MATH GRADE 7 UNIT 6

SAMPLES AND PROBABILITY

ANSWERS FOR EXERCISES

ALWAYS LEARNING

PEARSON

LESSON 2: THEORETICAL PROBABILITY ANSWERS

ANSWERS

1.

Fraction	Decimal	Percent
$\frac{1}{5}$	0.2	20%
$\frac{4}{5}$	0.8	80%
$\frac{3}{25}$	0.12	12%
$\frac{1}{3}$	$0.\overline{3}$	$33.\overline{3}\%$
$\frac{7}{10}$	0.7	70%

2. **C** 143 heads in 150 flips

About half of the flips should result in heads. Although heads probably would not come up exactly half of the time, it is likely. 45 is about half of 100 and 36 is half of 72. Although 6 is more than half of 10, being 1 over the average is possible for so few flips. 143 out of 150 is about $\frac{14}{15}$, which is not close to $\frac{1}{2}$; although this result is possible, it is very unlikely.

3. **D** The probability that you will choose a green marble if 170 out of 200 marbles in a bag are green

All of the ratios need to be in the same form before they can be compared. For example, they could all be expressed as percentages:

A 80%

B $\frac{3}{4} = \frac{75}{100} = 75\%$

C $0.78 = \frac{78}{100} = 78\%$

D $\frac{170}{200} = \frac{85}{100} = 85\%$

LESSON 2: THEORETICAL PROBABILITY ANSWERS

4. The first and last statements are false.
   - When rolling a number cube each set of numbers is one outcome and each number is equally likely to be rolled. So, 2, 3, 1, 6 is just as likely as 6, 6, 6, 6.
   - Even though it is unlikely it is possible to get 20 heads in a row.
   - The probability of rolling a 2 on a six-sided number cube is $\frac{1}{6} = 0.1\overline{6}$.

5. You should pick from Bag B.

   The probability of drawing a red jellybean from Bag A is $\frac{100}{300} = \frac{1}{3} \approx 0.33$.

   The probability for Bag B is $\frac{10}{22} = \frac{5}{11} \approx 0.45$.

Challenge Problem

6. You could expect about 5 to 6 students to have pizza for dinner.

   $\frac{80}{15} = \frac{16}{3} = 5\frac{1}{3}$

LESSON 3: EXPECTED RESULTS ANSWERS

ANSWERS

1. (D) 80 times

   The problem can be approached two ways. First, if 1 or 6 is not rolled, then 2, 3, 4, or 5 is. There are four favorable outcomes out of six total outcomes: $\frac{4}{6} = \frac{2}{3}$.

   Comparing this to 120 you get:

   $\frac{2}{3} = \frac{x}{120}$

   $x = 80$

   Alternately, the probability of something happening and not happening must add up to 1 because these possibilities cover all outcomes. The events are complementary events. So, the probability of rolling 1 or 6 can be subtracted from 1 to give the probability of *not* rolling 1 or 6. The probability of 1 or 6 is $\frac{2}{6}$, or $\frac{1}{3}$, and $1-\frac{1}{3} = \frac{2}{3}$. When compared to 120, you once again get 80.

2. (B) 75 times

   There is a $\frac{1}{6}$ probability of rolling a 2 (1 favorable outcome out of 6 total outcomes). Using a proportion, you get:

   $\frac{1}{6} = \frac{x}{450}$

   $x = 450 \div 6 = 75$

3. The probability of drawing a 7 is $\frac{1}{13}$. You would expect to draw 32 or 33 7s during 425 draws.

   There are four favorable outcomes (a 7 of each of the four suits) out of 52 total outcomes: $\frac{4}{52} = \frac{1}{13}$. This ratio must be equal to the ratio of 7s drawn in 425 turns:

   $\frac{1}{13} = \frac{x}{425}$

   $x = 425 \div 13 \approx 32.7$

   So, there should be 32 or 33 7s.

