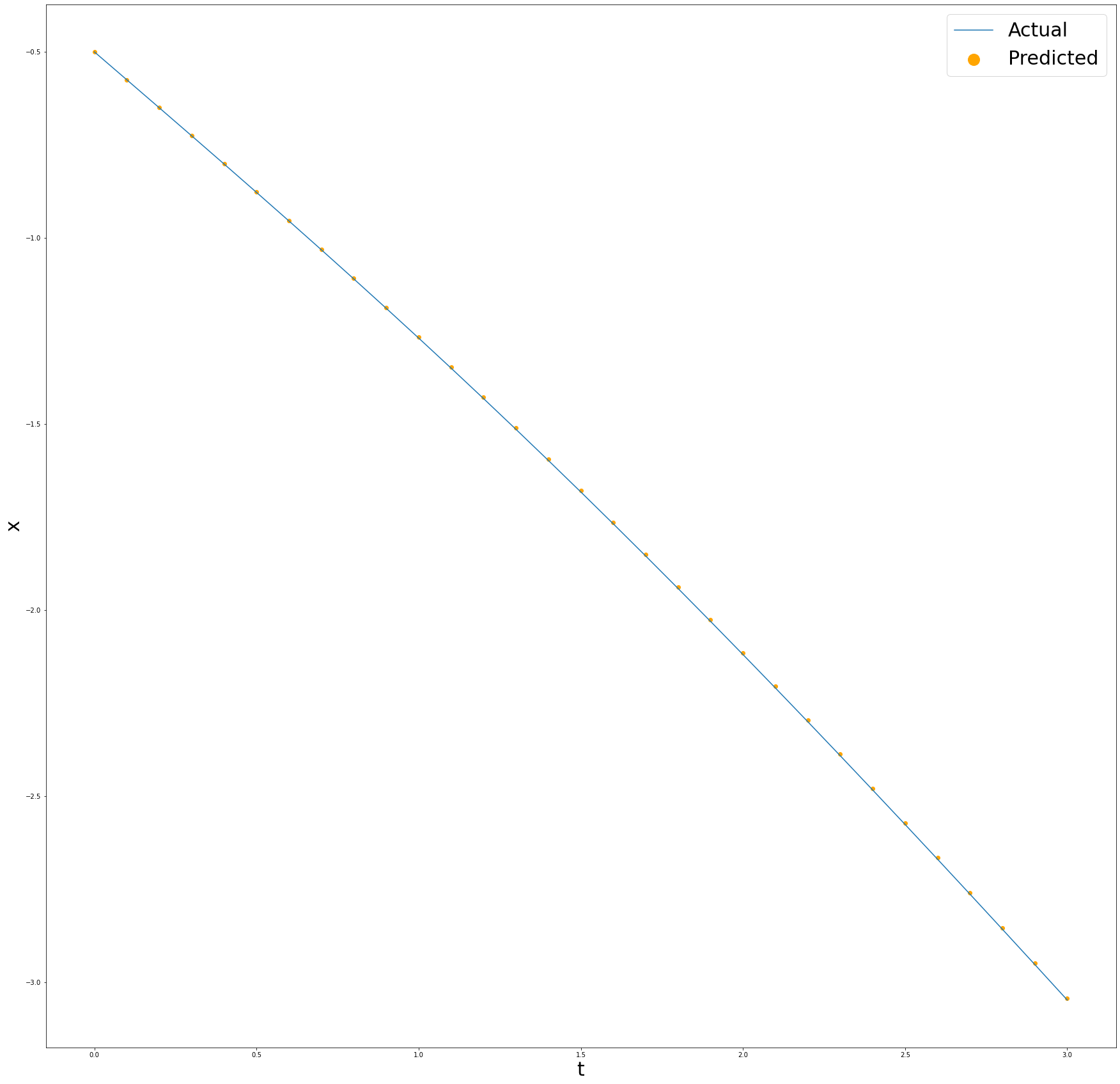
Q1)

a)

Graph obtained by plotting the actual curve vs the points predicted by Euler’s first order scheme.

