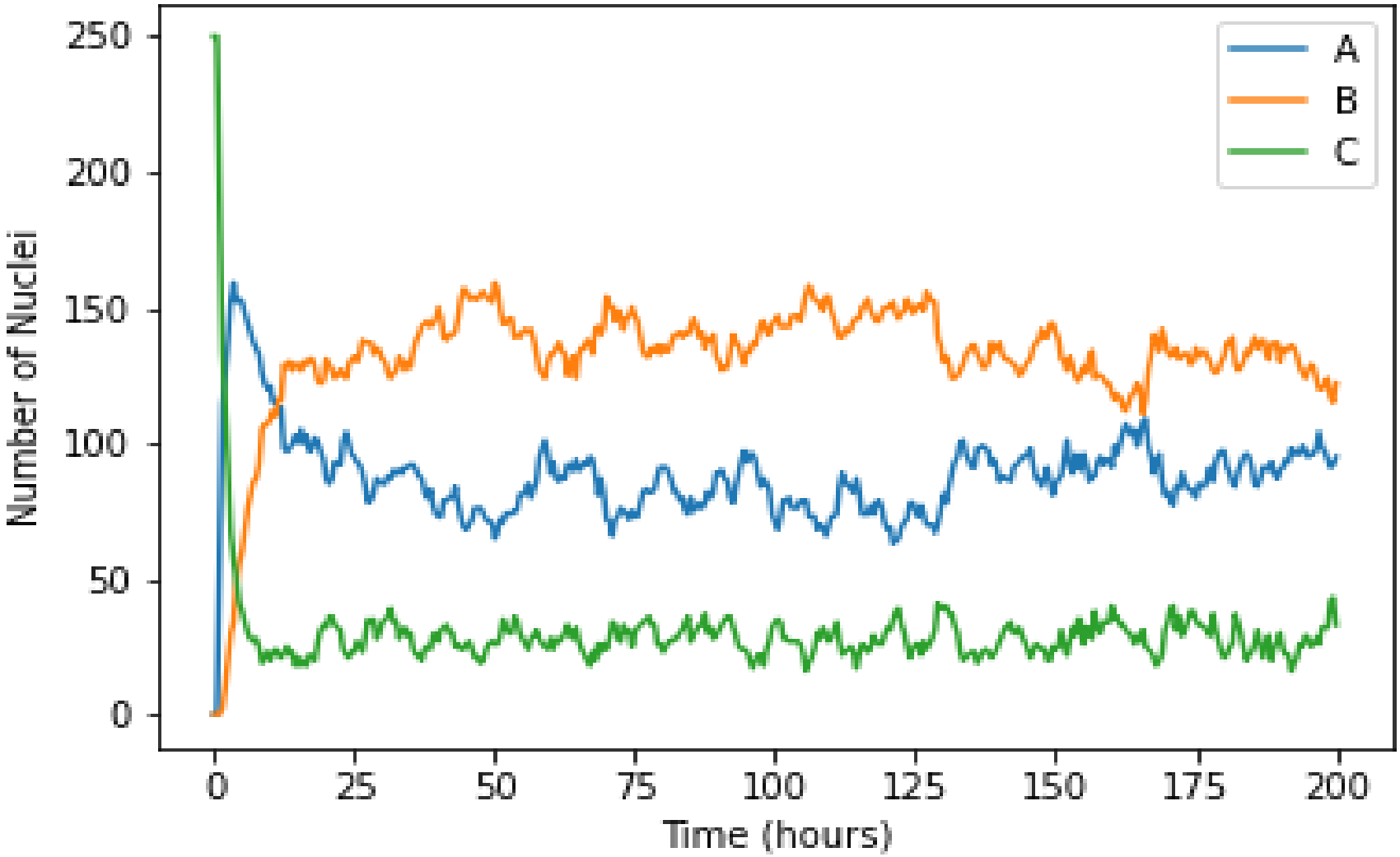

Difference between Analytical and Numerical Derivatives
Difference
x
Analytical Derivative
dx = 0.01
dx = 0.1
dx = 0.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
0
1
2
3
4
5
6

