

Section 4.5 Exponential and Logarithmic Models

Objective: In this lesson you learned how to use exponential growth models, exponential decay models, Gaussian models, logistic models, and logarithmic models to solve real-life problems and how to fit exponential and logarithmic models to sets of data.

Course Number

Instructor

Date

Important Vocabulary

Define each term or concept.

Bell-shaped curve

Logistic curve

Sigmoidal curve

I. Introduction (Page 340)

The **exponential growth model** is _____.

The **exponential decay model** is _____.

The **Gaussian model** is _____.

The **logistic growth model** is _____.

Logarithmic models are _____ and

_____.

What you should learn

How to recognize the five most common types of models involving exponential and logarithmic functions

II. Exponential Growth and Decay (Pages 341–343)

Example 1: Suppose a population is growing according to the model $P = 800e^{0.05t}$, where t is given in years.

- What is the initial size of the population?
- How long will it take this population to double?

What you should learn

How to use exponential growth and decay functions to model and solve real-life problems

To estimate the age of dead organic matter, scientists use the carbon dating model _____, which denotes the ratio R of carbon 14 to carbon 12 present at any time t (in years).

Example 2: The ratio of carbon 14 to carbon 12 in a fossil is $R = 10^{-16}$. Find the age of the fossil.

III. Gaussian Models (Page 344)

The Gaussian model is commonly used in probability and statistics to represent populations that are _____

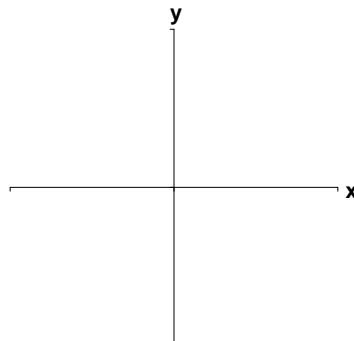
_____.

On a bell-shaped curve, the average value for a population is the _____ of the curve.

Example 3: Draw the basic form of the graph of a Gaussian model.

What you should learn

How to use Gaussian functions to model and solve real-life problems

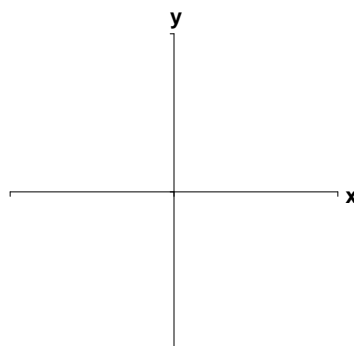
**IV. Logistic Growth Models** (Page 345)

Give an example of a real-life situation that is modeled by a logistic growth model.

Example 4: Draw the basic form of the graph of a logistic growth model.

What you should learn

How to use logistic growth functions to model and solve real-life problems

**V. Logarithmic Models** (Page 346)

Example 5: The number of kitchen widgets y (in millions) demanded each year is given by the model $y = 2 + 3 \ln(x + 1)$, where $x = 0$ represents the year 2000 and $x \geq 0$. Find the year in which the number of kitchen widgets demanded will be 8.6 million.

What you should learn

How to use logarithmic functions to model and solve real-life problems

VI. Fitting Models to Data (Pages 346–347)

Describe how to use a graphing utility to fit a logarithmic or an exponential model to data.

What you should learn

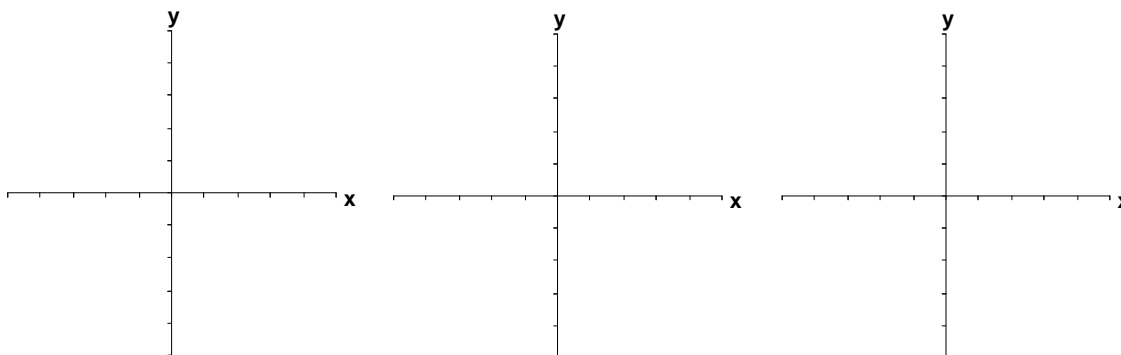
How to fit exponential and logarithmic models to sets of data