Time,

taking time-steps, h = 0.01

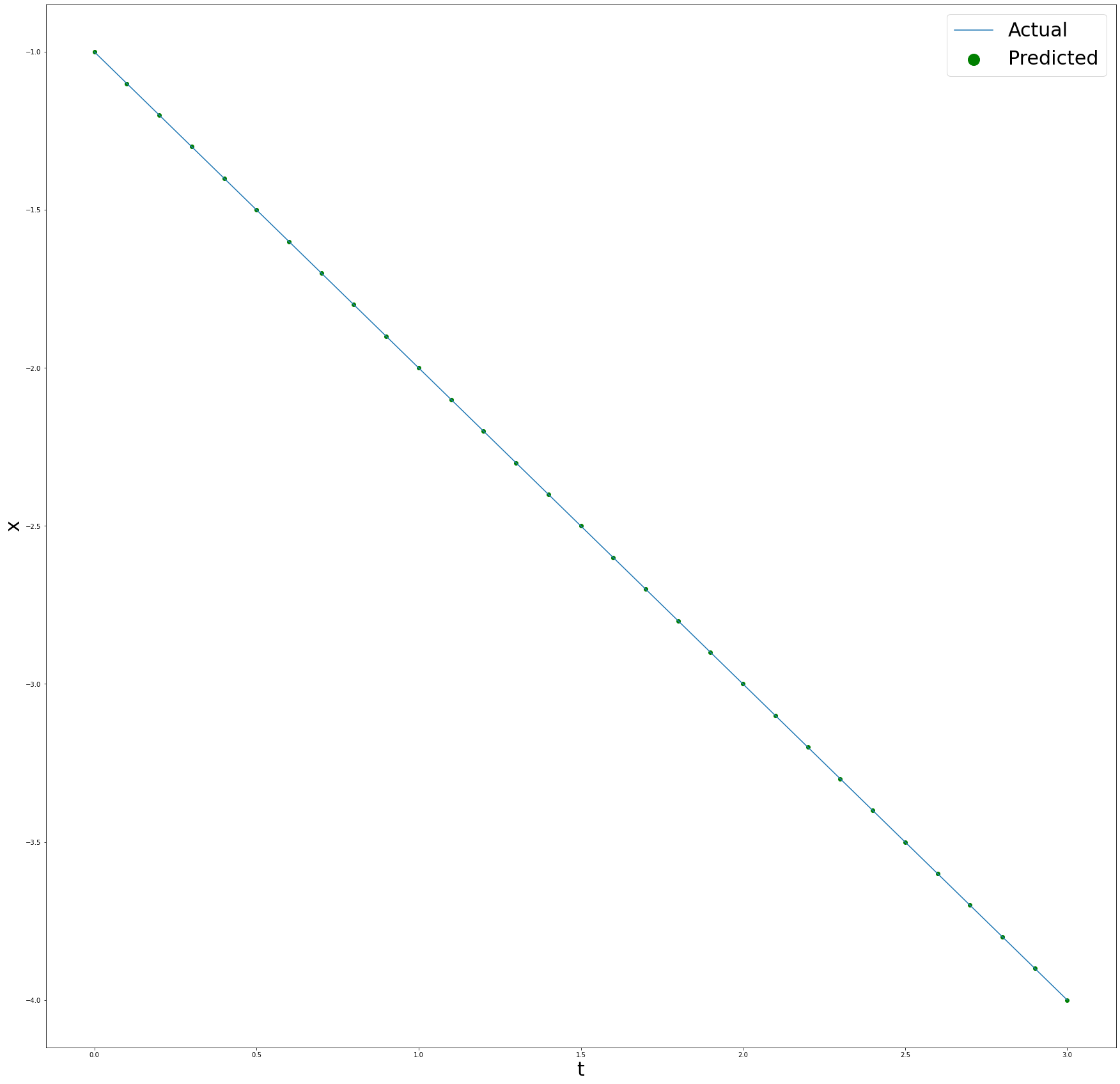


b)

Graph obtained by plotting the actual curve vs the points predicted by Euler’s first order scheme.

Time,

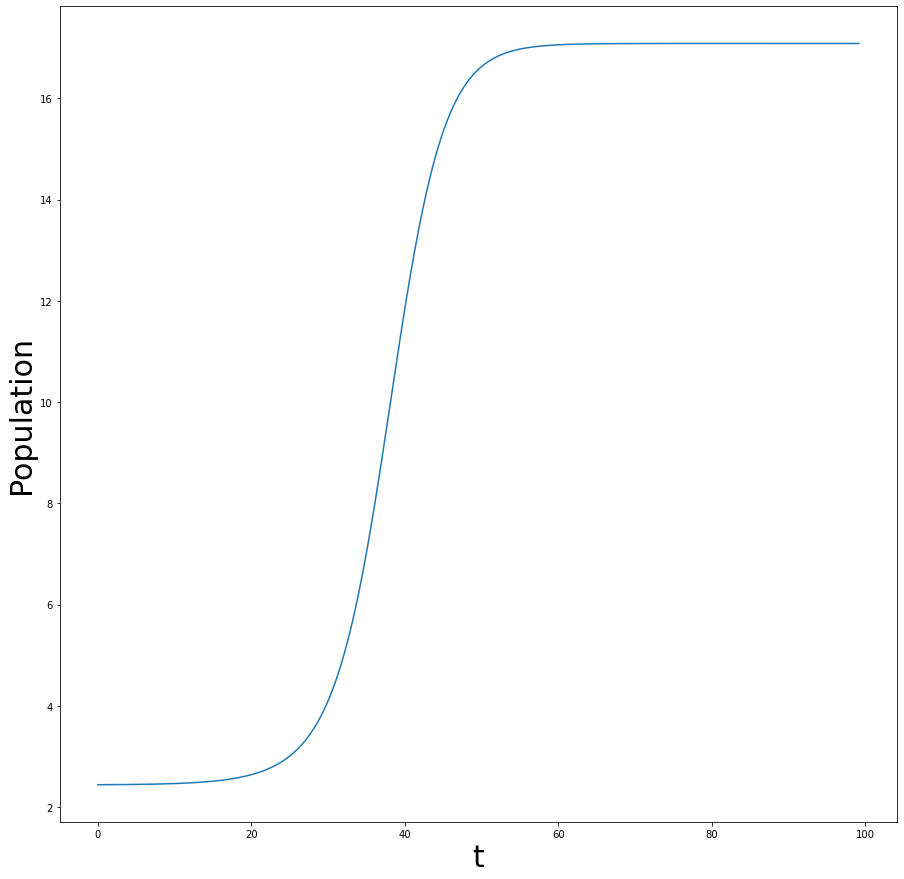
taking time-steps, h = 0.01



2)

