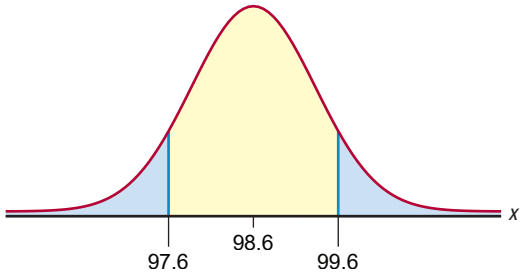


Now, using either tables or available technology find the value of the shaded area.

Tables: Convert both temperatures to standard scores and then use the cumulative probability tables.

For 97.6 °F: $z_1 = \dfrac{x-\mu}{\sigma}$

$= \dfrac{97.6-98.60}{0.73}$

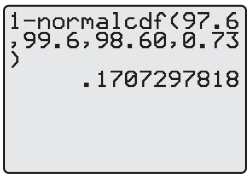
≈ -1.37

For 99.6 °F: $z_2 = \dfrac{x-\mu}{\sigma}$

$= \dfrac{99.6-98.60}{0.73}$

≈ 1.37

Notice that these z-scores are equal distances from the mean. Because of the symmetry of the curve, the shaded areas must then be equal. The easiest way to calculate the total area is to find the area to the left of $z_1 \approx -1.37$ and simply double it. We then have $(0.0853)(2) = 0.1706$.



TI-83/84 Plus: The area in the tails can be found in one step on the calculator by subtracting the area between the two z-values from one. Therefore, the probability can be found by entering `1-normalcdf(lower bound, upper bound, μ,σ)`. For our question, these values are

lower bound: 97.6
upper bound: 99.6
$\mu = 98.6$
$\sigma = 0.73$

As shown in the margin screenshot, the calculator gives the more accurate value of 0.1707.

The probability would be reported as 0.1706 if using the the tables or 0.1707 if using the calculator. Thus, the probability of a healthy adult having a body temperature that differs from the population mean by more than 1°F is approximately 17%.

6.3 Section Exercises

Probability for Normal Distributions

Complete the exercises for the given scenario. Round your answer to two decimal places for a percentage and four decimal places for a probability.

1. Recently, birth weights of Norwegians were reported to be normally distributed with a mean of 3668 grams (g) and a standard deviation of 511 g. Suppose that a Norwegian baby was chosen at random.

a. Find the probability that the baby's birth weight was less than 4000 g.

b. Find the probability that the baby's birth weight was greater than 3750 g.

c. Find the probability that the baby's birth weight was between 3000 g and 4000 g.

d. Find the probability that the baby's birth weight was less than 2650 g or greater than 4650 g.

2. Systolic blood pressure is normally distributed with a mean of 113.8 and a standard deviation of 10.8. Suppose a person was chosen at random.

a. Find the probability that a randomly selected person will have a systolic blood pressure of less than 124.

b. Find the probability that a randomly selected person will have a systolic blood pressure of more than 126.5.

c. Find the probability that a randomly selected person will have a systolic blood pressure between 93 and 130.

d. Find the probability that a randomly selected person will have a systolic blood pressure of less than 95 or greater than 120.

3. Data collected on the total number of minutes people spent in the local emergency room revealed that patients spent on average 166.9 minutes in the ER, with a standard deviation of 55.4 minutes. Assume that the times collected follow a normal distribution.

a. What percentage of the ER patient population spent less than 3 hours there?

b. What percentage of the ER patient population spent more than 2 hours there?

c. What percentage of the ER patient population spent between 2.5 hours and 3.5 hours there?

d. What percentage of the ER patient population spent either less than 2.5 hours or more than 3.5 hours there?

4. Deer hunters score the antlers of their quarry in order to compare the most spectacular specimens. White-tailed bucks are given a score based on lengths and circumferences of their antlers. These scores are normally distributed with a mean of 133 and a standard deviation of 18.

a. What is the probability that a random white-tailed buck in a herd has an antler score of more than 150?

b. What is the probability that a random white-tailed buck in a herd has an antler score of less than 160?

c. What is the probability that a random white-tailed buck in a herd has an antler score of between 130 and 140?

d. What is the probability that a random white-tailed buck in a herd has an antler score of less than 100 or greater than 170?