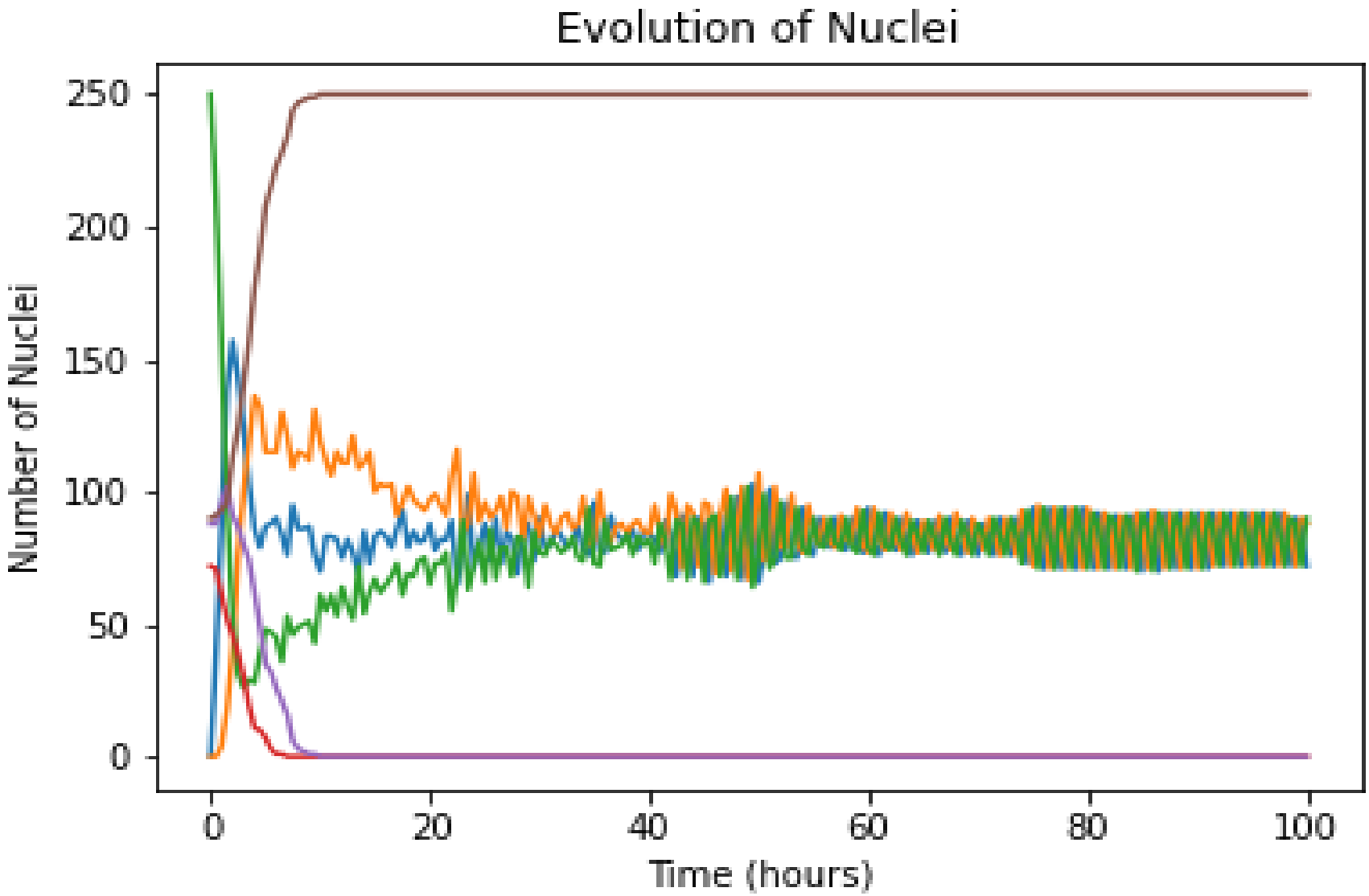

Fractional Error in Numerical Integration using Simpson's Rule
Fractional Error
10^{-3}
10^{-5}
10^{-7}
10^{-9}
10^{-11}
10^{1}
10^{2}
10^{3}
Number of Panels