For initial population = 2.44

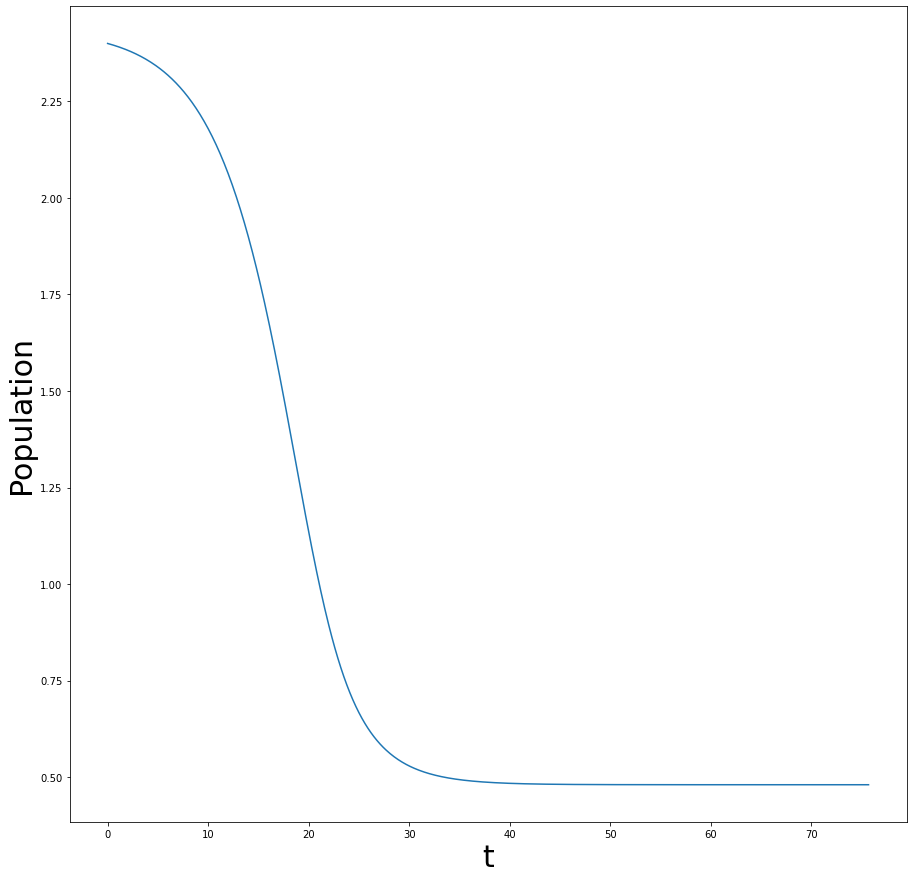
Graph obtained by plotting the points predicted by Euler’s first order scheme.



The population increases and eventually converges to 17.0831307

For initial population = 2.40

Graph obtained by plotting the points predicted by Euler’s first order scheme.