5. Suppose that the mean calorie intake is 2050 calories per day, with a standard deviation of 175 calories. Assume that calorie intakes follow a normal distribution.

a. Find the probability that a peer in your class consumes more than 1800 calories per day.

b. Find the probability that a randomly selected stranger consumes fewer than 1500 calories per day.

c. Even though the "freshman fifteen" is a common occurrence, for a freshman to put on 15 pounds in one semester they would have to consume between 2100 and 2600 calories per day. Find the probability that a randomly chosen freshman would consume this many calories.

6. The total blood cholesterol levels in a certain Mediterranean population are found to be normally distributed with a mean of 160 milligrams/deciliter (mg/dL) and a standard deviation of 50 mg/dL. Researchers at the National Heart, Lung, and Blood Institute consider this pattern ideal for a minimal risk of heart attacks.

a. Find the percentage of this population who have blood cholesterol levels less than 150 mg/dL.

b. Find the percentage of this population who have blood cholesterol levels which exceed the ideal level by at least 10 mg/dL.

c. Find the percentage of this population who have blood cholesterol levels between 150 and 200 mg/dL.

d. Find the percentage of this population who have blood cholesterol levels less than 100 mg/dL or greater than 220 mg/dL.

7. Suppose that motorists in the southeastern United States use a mean of 8.20 gallons of gasoline per week with a standard deviation of 0.47 gallons. Assume that gasoline consumption levels are approximately normally distributed.

a. What percentage of southeastern drivers use more than 9.0 gallons of gasoline per week?

b. What percentage of southeastern drivers use no more than 7.0 gallons of gasoline per week?

c. What percentage of southeastern drivers use an amount of gasoline that differs from the mean by more than 0.5 gallons per week?

8. Abby is on very strict sugar diet and is trying to account for all of the grams of sugar she intakes in a week. For a snack, she loves to eat raw carrots and knows that a carrot of average length contains approximately 3.5g of sugar. Answer the following questions assuming that the lengths of carrots are normally distributed with a mean of 17.78 cm and a standard deviation of 3.81 cm.

a. Find the probability that a randomly chosen carrot is less than 10 cm long.

b. Find the probability that in a bag of raw carrots, Abby randomly chooses a carrot which is shorter than the average carrot.

c. Find the probability that in a bag of raw carrots, Abby randomly eats a carrot with more than 3.5 grams of sugar.

d. Suppose Abby randomly selects 2 carrots to eat. Find the probability that both will have at most 3.5 grams of sugar. (Hint: See Chapter 4 for probability of 2 events occuring)

9. Assume for the moment that the distribution of weights of adults is approximately normal with a mean of 179.8 lb and a standard deviation of 93.0 lb.

a. Find the probability that a randomly selected adult would have a weight at least two standard deviations above the mean.

b. Find the probability that a randomly selected adult would have a weight at least two standard deviations below the mean.

c. Given your answers in parts **a.** and **b.**, do you think it is reasonable to assume that weights of adults follow this normal distribution? Explain your answer.

10. Suppose that lifetimes for a particular car battery are normally distributed with a mean of 148 weeks and a standard deviation of 8 weeks.

a. If the company guarantees its battery for 3 years, what percentage of the batteries sold would you expect to be returned before the end of the warranty period? Assume that there are 52 weeks in a year.

b. Imagine you were the CEO of the battery company. Evaluate the warranty offer and list any changes you would make as the CEO.

11. Ella refuses to tell you her weight in her ninth month of pregnancy. However, she does tell you that her weight is above the mean. Which of the following z-scores is possible for her weight?

a. –0.08

b. 1.43

c. 0

d. Not enough information

12. The mean distance a new sales representative travels per week in the first year is 300 miles. At Olivia's job interview, she found out that she would travel at most the mean distance per week for first-year sales reps. Which of the following z-scores are possible for her mean weekly traveling distance during her first year?

a. 0

b. –1.42

c. 0.78

d. Not enough information