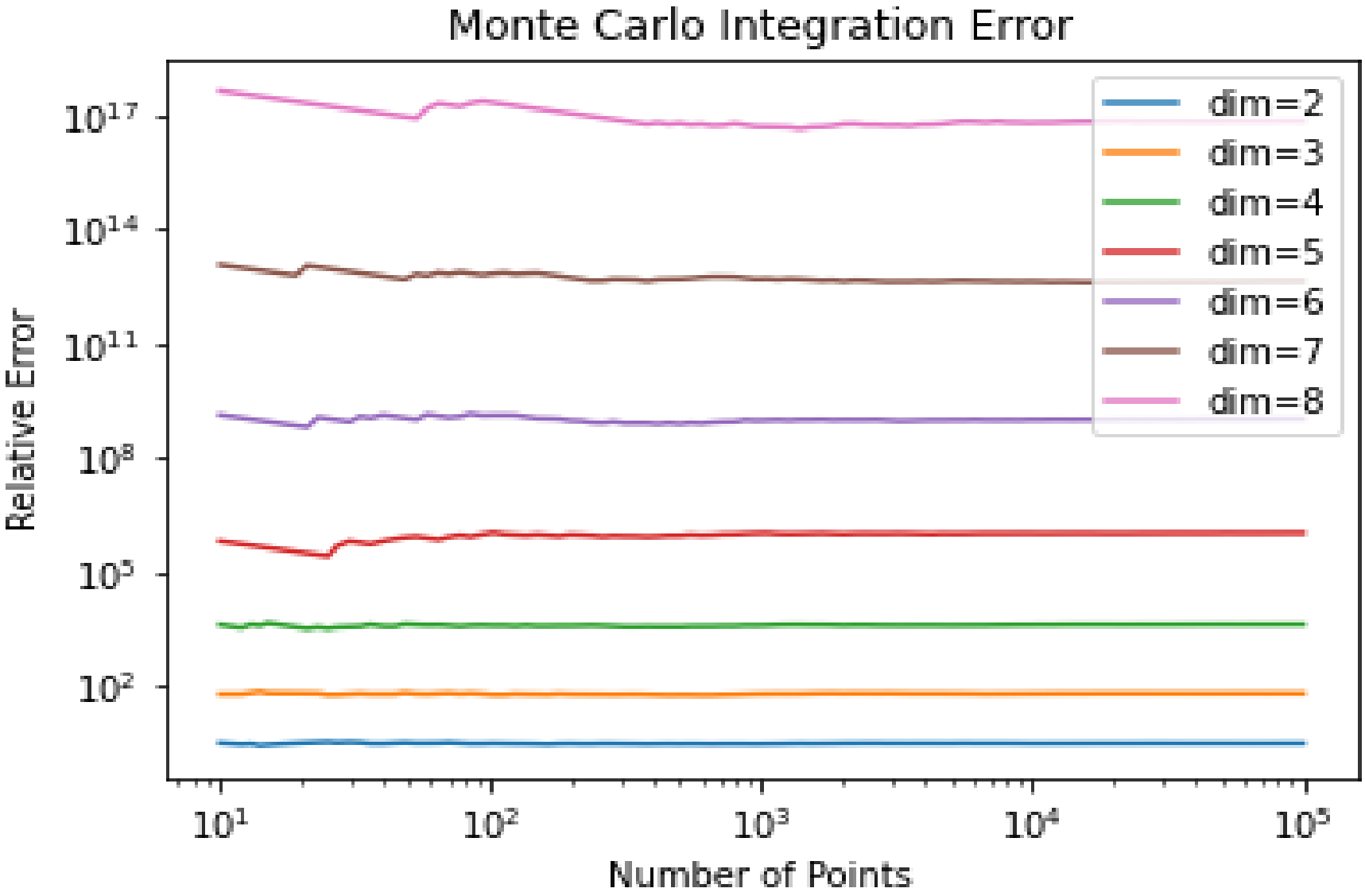

Error Comparison in Euler's and RK4 Methods
Euler's Method
RK4 Method
Error
10^{-5}
10^{-7}
10^{-9}
10^{-11}
10^{-13}
10^{-15}
10^{0}
10^{1}
10^{2}
10^{3}
Number of Steps