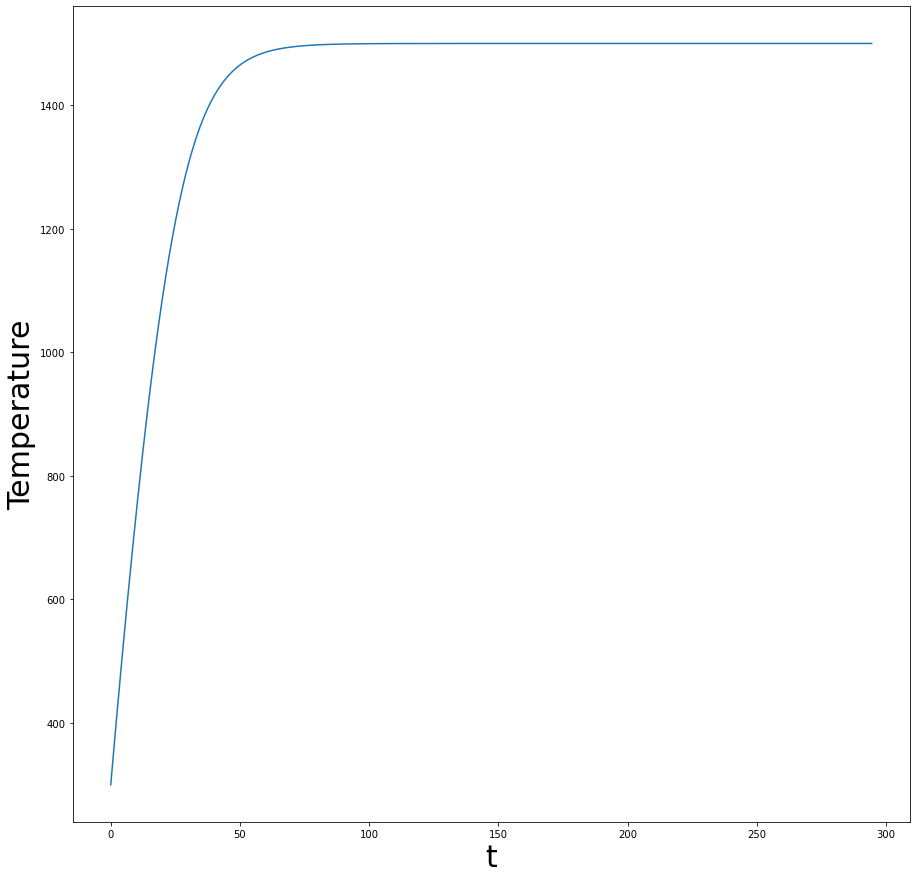


The population decreases and eventually converges to 0.480536317.

3)

For initial temperature = 0 K

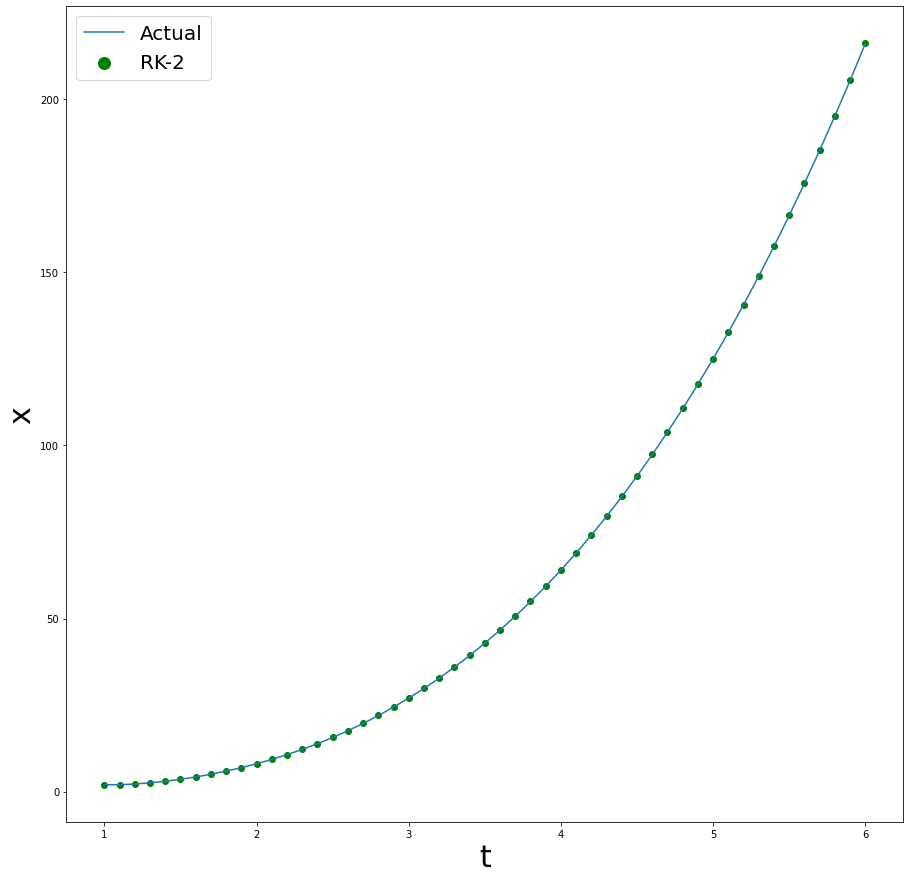
Graph obtained by plotting the points predicted by RK - 4 scheme.



Time taken, t = 294.4 s

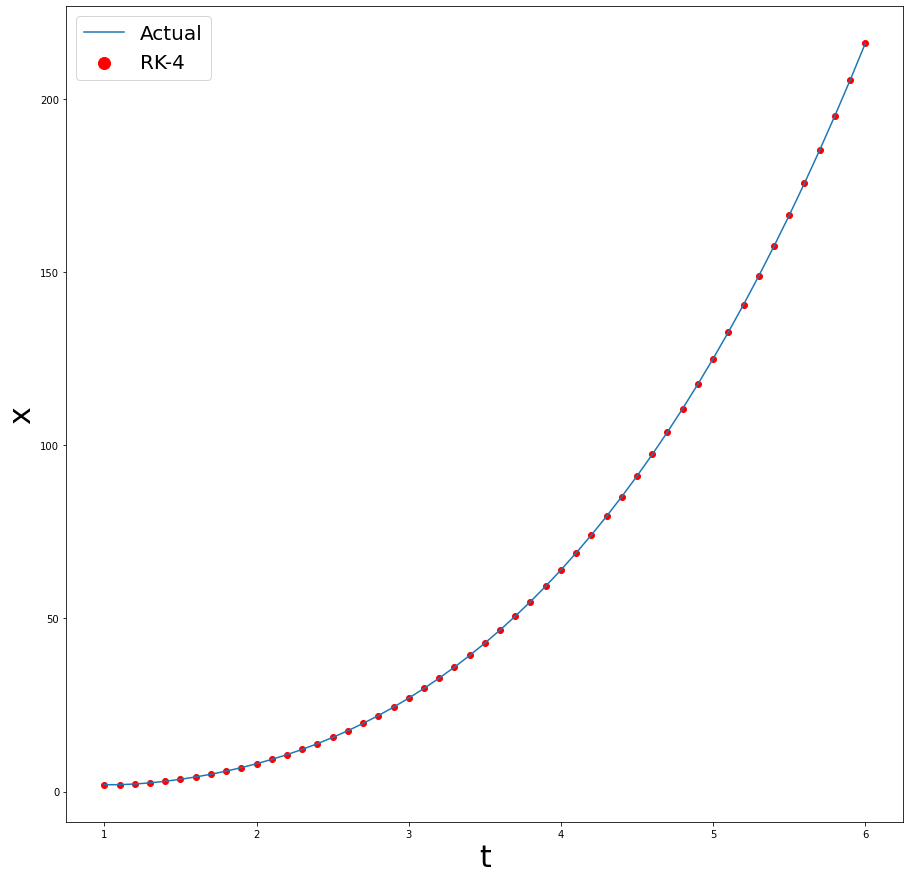
4)