LESSON 3: EXPECTED RESULTS ANSWERS

4. You are likely to win more by about 5 spins.

   There are five multiples of 4: 4, 8, 12, 16, and 20. So, you have 5 ways to win:

   $$\frac{5}{20} = \frac{1}{4} = \frac{x}{100}$$

   $x = 25$

   There are four multiples of 5: 5, 10, 15, 20. So, your friend has 4 ways to win:

   $$\frac{4}{20} = \frac{1}{5} = \frac{x}{100}$$

   $x = 20$

5. Answers will vary. Possible answer:

   The favorable outcomes could be numbers less than 4.

   There are 10 total outcomes, so there will be a ratio out of 10. This means the probabilities can all be expressed in tenths. For the three experiments the probability is as follows.

   $$\frac{3}{10} = 0.3 \qquad \frac{37}{100} = 0.37 \qquad \frac{206}{500} = 0.412$$

   These equations show that with each roll the probability is getting closer to 0.4, or 4 out of 10. The numbers less than 4 on the number cube are 3, 2, 1, and 0—4 favorable outcomes out of 10 total outcomes. Any of the four numbers could be the favorable outcomes.

Challenge Problem

6. There are 27 winning tickets and about 11 people are expected to win on Friday.

   3% of 900 tickets = 0.03 • 900 = 27 tickets; so there must be 27 winning tickets.
   If 371 people come to the store on Friday 3% should have winning tickets:
   3% of 371 = 11.13 ≈ 11 people.

LESSON 4: SPINNERS

ANSWERS

ANSWERS

1. C 200 times

   500 • 0.4 = 200

2. B 14 times

   The probability of 0.345 can be multiplied by 40:

   0.345 • 40 = 13.8 ≈ 14

   Notice that solving this equation is the same as solving the following proportion (although multiplying the decimal is much faster):

   $$\frac{345}{1{,}000} = \frac{x}{40}$$

   $$1{,}000x = 345 \cdot 40$$

   $$x = \frac{13{,}800}{1{,}000} = 13.8$$

   $$x \approx 14$$

3. A $\frac{137}{400}$ C 34.25%

   There are 137 favorable outcomes out of 400 total trials: $\frac{137}{400}$. The numbers can be divided to find the decimal equivalent: 137 ÷ 400 = 0.3425, or 34.25%.

4. Red ≈ 41%; Blue = 40%; Green ≈ 9%; Yellow = 10%

   The sections on the spinner are not all the same size.

   First, the number of yellow spins needs to be found:

   80 – (33 + 32 + 7) = 80 – 72 = 8

   Next, the probability for each color can be found using the ratio of the number of spins compared with 80 total spins:

   Red: $\frac{33}{80}$ = 0.4125 ≈ 41%

   Blue: $\frac{32}{80}$ = 0.4 = 40%

   Green: $\frac{7}{80}$ = 0.0875 ≈ 9%

   Yellow: $\frac{8}{80}$ = 0.1 = 10%

LESSON 4: SPINNERS ANSWERS

Notice that the percentages add to 100. It is clear from these percentages that the spinner does not have equally likely outcomes. The red and blue sections are the largest and are probably the same size. The green and yellow sections are the smallest and are also probably the same size. The red and blue sections are about four times larger than the green and yellow sections (10% • 4 = 40%). One large section and one small section make up half of the spinner, because 41% + 9% = 50% and 40% + 10% = 50%.

5. A ≈ 45 times, B ≈ 93 times, C ≈ 113 times

   The probability of A and B is 18% + 37% = 55%; so the probability of C is 100% – 55% = 45%. You can convert each percentage to a decimal and multiply that by the number of trials (250):

   A = 18% = 0.18, 0.18 • 250 = 45

   B = 37% = 0.37, 0.37 • 250 = 92.5

   C = 45% = 0.45, 0.45 • 250 = 112.5

   The three numbers add to 251, but two of them are halfway between numbers. So, one needs to be rounded up and the other needs to be rounded down.

Challenge Problem

6. Red = 29%; Blue = 21%; Green = 25%; Yellow = 25%

   All that is known about the yellow section is that its probability is 25%. The assumption is that 25% of 500 spins land on yellow (this may not be exactly true, but it will be close enough that the probabilities will not be far off, because you expect about 25% yellow). 0.25 • 500 = 125; so yellow is spun 125 times. The sum of known spins is now 125 + 145 + 105 = 375. 500 – 375 = 125; so green is also spun 125 times. Now you have the ratios you need to establish the probability:

   Yellow = 25%

   $$\text{Red} = \frac{145}{500} = \frac{29}{100} = 29\%$$

   $$\text{Blue} = \frac{105}{500} = \frac{21}{100} = 21\%$$

   $$\text{Green} = \frac{125}{500} = \frac{25}{100} = 25\%$$

   The four numbers add up to 100%, which means the answer is reasonable.