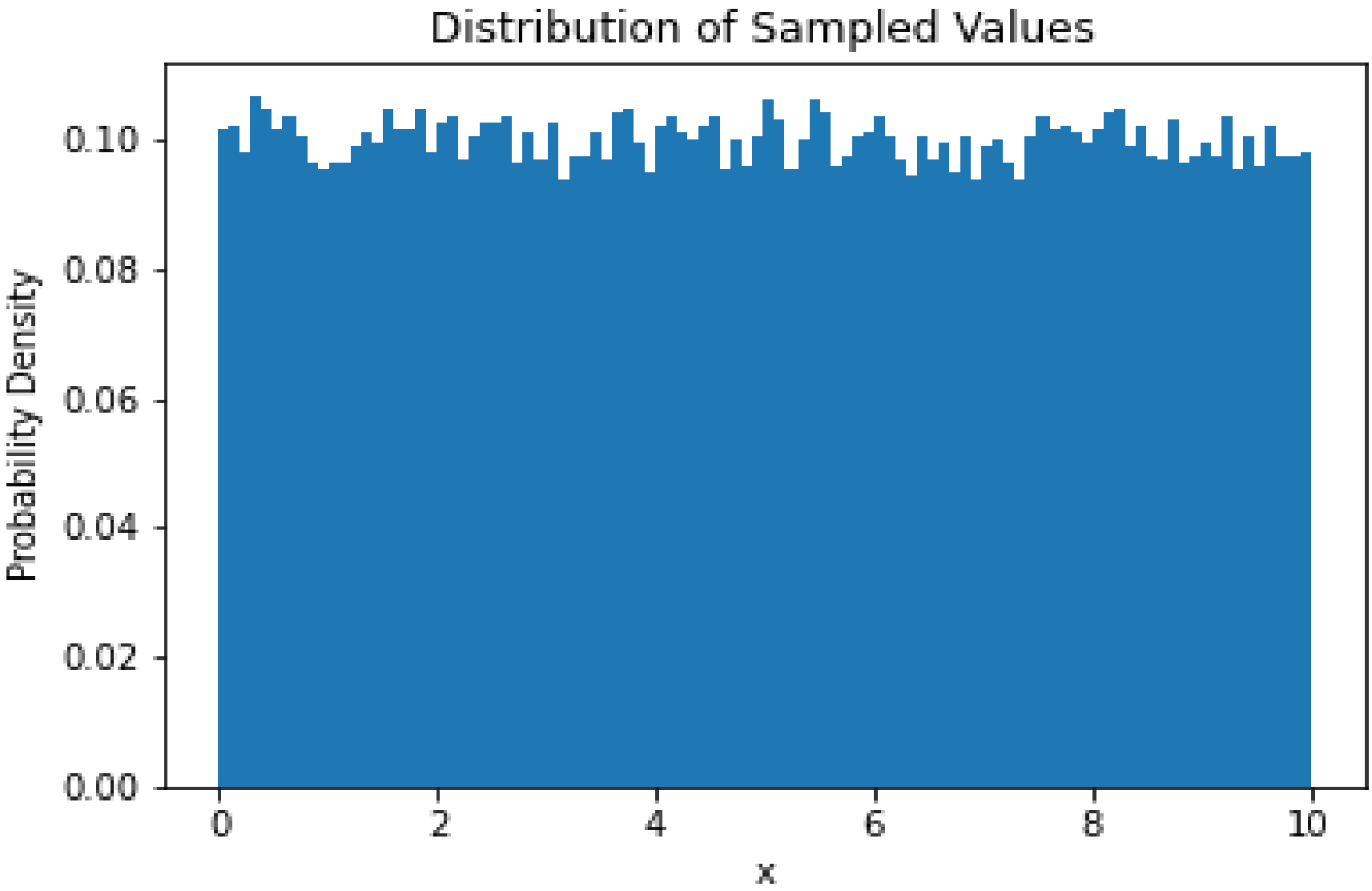

Trajectories of Cannonball for Different Initial Angles
Theta = 30 degrees
Theta = 45 degrees
Theta = 60 degrees
Theta = 75 degrees
Theta = 87 degrees
Height (m)
Distance (m)
0
100
200
300
400
500
600
700
800
0
200
400
600
800
1000
1200
1400
1600

