Exponential Growth & Decay
And Other Applications

Topics

1) **Model exponential growth and decay.**
2) **Understand half-life and doubling-time.**
3) **Use logistic growth models.**
4) **Other applications.**

1) Model exponential growth and decay.

The basic exponential growth/decay function:

$A = A_0 e^{kt}$ if $k < 0$ the “thing” is decaying

if $k > 0$ the “thing” is growing

To “create” the function from data…

1) Make a chart with your data.
2) Decide on the starting time and amount.
3) “Insert” A_0.
4) Use a data pair for A and t to plug in and find k.
5) “Insert” k and you now have the correct function.
6) Use the function to answer any questions.

An endangered species of fish has a population that is decreasing exponentially ($A = A_0e^{kt}$). The population 9 years ago was 1900. Today, only 700 of the fish are alive. Once the population drops below 100, the situation will be irreversible. When will this happen, according to the model? (Round to the nearest whole year.)

Exponential Growth & Decay
And Other Applications

2) Understand half-life and doubling-time.

Half-Life

The half-life of medina-molecules is 500 years. If 100 grams are present now, how many grams will there be in 500 years? In 1000 years? In 1500 years?

The half–life of silicon–32 is 710 years. If 70 grams is present now, how much will be present in 400 years? (Round your answer to three decimal places.)

A fossilized leaf contains 6% of its normal amount of carbon 14. How old is the fossil (to the nearest year)? Use 5600 years as the half–life of carbon 14.

A handy formula:

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And Other Applications

Doubling-Time

Renee has found that the amount of laundry to be washed doubles every day. If there is one load on Monday, how many loads are there on Tuesday? On Wednesday? On Friday?

Another handy formula:

3) Use logistic growth models.

The logistic growth function $f(t) = \dfrac{70{,}000}{1 + 1399.0e^{-1.6t}}$ models the number of people who have become ill with a particular infection t weeks after its initial outbreak in a particular community. How many people became ill with this infection when the epidemic began?

4) Other applications.

Newton's Law of Cooling

Present Value

Doubling time for an investment