NAME _____ DATE _____ PERIOD _____

Skills Practice

Using Exponential and Logarithmic Functions

1. **FISHING** In an over-fished area, the catch of a certain fish is decreasing exponentially. Use $k = 0.084$ to determine how long it will take for the catch to reach half of its current amount? **about 8.3 yr**

2. **POPULATION** A current census shows that the population of a city is 3.5 million. Using the formula $P = ae^{rt}$, find the expected population of the city in 30 years if the growth rate r of the population is 1.5%, a represents the current population in millions, and t represents the time in years. **about 5.5 million**

3. **POPULATION** The population P in thousands of a city can be modeled by the equation $P = 80e^{0.015t}$, where t is the time in years. In how many years will the population of the city be 120,000? **about 27 yr**

4. **BACTERIA** How many days will it take a culture of bacteria to increase from 2000 to 50,000? Use $k = 0.657$. **about 4.9 days**

5. **NUCLEAR POWER** The element plutonium-239 is highly radioactive. Nuclear reactors can produce and also use this element. The heat that plutonium-239 emits has helped to power equipment on the moon. If the half-life of plutonium-239 is 24,360 years, what is the value of k for this element? **about 0.00002845**

6. **DEPRECIATION** A Global Positioning Satellite (GPS) system uses satellite information to locate ground position. Abu's surveying firm bought a GPS system for \$12,500. The GPS is now worth \$8600. How long ago did Abu buy the GPS system? Use $k = 0.062$.

   about 6.0 yr

7. **LOGISTIC GROWTH** The population of a certain habitat follows the function

$$p(t) = \frac{105{,}000}{1 + 2.7e^{-0.0981t}}.$$

   a. What is the maximum population of this habitat? **105,000**

   b. When does the population reach 100,000? Round to the nearest hundredth.

   $t = 40.66$

NAME _____ DATE _____ PERIOD _____

Practice

Using Exponential and Logarithmic Functions

1. **BACTERIA** How many hours will it take a culture of bacteria to increase from 20 to 2000? Use $k = 0.614$. **about 7.5 hr**

2. **RADIOACTIVE DECAY** A radioactive substance has a half-life of 32 years. Find the constant k in the decay formula for the substance. **about 0.02166**

3. **RADIOACTIVE DECAY** Cobalt, an element used to make alloys, has several isotopes. One of these, cobalt 60, is radioactive and has a half-life of 5.7 years. Cobalt 60 is used to trace the path of nonradioactive substances in a system. What is the value of k for cobalt 60? **about 0.1216**

4. **WHALES** Modern whales appeared 5–10 million years ago. The vertebrae of a whale discovered by paleontologists contain roughly 0.25% as much carbon-14 as they would have contained when the whale was alive. How long ago did the whale die? Use $k = 0.00012$. **about 50,000 yr**

5. **POPULATION** The population of rabbits in an area is modeled by the growth equation $P(t) = 8e^{0.26t}$, where P is in thousands and t is in years. How long will it take for the population to reach 25,000? **about 4.4 yr**

6. **RADIOACTIVE DECAY** A radioactive element decays exponentially. The decay model is given by the formula $A = A_0e^{-0.04463t}$. A is the amount present after t days and A_0 is the amount present initially. Assume you are starting with 50g. How much of the element remains after 10 days? 30 days? **about 32 g; about 13.1 g**

7. **POPULATION** A population is growing continuously at a rate of 3%. If the population is now 5 million, what will it be in 17 years' time? **about 8.3 million**

8. **BACTERIA** A certain bacteria is growing exponentially according to the model $y = 80e^{kt}$. Using $k = 0.071$, find how many hours it will take for the bacteria reach a population of 10,000 cells? **about 68 hr**

9. **LOGISTIC GROWTH** The population of a certain habitat follows the function $P(t) = \frac{16{,}300}{(1 + 17.5e^{-0.065t})}$.

   a. What is the maximum population? **16,300**

   b. When does the population reach 16,200? **$t = 122.3$**