9-6 Study Guide and Intervention

Exponential Growth and Decay

Exponential Decay Depreciation of value and radioactive decay are examples of **exponential decay**. When a quantity decreases by a fixed percent each time period, the amount of the quantity after t time periods is given by $y = a(1 - r)^t$, where a is the initial amount and r is the percent decrease expressed as a decimal.

Another exponential decay model often used by scientists is $y = ae^{-kt}$, where k is a constant.

Example **CONSUMER PRICES As technology advances, the price of many technological devices such as scientific calculators and camcorders goes down. One brand of hand-held organizer sells for $89.**

a. If its price decreases by 6% per year, how much will it cost after 5 years?

Use the exponential decay model with initial amount $89, percent decrease 0.06, and time 5 years.

$y = a(1 - r)^t$	Exponential decay formula
$y = 89(1 - 0.06)^5$	$a = 89, r = 0.06, t = 5$
$y = \$65.32$	

After 5 years the price will be $65.32.

b. After how many years will its price be $50?

To find when the price will be $50, again use the exponential decay formula and solve for t.

$y = a(1 - r)^t$	Exponential decay formula
$50 = 89(1 - 0.06)^t$	$y = 50, a = 89, r = 0.06$
$\dfrac{50}{89} = (0.94)^t$	Divide each side by 89.
$\log\left(\dfrac{50}{89}\right) = \log(0.94)^t$	Property of Equality for Logarithms
$\log\left(\dfrac{50}{89}\right) = t \log 0.94$	Power Property
$t = \dfrac{\log\left(\dfrac{50}{89}\right)}{\log 0.94}$	Divide each side by log 0.94.
$t \approx 9.3$	

The price will be $50 after about 9.3 years.

Exercises

1. **BUSINESS** A furniture store is closing out its business. Each week the owner lowers prices by 25%. After how many weeks will the sale price of a $500 item drop below $100?

CARBON DATING Use the formula $y = ae^{-0.00012t}$, where a is the initial amount of Carbon-14, t is the number of years ago the animal lived, and y is the remaining amount after t years.

2. How old is a fossil remain that has lost 95% of its Carbon-14?

3. How old is a skeleton that has 95% of its Carbon-14 remaining?