Using RK-2:

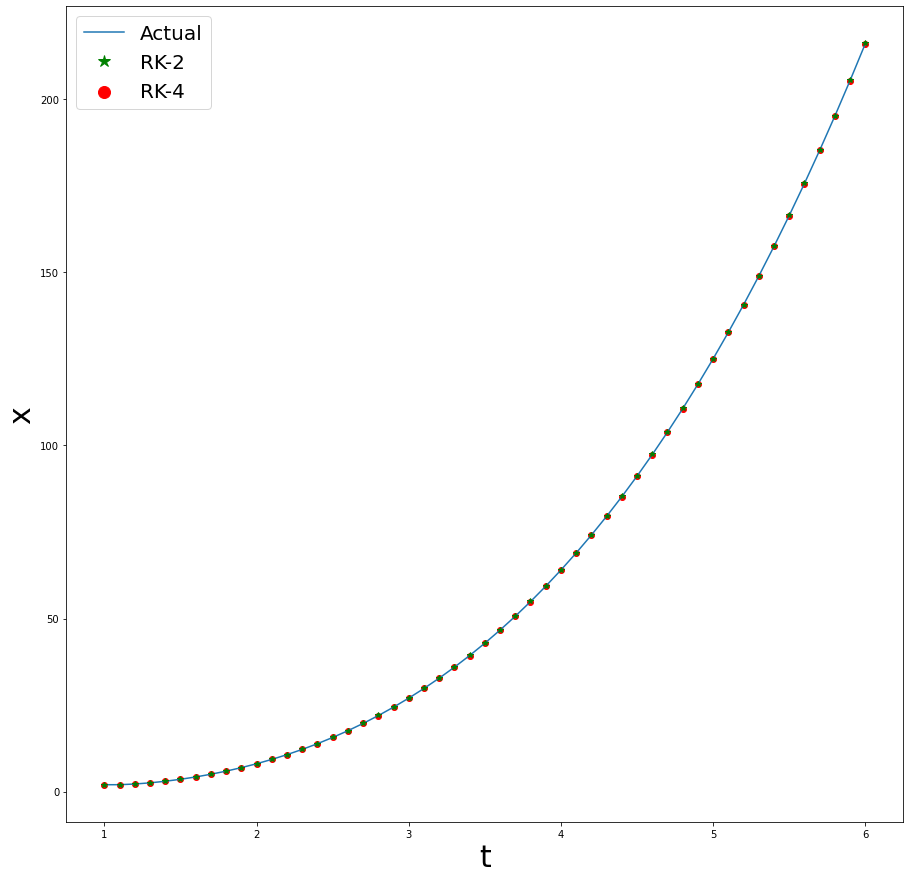


Taking time-steps of size 0.1, we get a percentage error of -0.03720518543% with RK-2.

Using RK-4:



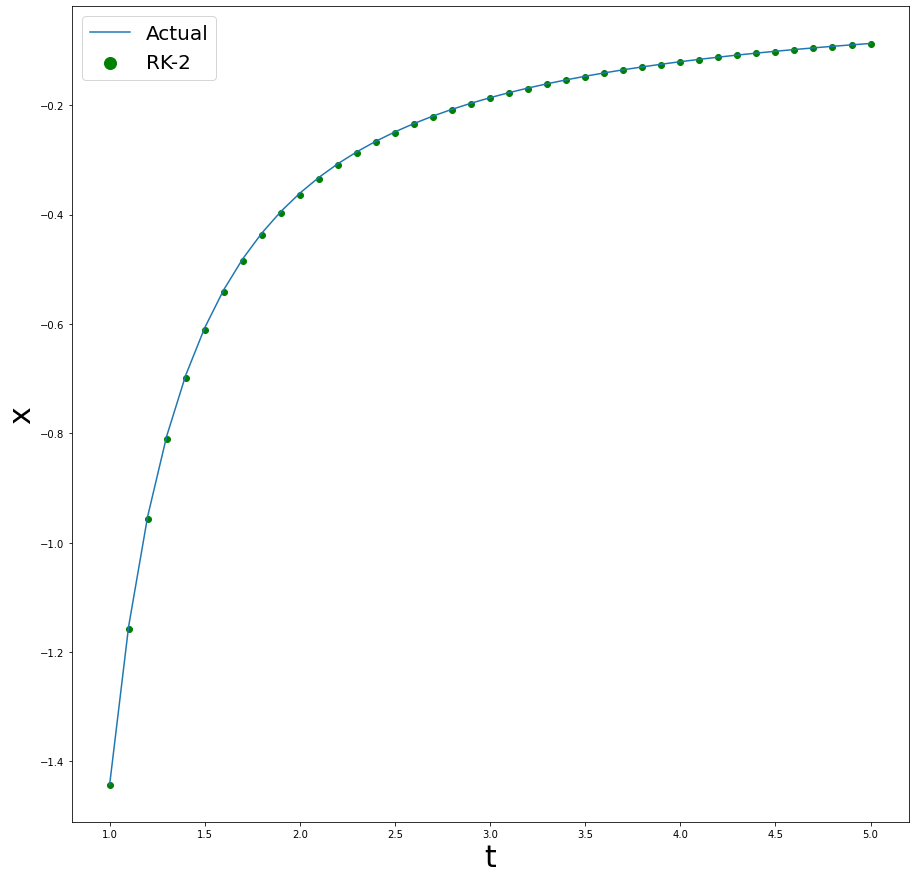
Taking the same time-steps of size 0.1, we get a percentage error of -8.66159974e-06% with RK-4.



Hence, we can see that RK-4 converges much faster in the same number of iterations.

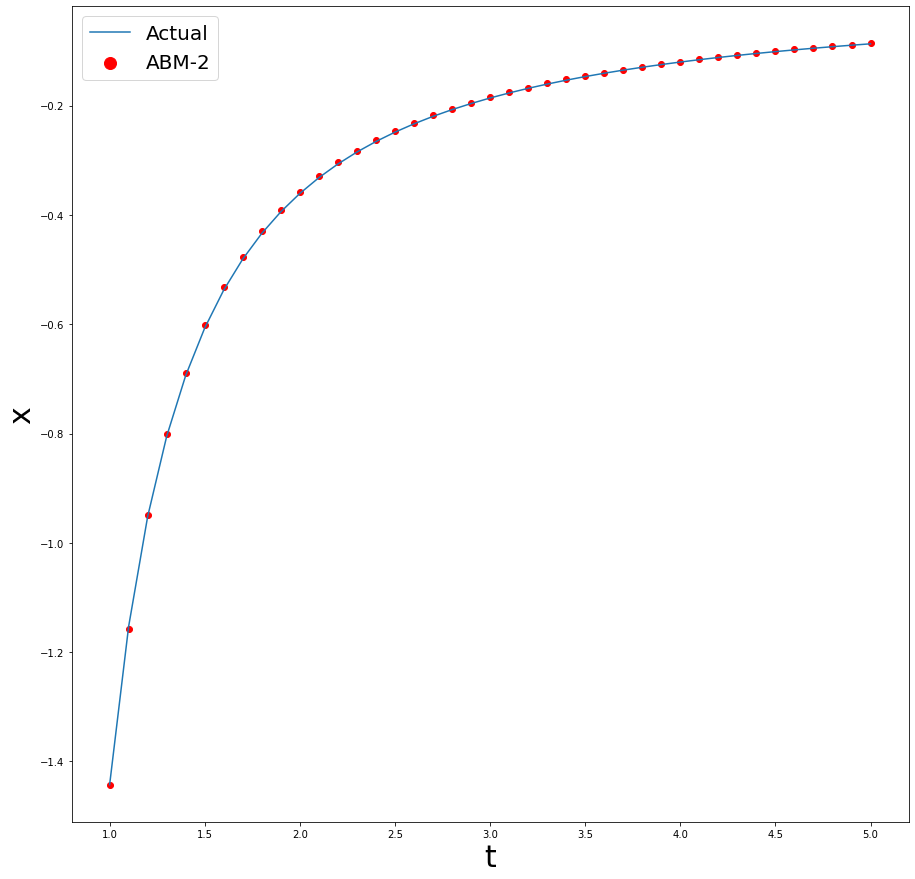
5)

Using RK-2:

