Exercise # 1. Numerical methods for ODES.

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Intro

Methods

Answers

Question 1

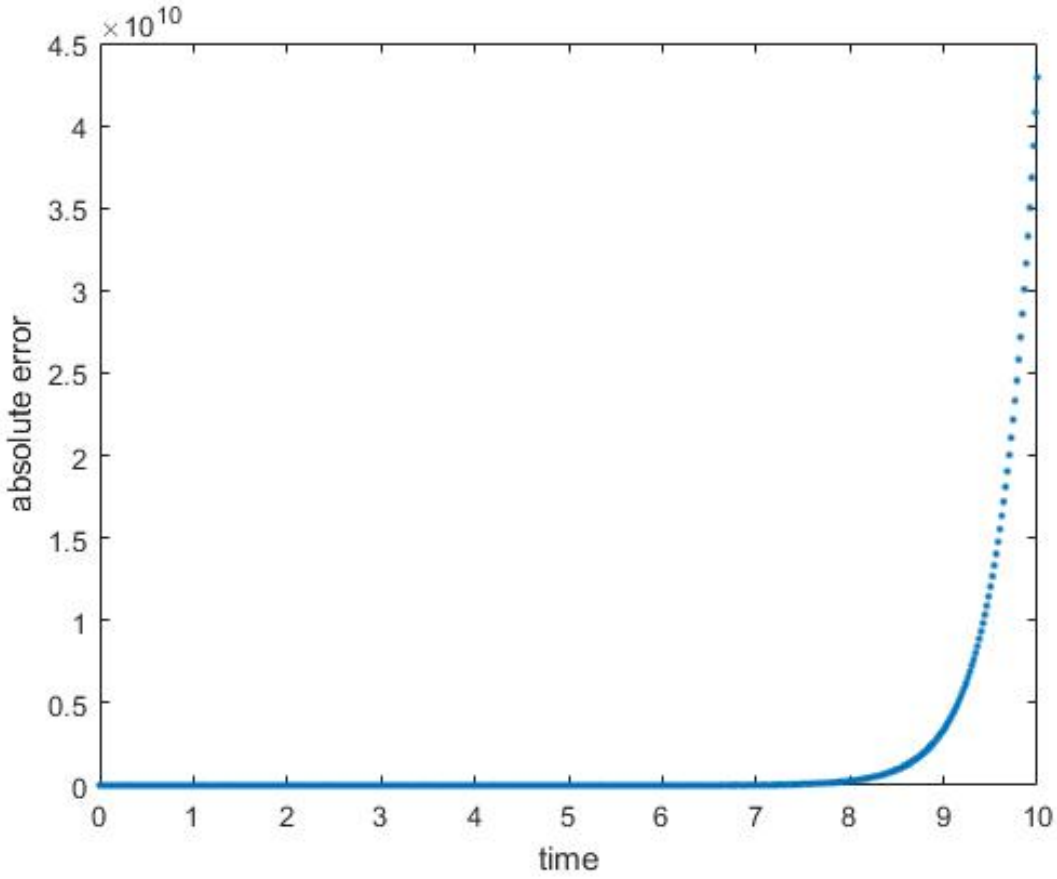

Figure 1: Absolute error in function of time using Forward Euler method to compute y(1)

We got a maximum error of 4.2916×10^{10}...

