Algebra 2 7.8

Use logarithms to solve problems involving exponential growth and decay

Use logarithms to solve problems of logistic growth

Calculate half-life

half-life

carbon dating

logistic growth

KeyConcept Exponential Growth and Decay

Exponential Growth	Exponential Decay
Exponential growth can be modeled by the function $f(x) = ae^{kt}$, where a is the initial value, t is time in years, and k is a constant representing the rate of continuous growth.	Exponential decay can be modeled by the function $f(x) = ae^{-kt}$, where a is the initial value, t is time in years, and k is a constant representing the rate of continuous decay.

Mistake(s) from yesterday

GuidedPractice

2. Use the information in Example 2 to answer the following questions.

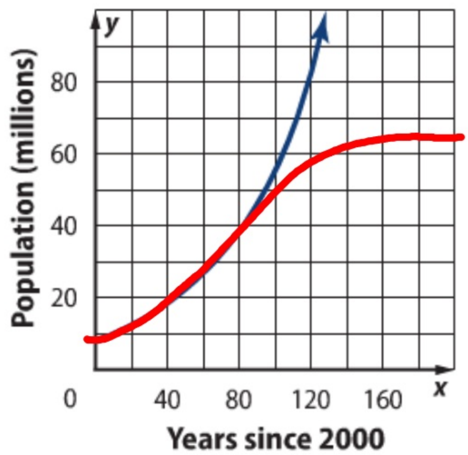
A. A specimen that originally contained 42 milligrams of Carbon-14 now contains 8 milligrams. How old is the fossil?

B. A wooly mammoth specimen was thought to be about 12,000 years old. How much Carbon-14 should be in the animal?

Logistic Growth Refer to the equation representing Georgia's population in Example 3. According to the aph at the right, Georgia's population will be about ie billion by the year 2130. Does this seem logical?

pulations cannot grow infinitely large. There are nitations, such as food supplies, war, living space, seases, available resources, and so on.

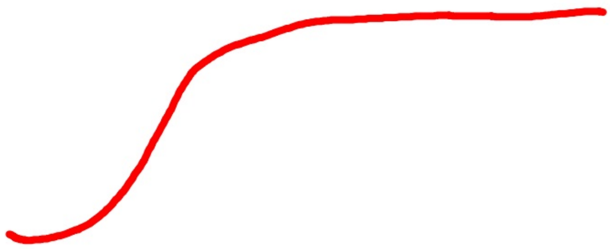
ponential growth is unrestricted, meaning it ill increase without bound. A **logistic growth odel**, however, represents growth that has a limiting ctor. Logistic models are the most accurate models r representing population growth.



limiting factor...

KeyConcept Logistic Growth Function

Let a, b, and c be positive constants where $b < 1$. The logistic growth function is represented by $f(t) = \frac{c}{1 + ae^{-bt}}$, where t represents time.



Will give you this equation if needed

Graphing calculator (be careful with parentheses)

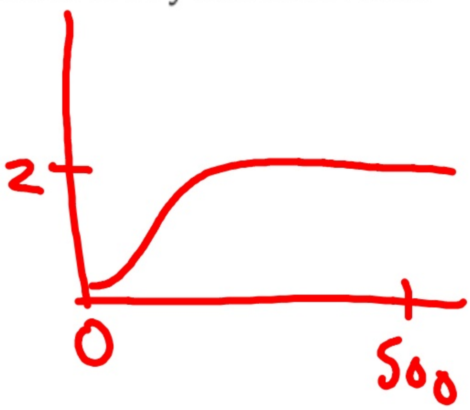
Real-World Example 4 Logistic Growth

The population of Phoenix, Arizona, in millions can be modeled by the logistic function $f(t) = \frac{2.0666}{1 + 1.66e^{-0.048t}}$, where t is the number of years after 1980.

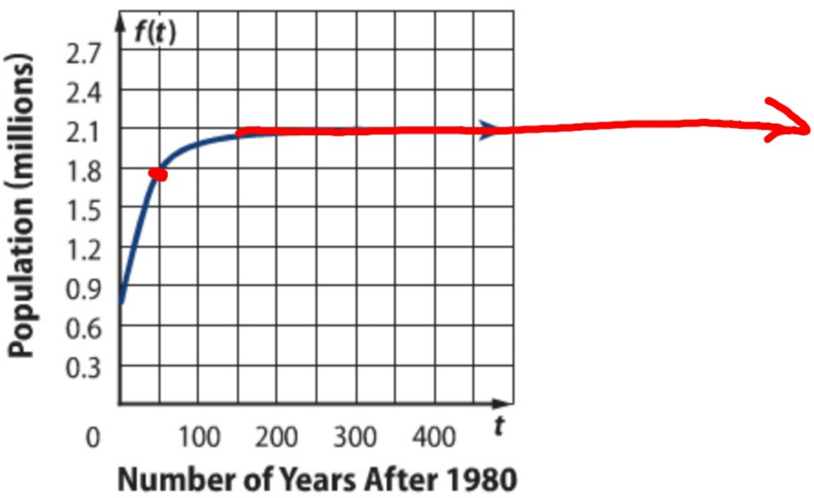
a. Graph the function for $0 \leq t \leq 500$.

b. What is the horizontal asymptote?

2.066



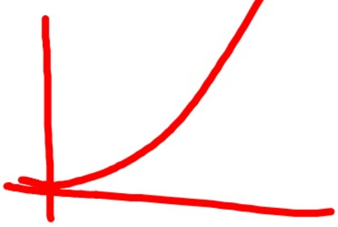
better graph next page


f(t)
2.7
2.4
2.1
1.8
1.5
1.2
0.9
0.6
0.3
Population (millions)
0
100
200
300
400
t
Number of Years After 1980

c. Will the population of Phoenix increase indefinitely? If not, what will be their maximum population?

1980
+ 59
2039

d. According to the function, when will the population of Phoenix reach 1.8 million people?



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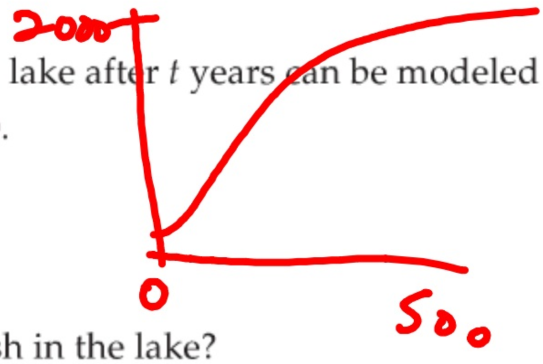
4. The population of a certain species of fish in a lake after t years can be modeled by the function $P(t) = \frac{1880}{1 + 1.42e^{-0.037t}}$, where $t \geq 0$.



A. Graph the function for $0 \leq t \leq 500$.

B. What is the horizontal asymptote?

C. What is the maximum population of the fish in the lake?

D. When will the population reach 1875?

170 yrs

b. **If prior research points to the animal being around 20,000 years old, how much Carbon-14 should be in the animal?**

StudyTip

Carbon Dating When given a percent or fraction of decay, use an original amount of 1 for *a*.