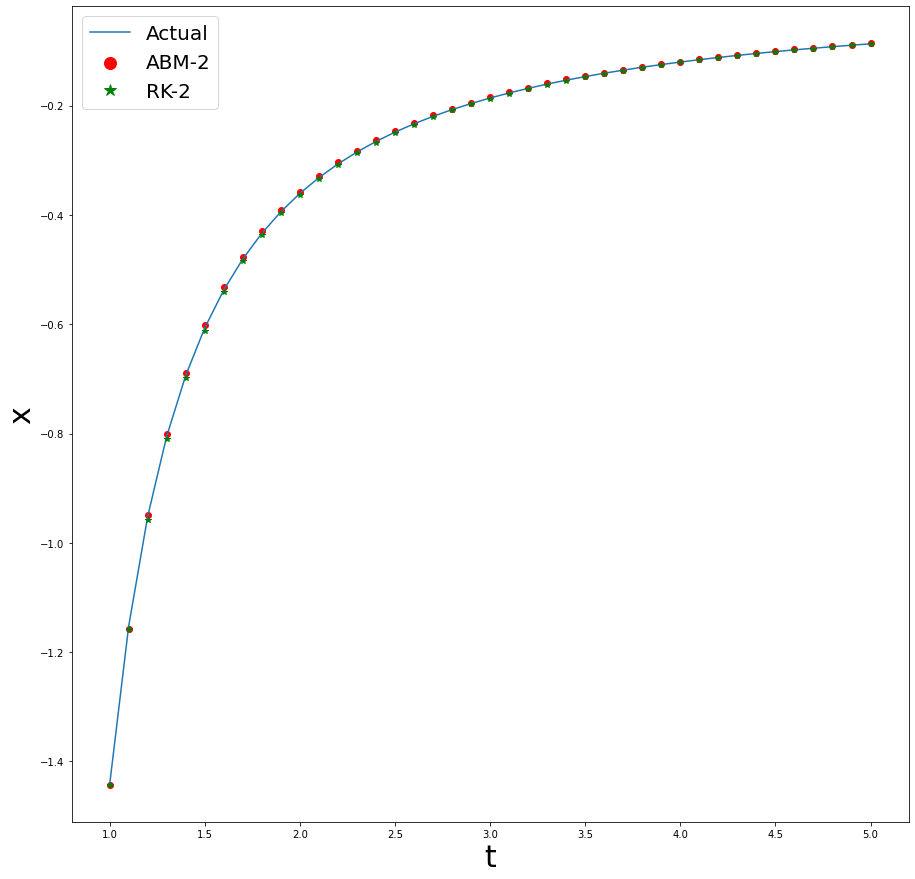


Taking time-steps of size 0.1, we get a percentage error of -0.5357938563% with RK-2.

Using ABM-2:



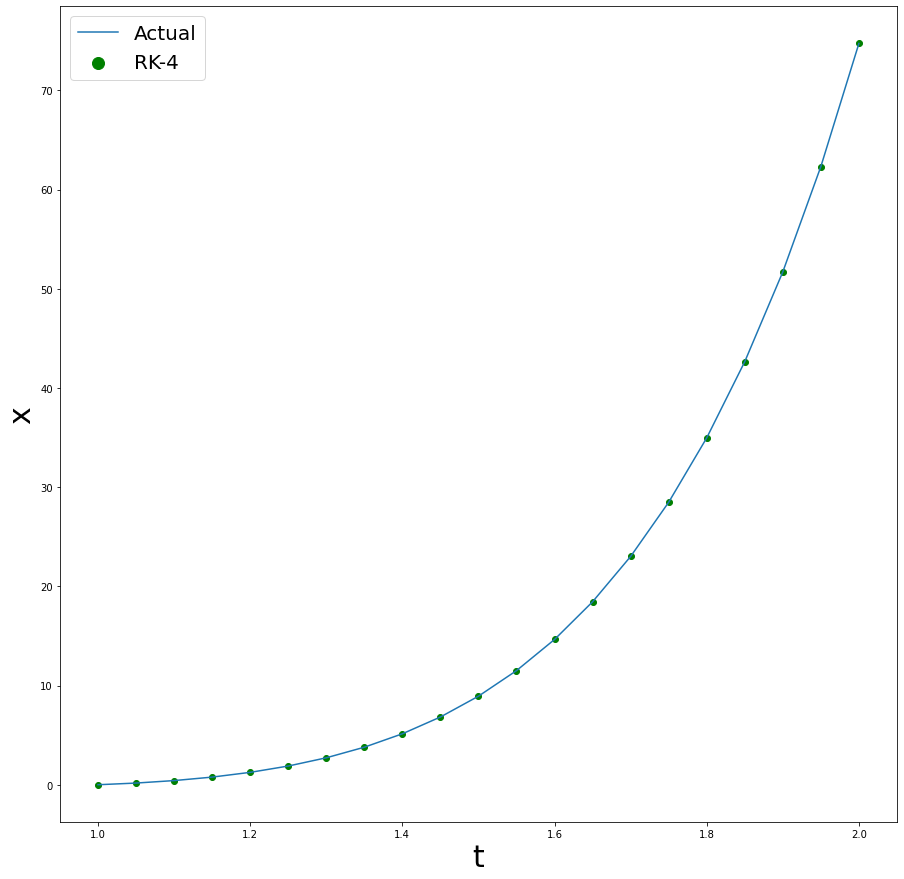
Taking the same time-steps of size 0.1, we get a percentage error of 0.7384963899% with ABM-2.



Hence, we can conclude that RK-2 has better convergence than ABM-2 for same time-steps.