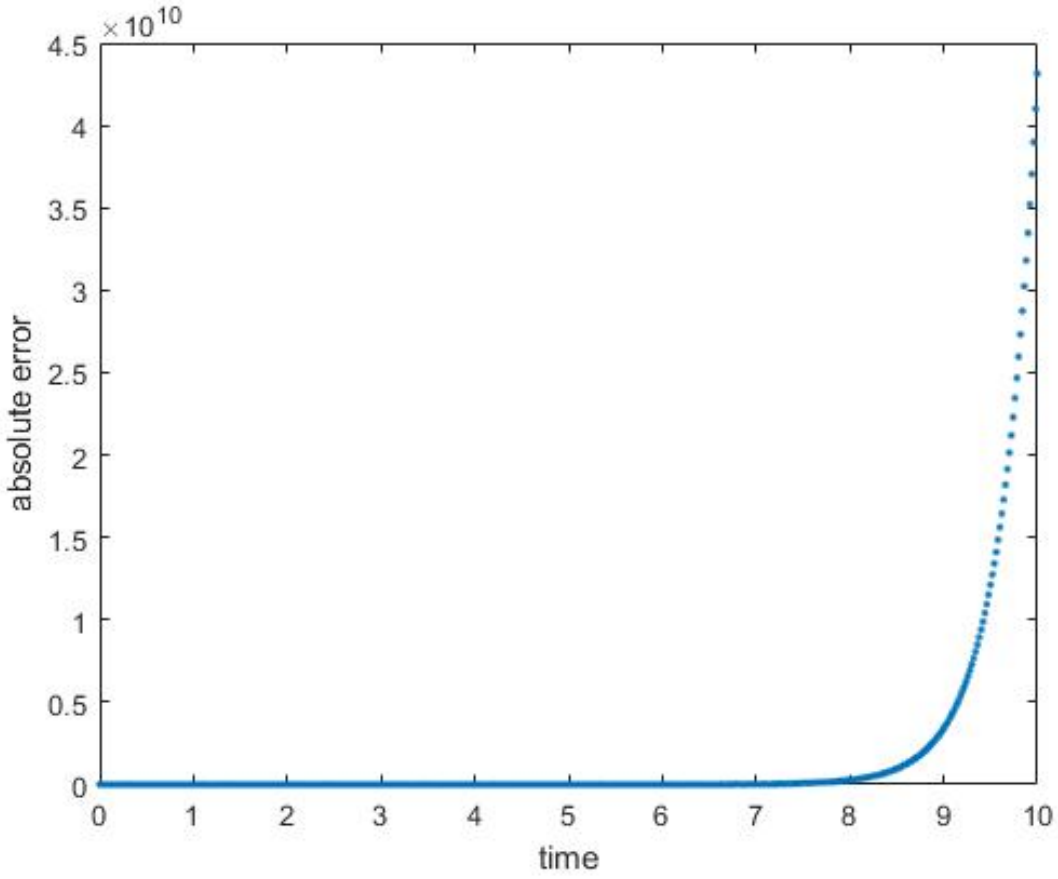

Figure 2: Absolute error in function of time using RK4 method to compute y(1)

We got a maximum error of 4.3146×10^{10}...

Comment the different behavior observed by the numerical method.

