Using the probability density to determine the probability of some interval would be complicated. Fortunately, there is an easier way. A special normal distribution, called the **standard normal**, can be used to determine probabilities for any normal random variable. The standard normal distribution will be discussed in Section 8.3.

8.2 Exercises

Basic Concepts

1. How was the normal distribution developed?

2. Are the normal and uniform distributions probability models?

3. List the properties of the normal distribution.

4. What is the shape of the normal distribution?

5. What are the parameters of the normal distribution?

6. If the variance of a normal distribution is constant, what effect will changes in the mean have on the distribution?

7. If the mean of a normal distribution is constant, what effect will changes in the standard deviation have on the distribution?

Exercises

8. Sketch a normal curve and mark each of the following on the x-axis.

a. μ

b. $\mu + \sigma$

c. $\mu - \sigma$

9. Sketch a normal curve and use labels to illustrate the empirical rule.

10. Sketch three normal curves on a single axis that have the same standard deviation but different means.

11. Sketch three normal curves on a single axis that have the same mean, but different standard deviations.

12. Using the Human Development Trends data set and technology, create a histogram for the following variables in the data set using 10 classes (or bins in Excel). Does the distribution of each variable appear to be normally distributed? Why or why not?

a. Human Development Index (HDI)

b. Life expectancy

Data

stat.hawkeslearning.com
Discovering Statistics and Data, Fourth Edition > Data Sets > Human Development Trends

Technology

For instructions on how to create a histogram, visit stat.hawkeslearning.com and navigate to **Discovering Statistics and Data, Fourth Edition > Technology Instructions > Graphs > Histogram**.

13. Using the following data on the length in feet of 40 great white sharks, create a stem-and-leaf plot of the data using a two-digit stem. Do the data appear to be normally distributed?

11.9	16.6	14.0	10.8	17.7	13.7	16.1	17.3
15.8	18.7	13.1	14.9	17.0	13.3	15.5	19.7
12.9	16.2	17.3	18.4	14.8	14.8	10.7	14.0
19.4	14.8	14.9	13.4	19.7	15.1	14.0	12.2
16.4	11.5	15.6	19.5	19.0	16.1	17.9	15.4

8.3 The Standard Normal Distribution

Given that the normal distribution is a function of two continuous parameters, μ and σ, there are an infinite number of combinations for μ and σ, and thus an infinite number of normal distributions. The **standard normal distribution** in Figure 8.3.1 is a special version of the normal distribution. This distribution provides a basis for computing probabilities for all normal distributions.

Standard Normal Distribution

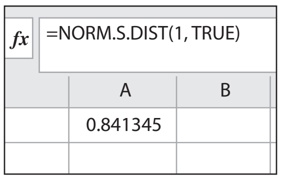
The **standard normal distribution** is a normal distribution with a mean of zero and a standard deviation of one.

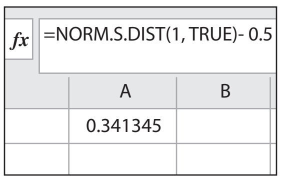
$$\mu = 0 \quad \text{and} \quad \sigma = 1$$

DEFINITION

Technology

A normal probability can also be easily found using technology. For full instructions on computing normal probabilities using technology, visit stat.hawkeslearning.com and navigate to **Discovering Statistics and Data, Fourth Edition > Technology Instructions > Normal Distribution > Normal Probability (cdf)**.





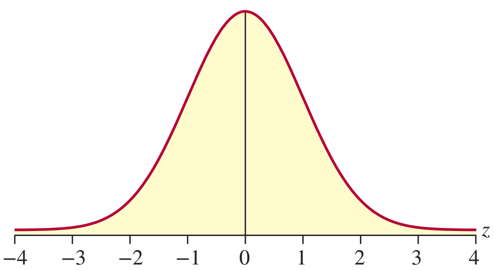


Figure 8.3.1

The technique used to translate any normal random variable into a standard normal random variable is called a ***z*-transformation** (or "standardizing" the random variable) and was discussed earlier in Chapter 4. Because the *z*-transformation gives the standard normal unique status among normals, the standard normal is also referred to as the ***z*-distribution**.

Tables A, B, and C in Appendix A contain probability calculations for various areas under the standard normal curve. Specifically, Tables A and B provide the probability that a standard normal random variable will be less than a specified value. Table C provides the probability that a standard normal random variable will be between 0 and a specified value. For example, to compute the probability that a standard normal random variable will be less than 1 (see Figure 8.3.2), look up the value 1.00 in Table B. The table value of 0.8413 is the area under the curve between negative infinity and 1, which is also the probability that the random variable will assume a value in that interval.