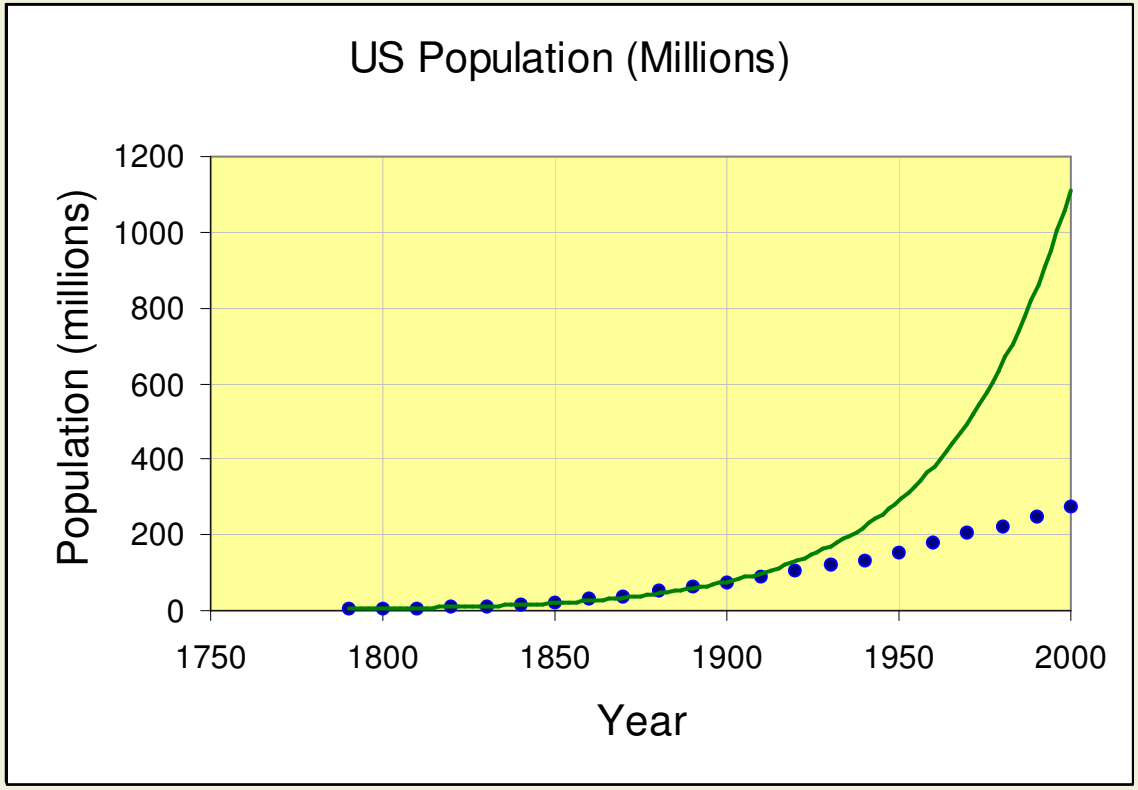
Exponential Growth Rate

In 1800 the US population was approximately 5.2 million and in 1900 the population was approximately 76 million.

1. What is the average rate of change? The percentage change?
2. Assuming exponential growth what is the average annual growth rate?
3. Predict the population in 2007 based on this growth rate.



Exponential Decay

Strontium 90 has a half-life of 28 years.

1. If there there is radioactive fallout from a nuclear power how long will it take for the radiation level due to strontium 90 to reduce to ¼ of the initial level? How about to 1/8th of its initial level?
2. What is the annual decay rate for strontium 90?

Rates of Change

In 1977, the year Elvis died, there were 48 professional Elvis impersonators in the US. By 1996 the figure had grown to 7328. Find the number of Elvis impersonators as a function of time in years since 1977 assuming:

1. Linear growth
2. Exponential growth

Transforming Population Growth Models

The world population doubles in size every 50 years. In 1950 the population was 3.2 billion.

(a) Find the function $y=f(x)$ where y is population in billions and x is the number of 50 year periods since 1950.

(b) Now transform this function so that x is measured in years since 1950.

(c) Finally transform this function so that x is measured in years since 2000.

Newton's Law of Cooling

Coffee initially at 90 degrees C will cool down over time to room temperature of 20 degrees C. The rate of cooling is not constant, but instead is proportional to the difference between its temperature and the temperature of the surroundings. The temperature y can be expressed as a transformed exponential function of time t of the form

$$y = c \cdot a^t + d$$

Find the constants a,c and d *if* $y = 80$ *degrees C after 10 minutes.*

Memory Test

A group of people are shown a list of 20 unrelated words and allowed to look at them for 1 minute. Then with the list removed they are given 1 minute to recall as many words as they can. The average number remembered was 10. This process was repeated a second time and the average score was 15. The test is repeated as many times as needed until everyone recalls all the words. The rate at which the score improves decreases the closer the average score gets to the maximum value of 20. The average score can be modeled by a transformed exponential function of the form

$$y=c\cdot a^{x+b}+d$$

Where, y is the average score and x is the number of tests taken. Find the constants a,b,c and d. (Hint. Sketch the graph first. It is an upside down exponential function with a horizontal asymptote of 20.)

Word recall

You will be given a list of 10 words and 30 seconds to read them. Do not write them down, but try to remember as many of them as you can.

Now write down as many of the words as you can remember. You have two minutes.

Now look at the words again and record how many you remembered

Sunshine
Mirror
Hubcap
Nectarine
Tea
Calm
Fountain
Library
Mostly
Pyramid