An exponential model of the form $y = ab^x$ can be changed to an equivalent exponential model of the form $y = ae^{cx}$ by letting $c = \underline{\hspace{2cm}}$ in the second model.

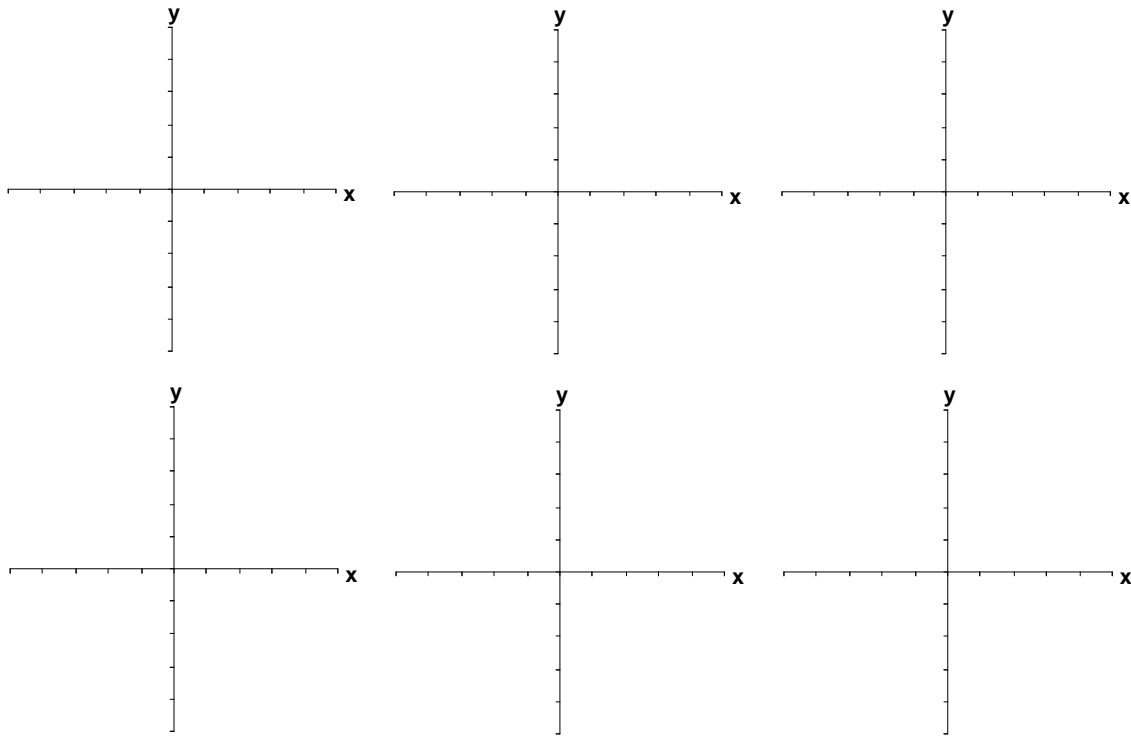
Example 6: Rewrite the exponential function $f(x) = 0.2(4)^x$ as a natural logarithmic function.

Example 7: Find an appropriate model, either logarithmic or exponential, for the data in the following table.

x	1	3	5	7	9
y	1.120	2.195	4.303	8.433	16.529



Additional notes



Homework Assignment

Page(s)

Exercises