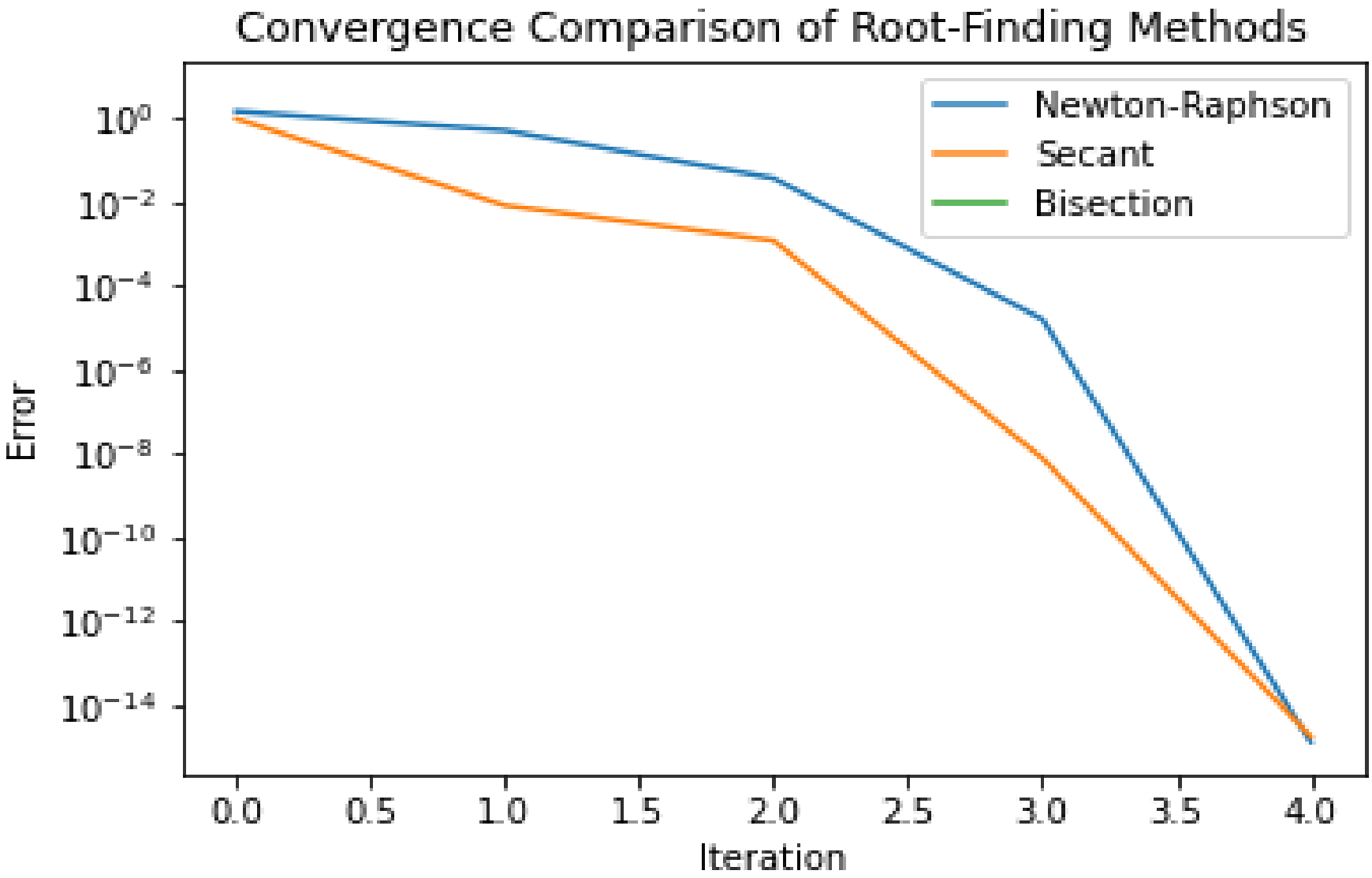

Effect of Initial Velocity on Projectile Range
With Air Resistance
Without Air Resistance
0.04
0.02
0.00
−0.02
−0.04
Range (m)
40
60
80
100
120
140
160
180
200
Initial Velocity (m/s)

