Fitting to a Normal Distribution

8.7

Who uses this?

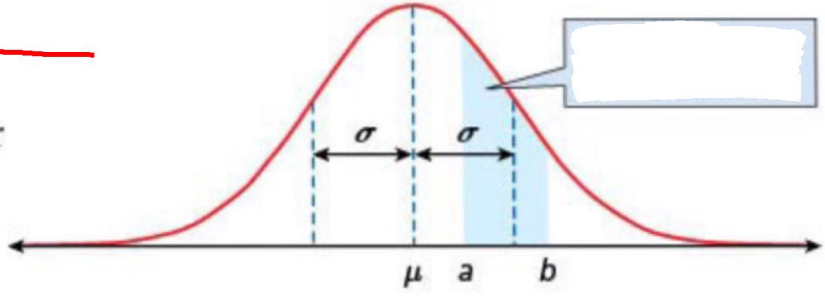
Biologists can use standard normal values to study animal populations. (See Example 3.)

Lesson Objective(s):

- Use tables to estimate areas under normal curves.
- Recognize data sets that are not normal.

Normal curves are used in a wide variety of situations to estimate probabilities. Remember that the maximum value of the curve occurs at the mean, and that the curve is symmetric about a vertical line through the mean. If a random variable x has a mean of μ, and standard deviation of σ, then nearly all of the area under the curve (99.7%) is within three standard deviations from the mean

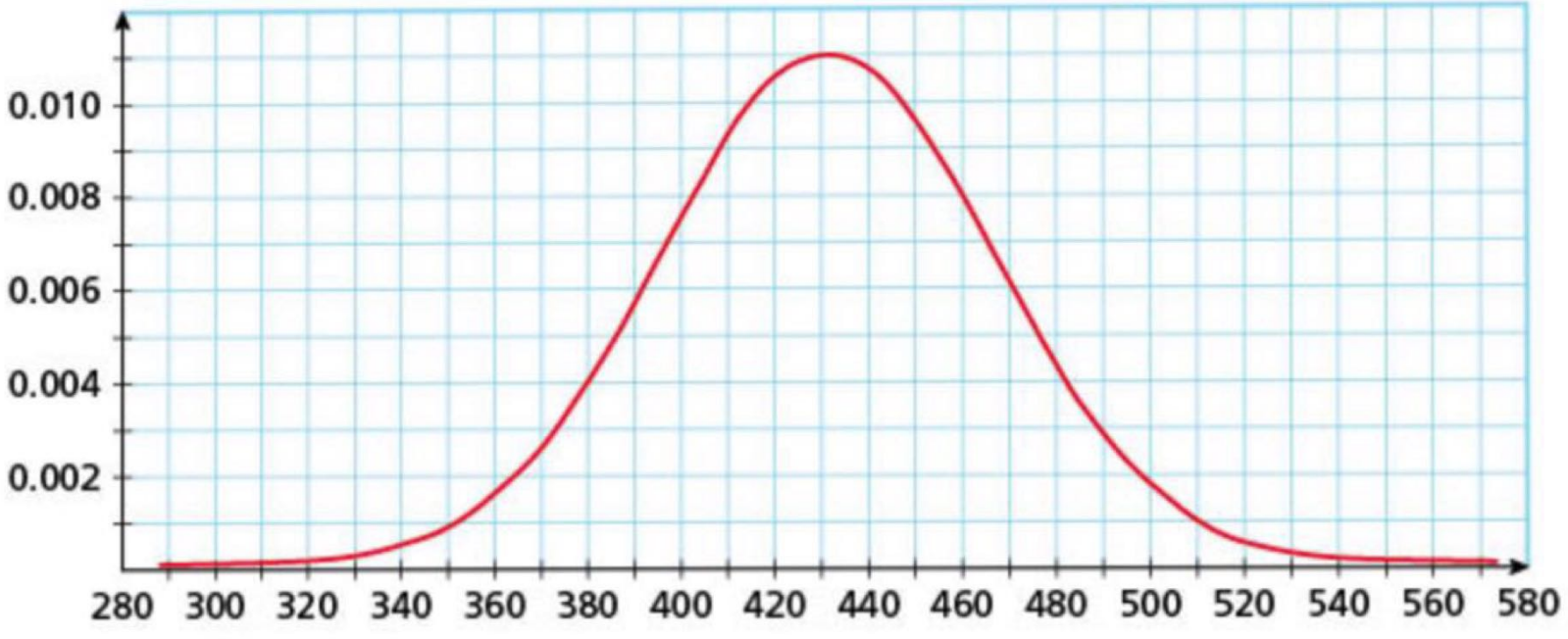
The total area under a normal curve is always 1. The area under the curve between two x-values corresponds to the probability that x is between those values.



