1. (1 pt) mathbioLibrary/setABiocLabs/Lab121_F2_mal_country.pg

Because of the accuracy of WeBWorK, you should use 5 or 6 significant figures on all problems.

The population of Australia \([1]\) was \(P_0 = 14.6\) million in 1980, while in 1990 it was \(P_{10} = 16.98\) million. The population in Niger \([1]\) was \(Q_0 = 6.07\) million in 1980, while it was \(Q_{10} = 7.81\) million in 1990.

a. Over a limited range of years, the population of most countries can be estimated using the Malthusian growth law, which is given by:

\[
P_{n+1} = (1 + k)P_n \quad \text{and} \quad Q_{n+1} = (1 + r)Q_n,
\]

where \(n\) is the number of years since 1980 with \(P_n\) the population of Australia and \(Q_n\) the population of Niger. Use the data above to find the annual growth rate of Australia

\[k = \text{_____}\]

and annual growth rate of Niger

\[r = \text{_____}.
\]

Find the Malthusian growth model for the population of Australia,

\[P_n = \text{_____} \text{ million}.
\]

(The expression above uses the values of \(P_0\) and \(k\) and depends on \(n\) in years.)

Find the Malthusian growth model for the population of Niger,

\[Q_n = \text{_____} \text{ million}.
\]

(The expression above uses the values of \(Q_0\) and \(r\) and depends on \(n\) in years.)

b. Use the Malthusian growth models to determine how long it takes for each country’s population to double.

Population of Australia doubles in _____ years

Population of Niger doubles in _____ years

According to the Malthusian growth models, the population of Australia is equal to the population of Niger.

Populations are equal in _____ years.

c. In your Lab Report, create a graph of the Malthusian growth models for both countries from 1980 to 2030. Include the data values of the populations for 1980, 1990, and 2000 on your graph. Briefly discuss how well you believe the models simulate the populations of these countries over the 50 years of simulation. Include some discussion of the strengths and weaknesses of using the Malthusian growth model for this simulation.