LESSON 5: ESTABLISHING PROBABILITY ANSWERS

ANSWERS

1. C 55 out of 100

$$\frac{12}{20} \div \frac{4}{4} = \frac{3}{5}, \frac{3}{5} = \frac{6}{10} = 0.6, \frac{6}{10} = \frac{60}{100} = 60\%, \frac{55}{100} \div \frac{5}{5} = \frac{11}{20}$$

2. C It becomes more accurate and approaches the theoretical probability.

   If there are few trials the experimental probability can vary widely. As you increase the number of trials the experimental probability of a favorable event will approach the same value as the theoretical probability.

3. B Finding the probability that an 18-year-old male driver will be involved in a car accident

   C Finding the probability that a particular basketball player will make a free throw

   Although quite a bit of experimental data exists for insurance companies to determine that a certain percentage of 18-year-old males has car accidents (this is how the companies determine rates), there is no theoretical probability.

   Similarly, a basketball player establishes his or her probability of making free throws as games are played.

   A lottery has a specific number of outcomes; the number of tickets you buy determines your number of favorable outcomes.

   The spinner has 20 equally likely outcomes and 10 favorable outcomes (2, 4, 6, 8, 10, 12, 14, 16, 18, and 20).

4. The largest set of data is the best indicator of the probability.

   The coin is not fair so the 2 outcomes are not equally likely. The experimental probability of 1,000 flips establishes the probability of the coin landing on heads:

$$\frac{627}{1,000} = 0.627 = \frac{62.7}{100} = 62.7\%$$

LESSON 5: ESTABLISHING PROBABILITY ANSWERS

5. Lucy is likely to make about 10 shots.

The experimental probability is 33 out of 60, or $\frac{33}{60}$:

$$\frac{33}{60} = \frac{11}{20} = \frac{55}{100} = 0.55$$

The ratio of $\frac{11}{20}$ could be used to solve a proportion:

$$\frac{11}{20} = \frac{x}{18}$$
$$20x = 18(11)$$
$$x = \frac{198}{20} = 9.9$$

The experimental probability decimal could also be multiplied by 18:

$0.55 \cdot 18 = 9.9$

Challenge Problem

6. Experimental probability for point up: $\frac{37}{50} = \frac{74}{100} = 0.74$

Experimental probability for point down: $\frac{13}{50} = \frac{26}{100} = 0.26$

The experimental probability could then be multiplied by 300 to find the number of results for each outcome in 300 trials:

Point up: $0.74 \cdot 300 = 222$ times

Point down: $0.26 \cdot 300 = 78$ times

Or you could multiply the results from 50 trials by 5 since there are 5 times as many results ($50 \cdot 6 = 300$).

Point up: $37 \cdot 6 = 222$ times

Point down: $13 \cdot 6 = 78$ times

LESSON 6: COMPOUND EVENTS ANSWERS

ANSWERS:

1. C H-red, T-red, H-blue, T-blue, H-green, T-green, H-yellow, T-yellow

   Two outcomes (H and T) can be paired with each of the four colors to make eight total outcomes.

2. C $\frac{1}{4}$

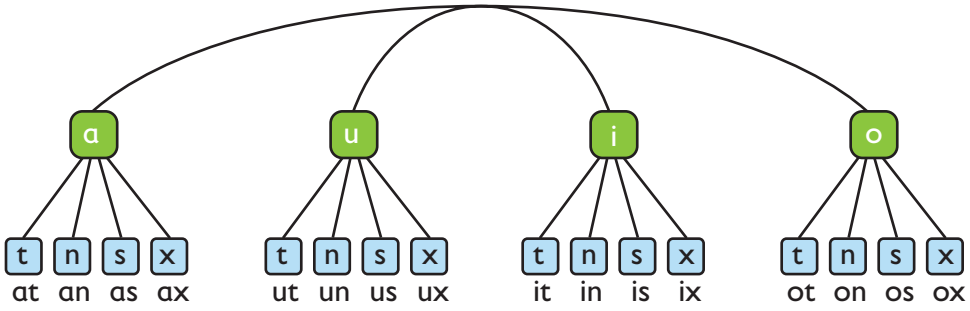
   You can draw a table to show the sample space.