EXAMPLE 1

Finding Joint and Marginal Relative Frequencies

Jamie can drive her car an average of 432 gallons per tank of gas, with a standard deviation of 36 miles. Use the graph to estimate the probability that Jamie will be able to drive more than 450 miles on her next tank of gas.



All normal curves have the same basic shape. If μ is changed, the curve shifts left or right. If σ is changed, the curve is stretched vertically and compressed vertically, or vice versa. The _____ has a mean of $\mu = 0$ and standard deviation of $\sigma = 1$, and is found by adjusting the variable in question, x, to match the standard normal curve.

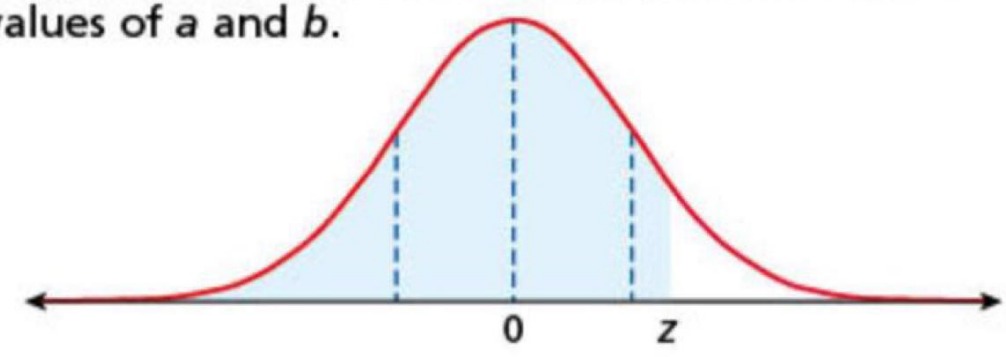
Standard Normal Values

If a random variable x is normally distributed with mean μ and standard deviation σ, then the standard normal value of x is given by the following formula:

_____

The area under the normal curve between $x = a$ and $x = b$ is equal to the area between the standard normal values of a and b.

The table shows the approximate area under the standard normal curve for all values less than z for selected values of z.



z											
Area											

EXAMPLE 2

Using Standard Normal Values

Scores on a test are normally distributed with a mean of 75 and a standard deviation of 8.

A Estimate the probability that a randomly selected student scored less than 87.

B Estimate the probability that a randomly selected student scored between 71 and 75.

There are many data sets in a variety of situations that can be modeled by using a normal curve. However, not all data is normally distributed. Sometimes the "tail" is longer on one side than the other, resulting in a skewed distribution.

You can compare the data to the areas under the curve to determine whether the normal curve is a good fit for a data set. For example, about half of the values should be less than the mean.

EXAMPLE 3

Determining Whether Data May Be Normally Distributed

A biologist is measuring the lengths of frogs in a certain location. The lengths of 20 frogs randomly chosen from the sample are shown. If the mean is 7.4 cm and the standard deviation is 0.8 cm, does the data appear to be normally distributed? Explain.

Length (cm)				
7.6	5.8	7.9	7.6	8.1
7.9	7.1	5.9	8.4	7.3
7.1	6.4	8.3	8.4	6.7
8.2	7.8	5.9	6.8	8.1

z	Area below z	x	Values below x	
			Projected	Actual