

PRECALCULUS GT/HONORS  
Worksheet 2 on Logistical Growth

Work the following on **notebook paper**. Give decimal answers correct to **three** decimal places.

1. The number of a certain species of fish is modeled by the function  $n = 12e^{0.012t}$ , where  $n$  is measured in millions.
  - (a) What is the relative rate of growth of the fish population? Express your answer as a percentage.
  - (b) What will the fish population be after 5 years?
  - (c) After how many years will the number of fish reach 30 million?
  
2. The population of a country has a relative growth rate of 3% per year. The government is trying to reduce the growth rate to 2%. The population in 1995 was approximately 110 million. Find the projected population for the year 2020 for the following conditions.
  - (a) The relative growth rate remains at 3% per year.
  - (b) The relative growth rate is reduced to 2% per year.
  
3. In 1996 the deer population in a Pennsylvania county was 20,000, and in 2000 it was 31,000. Assume the population growth exponentially.
  - (a) Find a function that models the deer population  $t$  years after 1996.
  - (b) What is the projected deer population in 2004?
  - (c) In what year will the deer population reach 100,000?
  
4. A culture starts with 8600 bacteria. After one hour the count is 10,000.
  - (a) Find a function that models the number of bacteria after  $t$  hours.
  - (b) Find the number of bacteria after 2 hours.
  - (c) After how many hours will the number of bacteria double?
  
5. The population of California was 10,586,223 in 1950 and 23,668,562 in 1980. Assume the population grows exponentially.
  - (a) Find a function that models the population  $t$  years after 1950.
  - (b) Find the time required for the population to triple.
  - (c) Use the function from part (a) to predict the population of California in the year 2000.

6. The half-life of cesium-137 is 30 years. Suppose we have a 10-g sample.
- Find a function that models the mass remaining after  $t$  years.
  - How much of the sample will remain after 80 years?
  - After how long will only 2 g of the sample remain?
7. The burial cloth of an Egyptian mummy is estimated to contain 59% of the carbon-14 it contained originally. How long ago was the mummy buried? (The half-life of carbon-14 is 5730 years.)
8. Newton's Law of Cooling is used in homicide investigations to determine the time of death. The normal body temperature is  $98.6^\circ\text{F}$ . Immediately following death, the body begins to cool. It has been determined experimentally that the constant in Newton's Law of Cooling is approximately  $k = 0.1947$ , assuming time is measured in hours. Suppose that the temperature of the surroundings is  $60^\circ\text{F}$ .
- Find a function that models the temperature  $t$  hours after death.
  - If the temperature of the body is now  $72^\circ\text{F}$ , how long ago was the time of death?
9. A kettle full of water is brought to a boil in a room with temperature  $20^\circ\text{C}$ . After 15 minutes the temperature of the water has decreased from  $100^\circ\text{C}$  to  $75^\circ\text{C}$ . Find the temperature after another 10 minutes.
10. A car engine runs at a temperature of  $190^\circ\text{F}$ . When the engine is turned off, it cools according to Newton's Law of Cooling with constant  $k = 0.0341$ , where the time is measured in minutes. Find the time needed for the engine to cool to  $90^\circ\text{F}$  if the surrounding temperature is  $60^\circ\text{F}$ .