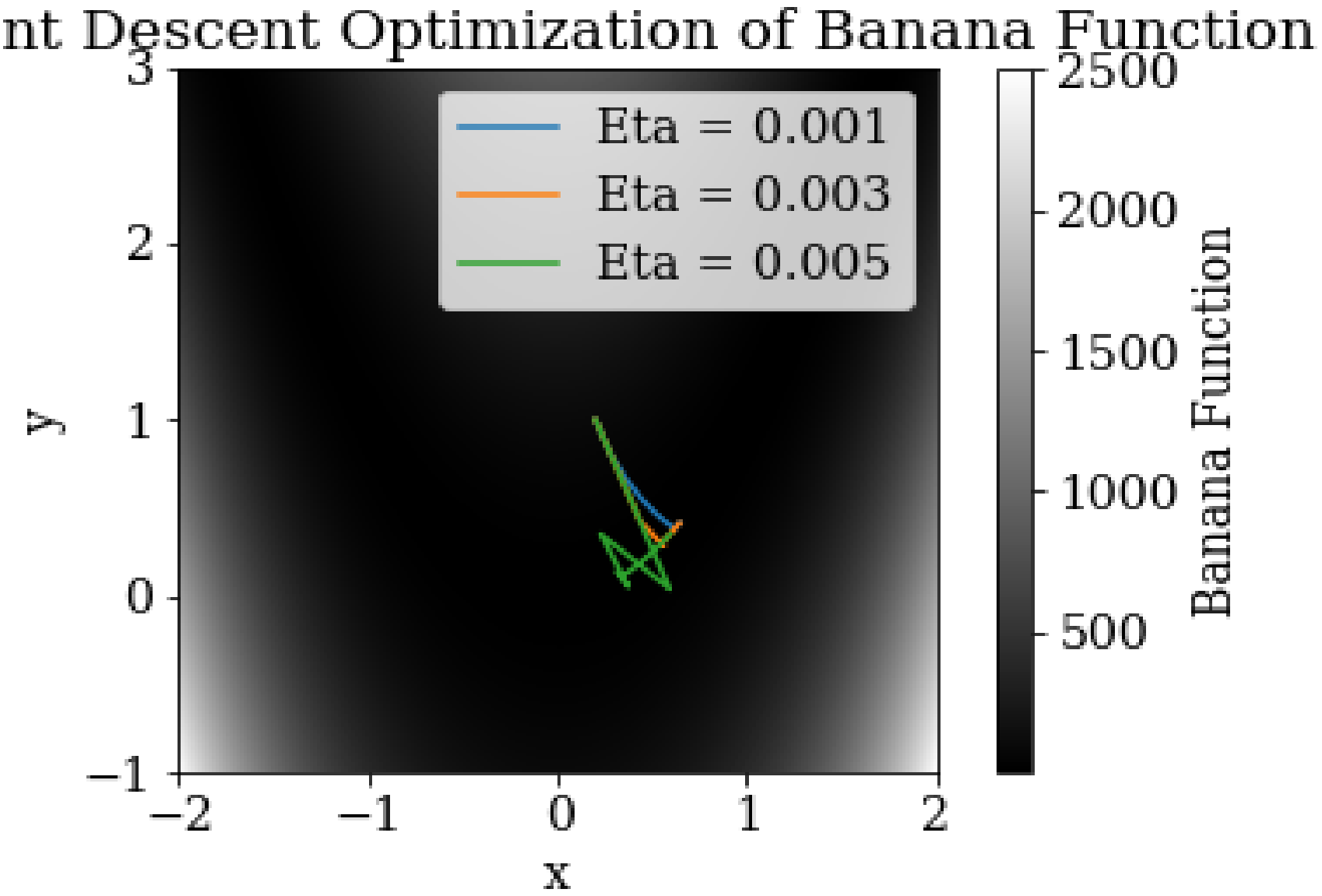

250
200
150
100
50
0
Number of Nuclei
0
25
50
75
100
125
150
175
200
Time (hours)
A
B
C

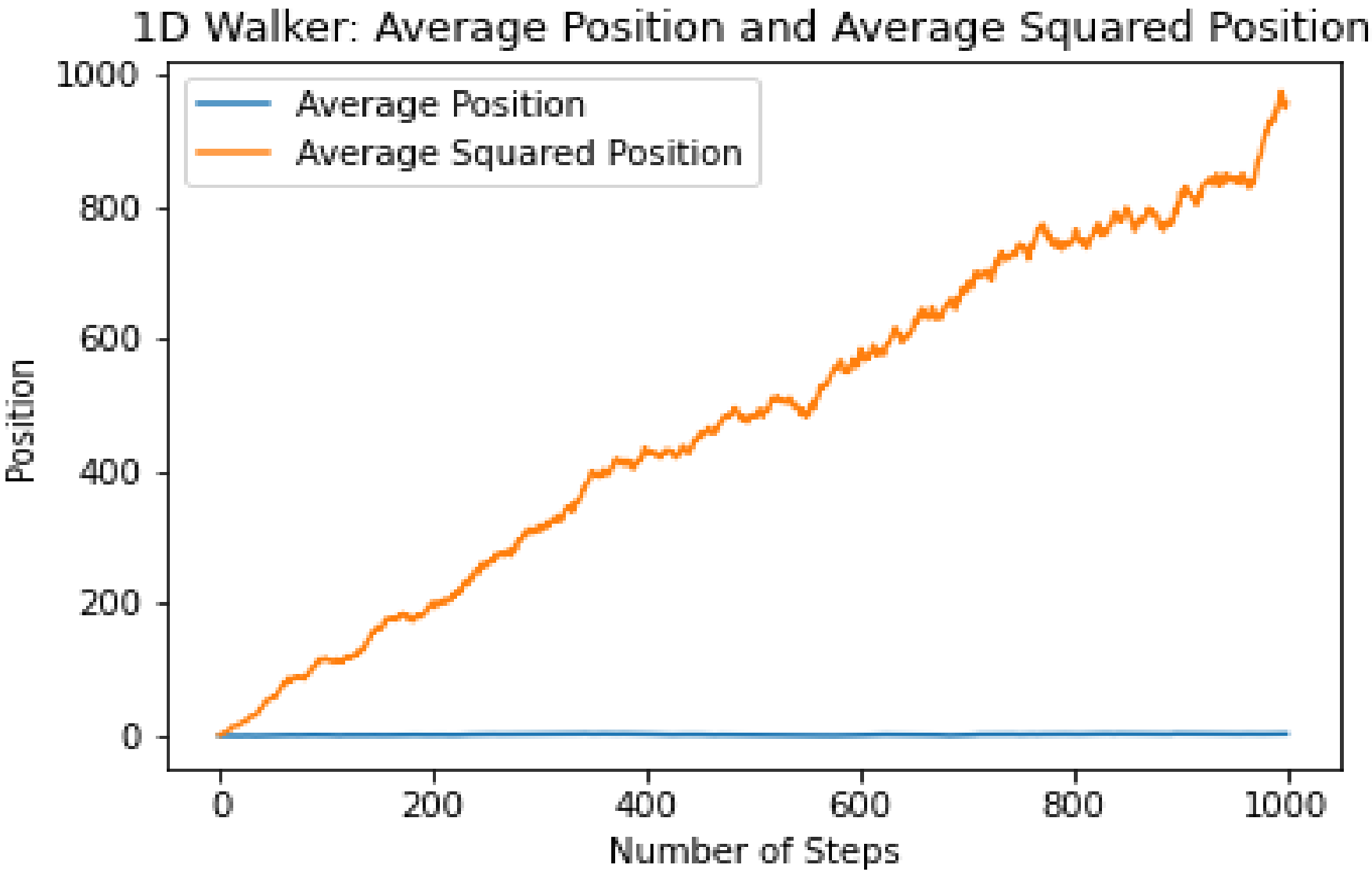

Evolution of Nuclei
Number of Nuclei
Time (hours)
0
50
100
150
200
250
0
20
40
60
80
100