	1	2	3	4	5	6
H	H1	H2	H3	H4	H5	H6
T	T1	T2	T3	T4	T5	T6

   There are 3 favorable outcomes (T2, T4, and T6) out of 12 total outcomes in the table: $\frac{3}{12} = \frac{1}{4}$.

3. $\frac{10}{16}$, or $\frac{5}{8}$, or 0.625, or 62.5%

   This is a good situation for a tree diagram because all of the outcomes need to be seen to know which are English words.



   10 of the outcomes are words: at, an, as, ax, us, it, in, is, on, and ox.

   There are 16 total outcomes: $\frac{10}{16} = \frac{5}{8}$.

LESSON 6: COMPOUND EVENTS ANSWERS

4. **D** 5%

The table shows 20 outcomes and only 1 (AZ) is favorable: $\frac{1}{20} = \frac{5}{100} = 5\%$.

5. Answers will vary. Possible answer:

If the outcome is expected to occur 25 out of 100 times the probability is $\frac{25}{100} = \frac{1}{4}$.

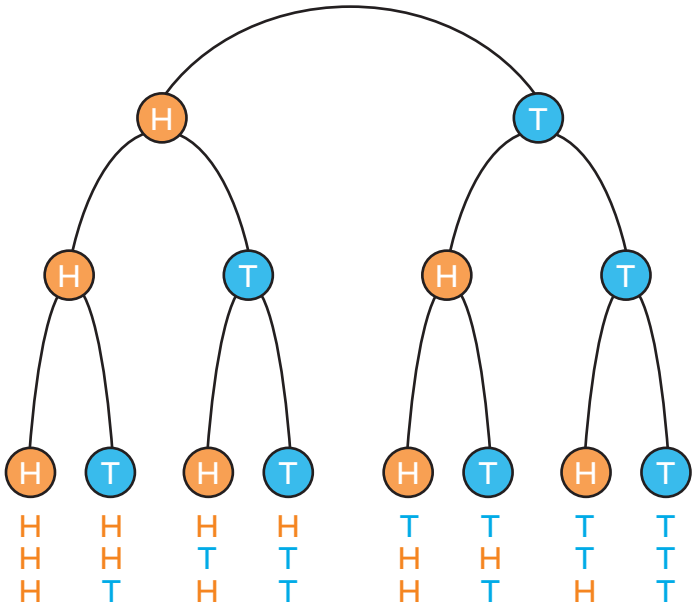
The tree diagram shows 8 outcomes: 1A, 1B, 2A, 2B, 3A, 3B, 4A, and 4B.

Since $\frac{2}{8} = \frac{1}{4}$, 2 out of the 8 outcomes need to be chosen as favorable outcomes. Some examples of favorable outcomes include getting an even number and B, an odd number and A, a low number (1 or 2) and B, a high number and A, etc.

Challenge Problem

6. 75 times

The tree diagram can continue to branch and be used for three events (or more).



There are 8 total outcomes and 6 are favorable: HHT, HTH, HTT, THH, THT, and TTH. In fact, the only outcomes that do not work occur when all three coins are the same (HHH and TTT): $\frac{6}{8} = \frac{3}{4} = \frac{75}{100}$.

LESSON 7: INDEPENDENT COMPOUND EVENTS ANSWERS

ANSWERS

1. **C** 20 sandwiches

   5 types of meat can each be paired with 4 kinds of bread: 5 • 4 = 20.

2. **B** 0.02

   There are 100 possible outcomes because each digit on the first number cube can be paired with each digit on the second number cube: 10 • 10 = 100. A 3 could be rolled first and then a 7, or a 7 could be rolled first and then a 3. In either case the number 37 can be formed. So, there are 2 favorable outcomes (3-7 and 7-3) out of 100 possible outcomes: $\frac{2}{100} = 0.02$.