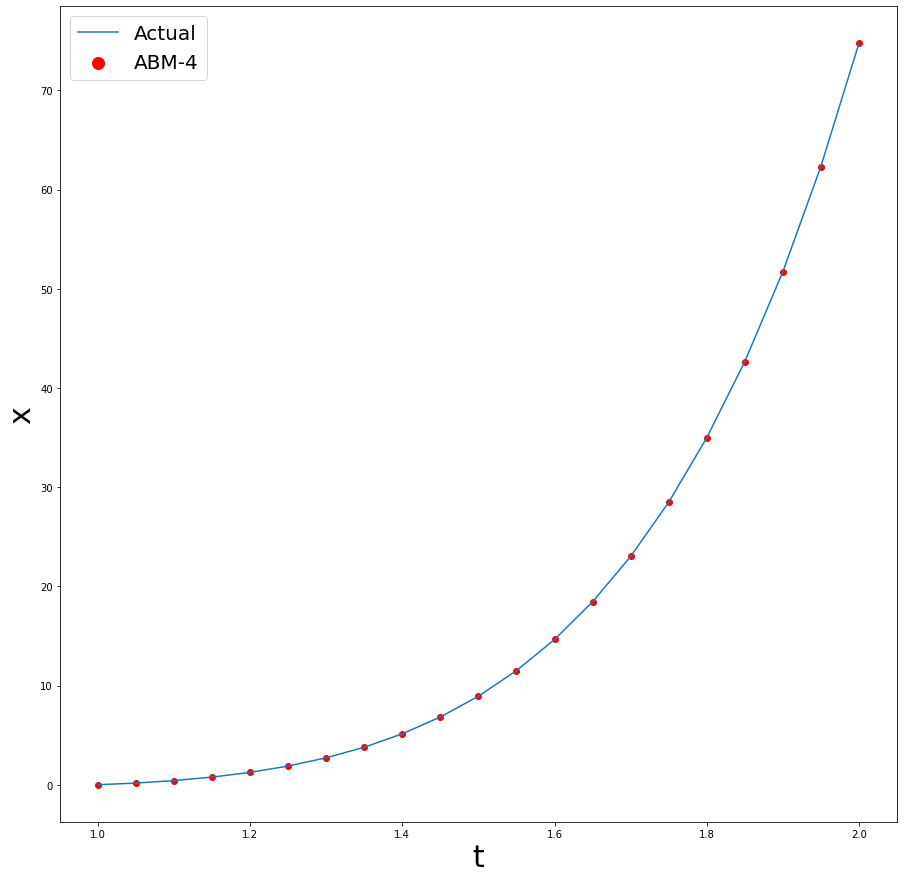
6)

Using RK-4:

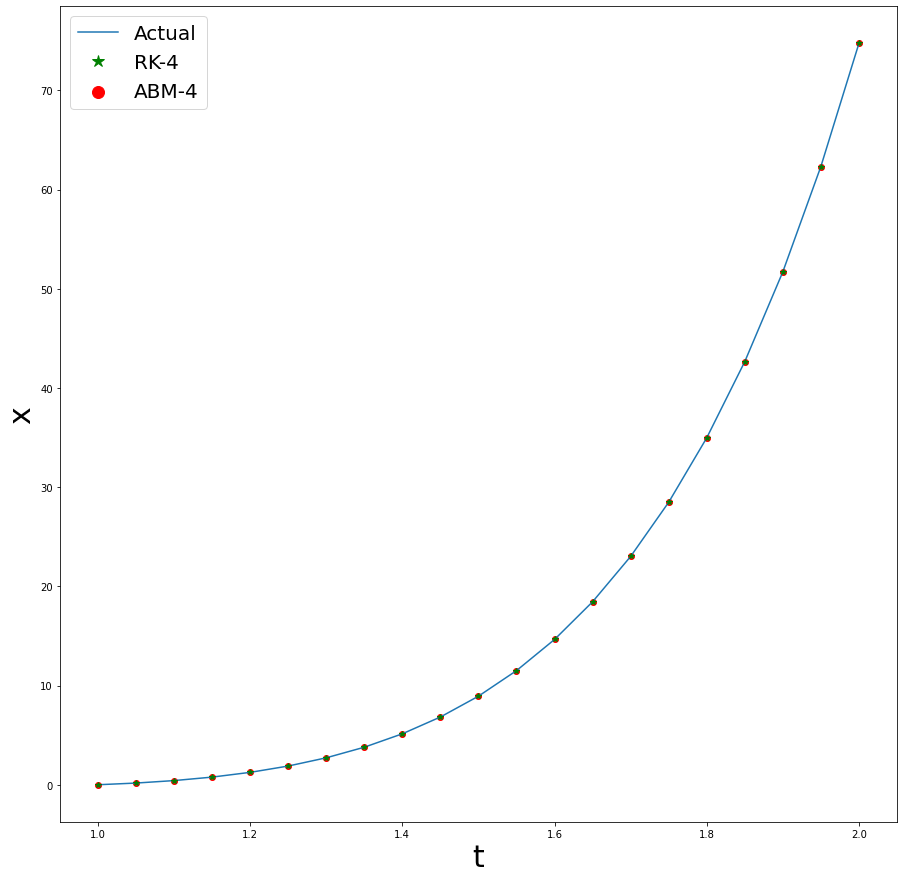


Taking time-steps of size 0.05, we get a percentage error of 0.0008569493606% with RK-4.

Using ABM-4:



Taking the same time-steps of size 0.05, we get a percentage error of -0.0005567053846% with ABM-4.



Hence, we can conclude that ABM-4 has better convergence than RK-4 for same time-steps.

7)

--(1)

--(2)

Taking time-steps, h = 0.1

Solving (1) and (2) simultaneously using RK-4, we get the following curve:

