Calculating Exponential Growth

Formula for Exponential Growth

A quantity A that has exponential growth can be modeled by

$$A = P(1 + r)^n$$

- A measures the quantity at any time.
- P is the initial value of A, when $n = 0$.
- r is the rate (%) of growth, *in decimal form.*
- n is the elapsed time.

http://www.math.andyou.com/pdf/152.pdf

http://www.math.andyou.com/152

EXAMPLE: The growth rate of a bacteria culture is 52% each hour. Initially, there are two bacteria. How many bacteria are there after 12 hours?

A = ?
P = 2
r = 0.52
n = 12

```
2(1+0.52)^12
      304.1956862
```

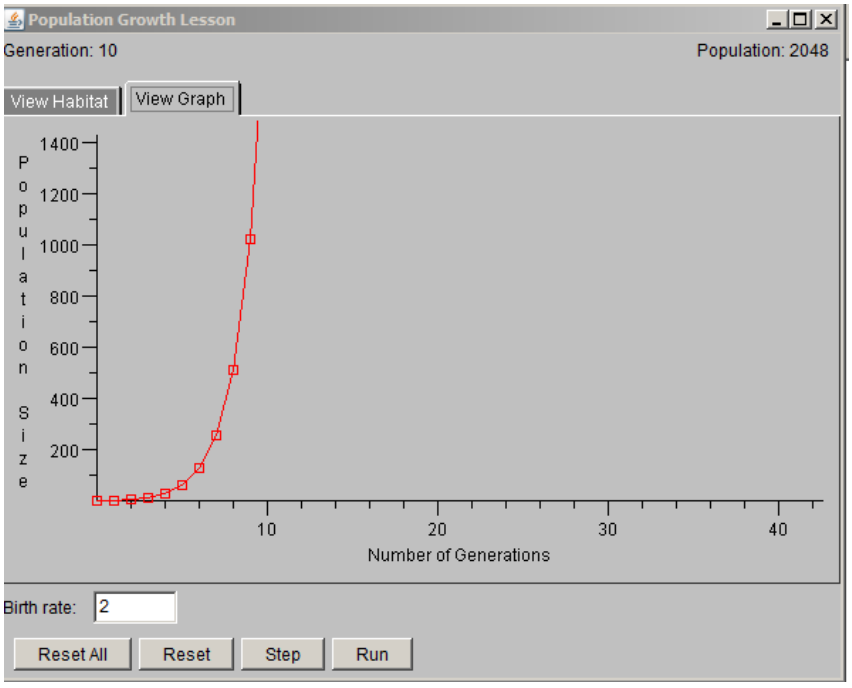
304 bacteria

Under ideal conditions:

NOTES - Exponential Growth.pdf

1. the **biotic potential** of a population is the maximum rate at which it can increase
2. **exponential growth** occurs - the population increases by the same percent from one time period to the next.

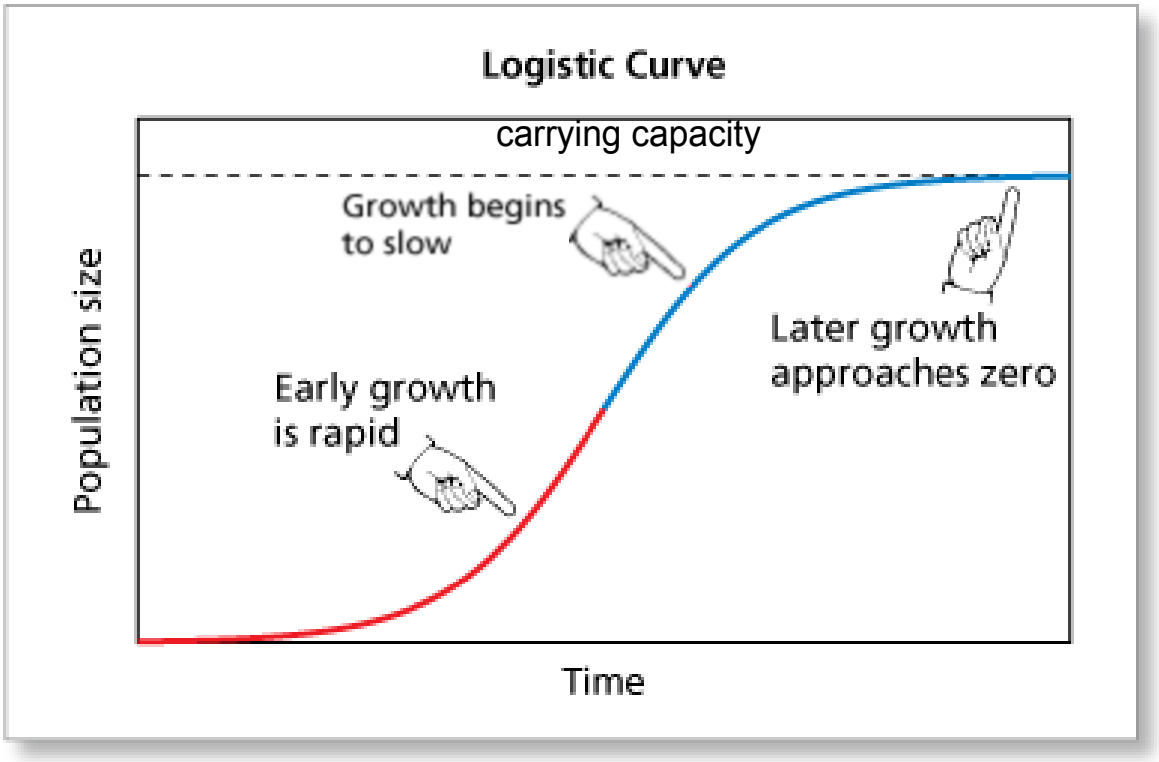
http://www.otherwise.com/population/exponent.html



- In nature, there are always limits to growth. A population will reach a size limit imposed by a shortage of one or more of the **limiting factors** of light, water, space and nutrients.
- **Carrying capacity** represents the highest population that can be maintained for an indefinite period of time by a particular environment.
- When a population grows exponentially at first, and then levels off to a stable number near the carrying capacity, it is called **logistic growth**. Logistic growth is much more common in nature than long-term exponential growth.
- **Natural Capital** - refers to all the natural resources on which people depend upon and includes resources we use to produce manufactured goods.

Exponential Growth -> "J"Curve

Logistic Growth -> "S" curve



Doubling Time - Rule of 72

$$\text{doubling time} = \frac{72}{\text{growth rate}}$$

ie/ annual growth rate of 8%

doubling time = 72/8
= 9 years


Poodwaddle World Clock
Stats | Time | Date | Life | ?
YR. MTH. WK. DAY NOW
World Population
7,214,370,187
Births
18,751,865
Deaths
7,852,265
Tuesday Feb 18
11:43:44 AM
Intro
Population
Mortality
Illness
Environment
Energy
Food
Economy
Crime
:) Smile It ain't all bad news
February 2014
S M T W T F S
1
2 3 4 5 6 7 8
9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28
New York Feb 18 10:37:52 AM
London Feb 18 3:37:52 PM
Moscow Feb 18 7:37:52 PM
Tokyo Feb 19 12:37:52 AM

Forecasting Population Size

- Age structure
  - Distribution of various age groups
  - Population pyramids can be made to show trends
  - High growth rates have young populations
- Survivorship
  - Determine how much of a population survives to a given age
- Fertility Rates
  - Number of babies born each year per 1000 women
- Migration
  - Movement of individuals in and out of a population
    - Immigration (into a country)
    - Emigration (out of a country)

Attachments

NOTES - Exponential Growth.pdf