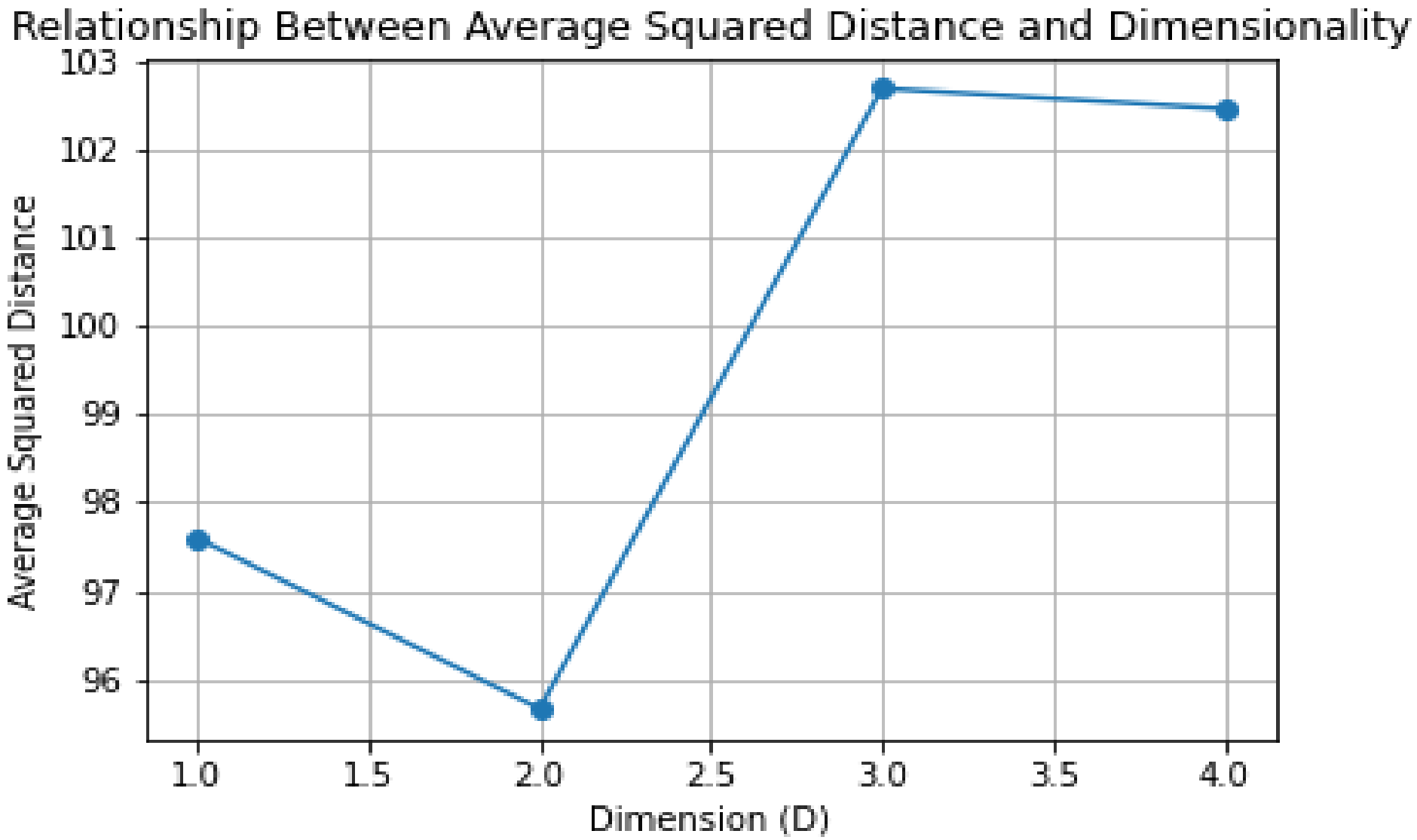

Monte Carlo Integration Error
Relative Error
Number of Points
dim=2
dim=3
dim=4
dim=5
dim=6
dim=7
dim=8
10^{17}
10^{14}
10^{11}
10^{8}
10^{5}
10^{2}
10^{1}
10^{2}
10^{3}
10^{4}
10^{5}