Question 2

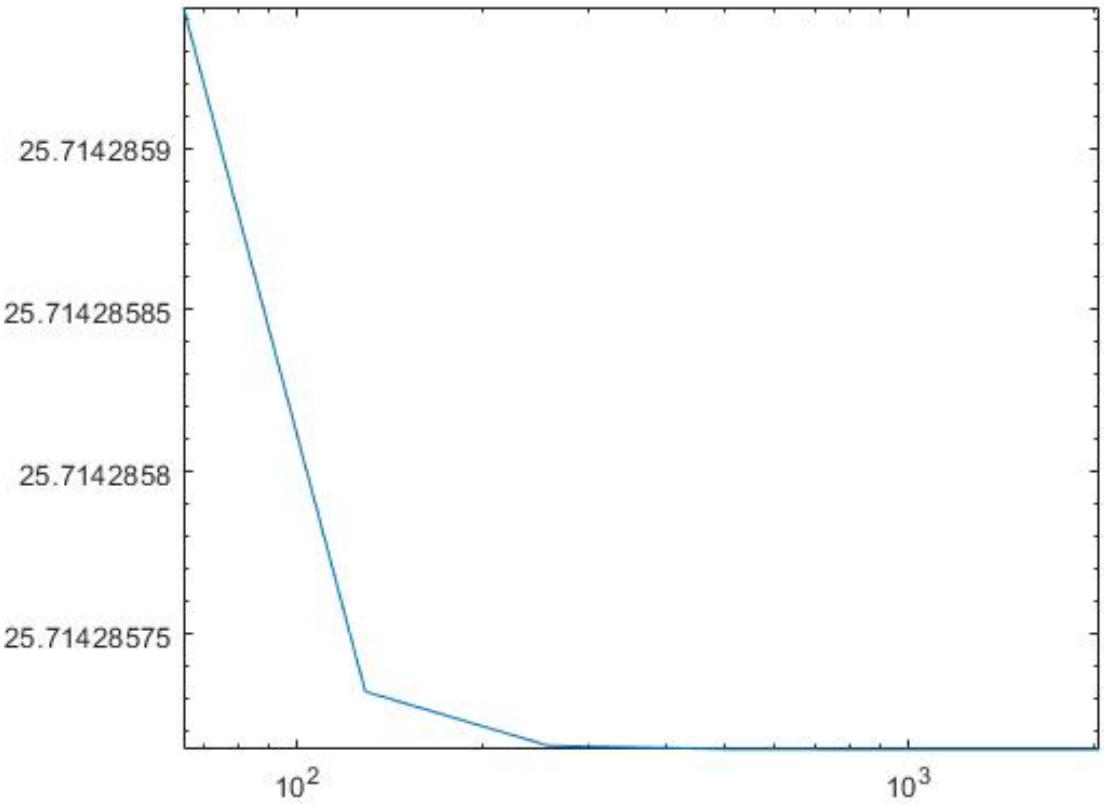

Figure 3: LogLog plot of the error as a function of the number of steps.

h	**error**
3.125000×10^{-2}	25.7142859434702
1.562500×10^{-2}	25.7142857321434
7.812500×10^{-3}	25.7142857154459
3.906250×10^{-3}	25.7142857143588
1.953125×10^{-3}	25.7142857142903
9.765625×10^{-4}	25.7142857142860

The error reduces with the increase in the number of steps due to the decrease of h as expected in theory. ...

Question 3

Question 4

Question 5

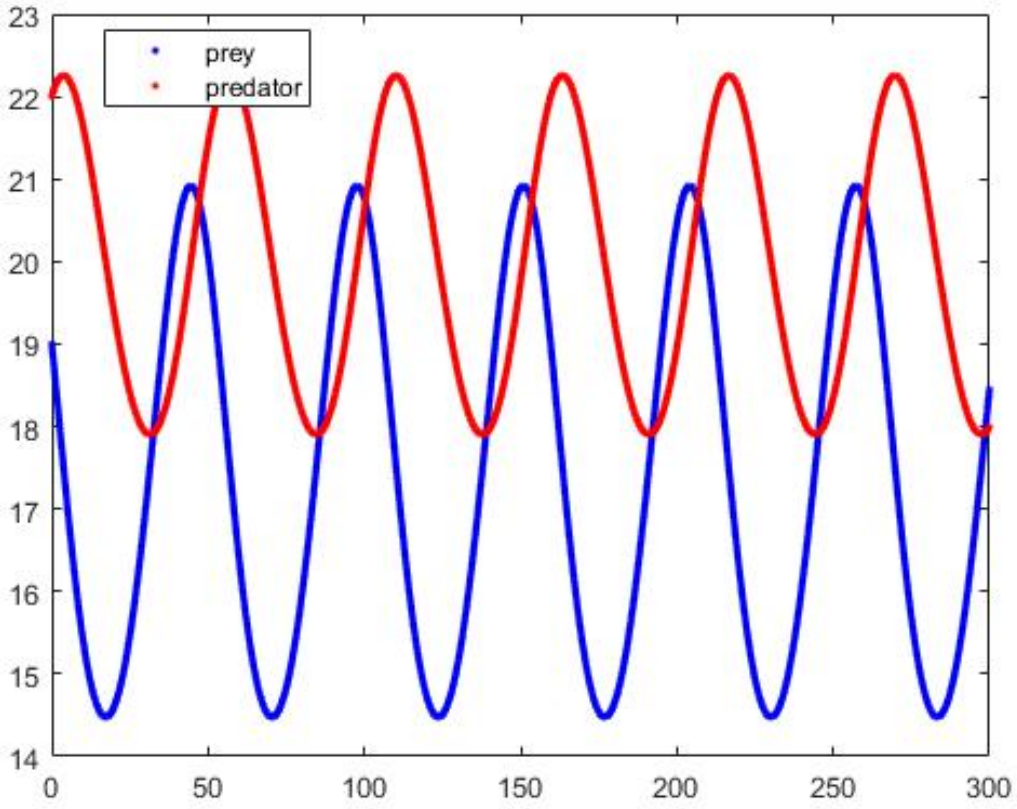

Figure 4: Evolution of the number of preys and predators.

Results

Outputs