

Growth and Decay

- A bacteria culture contains 1500 bacteria initially and doubles every hour.
 - Find a function that models the number of bacteria after t hours.
 - Find the number of bacteria after 24 hours.
- A certain breed of mouse was introduced onto a small island with an initial population of 320 mice, and scientists estimate that the mouse population is doubling every year.
 - Find a function that models the number of mice after t years.
 - Estimate the mouse population after 8 years.
- A 15-g sample of radioactive iodine decays in such a way that the mass remaining after t days is given by $M(t) = 15(0.5)^{t/10}$, where M is measured in grams. After how many days is there only 5 g remaining?
- A grey squirrel population was introduced in a certain county of Great Britain 30 years ago. Biologists observe that the population doubles every 6 years, and now the population is 100,000.
 - What was the initial size of the squirrel population?
 - Estimate the squirrel population 10 years from now.
- A certain species of bird was introduced in a certain county 25 years ago. Biologists observe that the population doubles every 10 years, and now the population is 13,000.
 - What was the initial size of the bird population?
 - Estimate the bird population 5 years from now.
- The fox population in a certain region has a relative growth rate of 8% per year. It is estimated that the population in 2005 was 18,000.
 - Find a function that models the population t years after 2005.
 - Use the function from part (a) to estimate the fox population in the year 2013.
- The population of a certain species of fish has a relative growth rate of 1.2% per year. It is estimated that the population in 2000 was 12 million.
 - Find an exponential model for the population t years after 2000.
 - Estimate the fish population in the year 2005.
- The bat population in a certain Midwestern county was 350,000 in 2009, and the observed doubling time for the population is 25 years.
 - Find an exponential model for the population t years after 2006.
 - Estimate when the population will reach 2 million.
- A culture starts with 8600 bacteria. After one hour the count is 10,000.
 - Find a function that models the number of bacteria after t hours.
 - Find the number of bacteria after 2 hours.
 - After how many hours will the number of bacteria double?
- The count in a culture of bacteria was 400 after 2 hours and 25,600 after 6 hours.
 - What is the relative rate of growth of the bacteria population? Express your answer as a percentage.
 - What was the initial size of the culture?
 - Find a function that models the number of bacteria after t hours.
 - Find the number of bacteria after 4.5 hours.
 - When will the number of bacteria be 50,000?
- The population of California was 29.76 million in 1990 and 33.87 million in 2000. Assume that the population grows exponentially.
 - Find a function that models the population t years after 1990.
 - Find the time required for the population to double.
 - Use the function from part (a) to predict the population of California in the year 2010.

Answers:

1. a. $y = 1500e^{(\ln 2)t}$
b. 25,165,824,000
2. a. $y = 320e^{(\ln 2)t}$
b. 81,920 mice
3. $y = 15e^{-0.087t}$, so $t = 12.628$ days
4. a. 3125
b. 317,480
5. a. 2298
b. 18,384
6. a. $y = 18,000e^{(\ln 1.08)t}$
b. 33,316.744
7. a. $y = 12e^{(\ln 1.012)t}$
b. 12,737,489 fish
8. a. $y = 350,000e^{0.0277t}$
b. 62.864 bats
9. a. $y = 8600e^{0.1508t}$
b. 11627
c. 4.596 hours
10. a. 104%
b. 50
c. $y = 50e^{1.04t}$
d. 5388.5
e. 6.64 hours
11. a. $y = 29.76e^{0.012936t}$
b. 53.58 years
c. 38.55 million