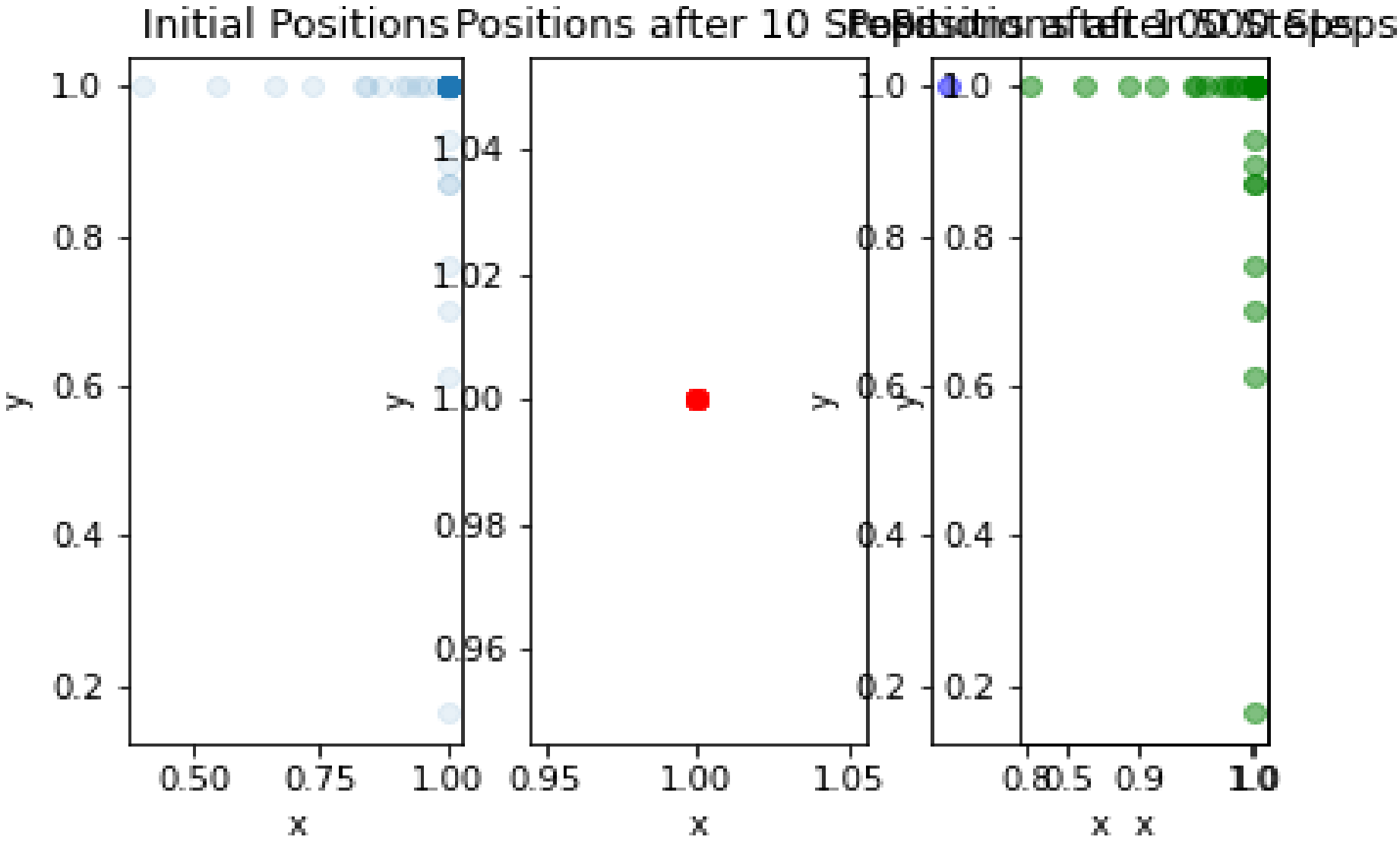

Distribution of Sampled Values
Probability Density
0.00
0.02
0.04
0.06
0.08
0.10
0
2
4
6
8
10
x


Convergence Comparison of Root-Finding Methods
Newton-Raphson
Secant
Bisection
Error
10^{0}
10^{-2}
10^{-4}
10^{-6}
10^{-8}
10^{-10}
10^{-12}
10^{-14}
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Iteration


Gradient Descent Optimization of Banana Function
Eta = 0.001
Eta = 0.003
Eta = 0.005
3
2
1
0
−1
y
−2
−1
0
1
2
x
2500
2000
1500
1000
500
Banana Function


1D Walker: Average Position and Average Squared Position
Average Position
Average Squared Position
Position
Number of Steps
0
200
400
600
800
1000


Relationship Between Average Squared Distance and Dimensionality
Average Squared Distance
103
102
101
100
99
98
97
96
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Dimension (D)


Initial Positions
Positions after 10 Steps
1.0
0.8
0.6
0.4
0.2
y
0.50
0.75
1.00
x
1.04
1.02
1.00
0.98
0.96
0.95
1.00
1.05
0.8
0.5
0.9
1.0
x

AI?