3. **B** 40 outcomes

   There are 2 outcomes for the first event (heads or tails) and there are 20 outcomes for the spinner that heads and tails can be paired with: 2 • 20 = 40.

4. 100 times

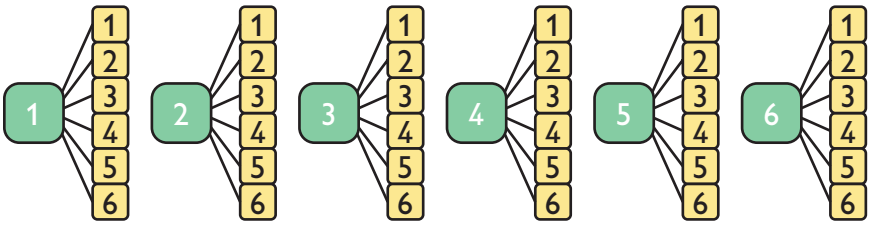
   Although it is possible to see that there are 20 outcomes without listing the sample space, in this case it is useful to create a sample space in order to see the combinations that work. A systematic list can be used to pair each outcome on the first spinner with each outcome on the second spinner. The pairs will show a plus sign and their total, since that is part of the experiment.

1 + 1 = 2	2 + 1 = 3	3 + 1 = 4
1 + 2 = 3	2 + 2 = 4	3 + 2 = 5
1 + 3 = 4	2 + 3 = 5	3 + 3 = 6
1 + 4 = 5	2 + 4 = 6	3 + 4 = 7

   There are 6 favorable outcomes out of 12 possible outcomes: $\frac{6}{12} = \frac{1}{2}$. So, half of the spins should result in a total of 5 or more: 200 ÷ 2 = 100.

LESSON 7: INDEPENDENT COMPOUND EVENTS ANSWERS

5. a. Answers will vary. Possible answer:



b. There are 36 total outcomes for rolling two number cubes. To find how many favorable outcomes there are you can set up a proportion, because the ratio for the probability $\left(\frac{x}{36}\right)$ must be the same as that for the expected results $\left(\frac{5}{180}\right)$:

$$\frac{x}{36} = \frac{5}{180}$$

$x = 1$ (because $180 \div 36 = 5$)

So, there is one favorable outcome and any specific roll would work, such as rolling a 1 and then a 5.

Challenge Problem

6. $\frac{1}{4}$

There are 30 outcomes for each event, or 900 total outcomes: $30 \cdot 30 = 900$.
15 of the outcomes for the first event are blue; these are the only outcomes to consider for favorable outcomes because both marbles need to be blue. Each of the 15 marbles can pair with 15 blue marbles for the second draw: $15 \cdot 15 = 225$.
Therefore, 225 outcomes out of 900 are favorable: $\frac{225}{900} = \frac{1}{4}$.

The ratios could also have been simplified to start: 15 out of 30 marbles are blue, or 1 out of every 2. If the bag is simplified to a red and a blue marble, then there are 4 outcomes with 1 favorable outcome.

RB	RR
BB	BR

LESSON 8: SIMULATIONS ANSWERS

ANSWERS

1. Answers will vary. Possible answer:
You can assume that a boy is equally likely as a girl to be born. You could flip a coin and count the number of flips until 3 heads came up. Record the number of flips and repeat the process. You would probably want to do at least 20 trials.

2. A The experimental probability is $\frac{2}{5}$.

   C Larger sets of trials are needed.

   The experimental probability, based on the given results, is $\frac{2}{5}$.
   The mean of the data set is 8:

   $3 + 5 + 6 + 7 + 7 + 8 + 9 + 10 + 10 + 15 = 80$

   $80 \div 10 = 8$

   However, the data have a wide range, indicating that the conclusion may not be valid. More data are needed. The experimental probability may or may not change, though the range should narrow.

   Since there is a wide range in the trial sets larger sets of trials are needed. If there are more trial sets of the same size the results are likely to still have the same range.

3. The experimental probability is 63%.

   $11 + 9 + 13 + 11 + 14 + 14 + 15 + 17 + 11 + 11 = 126$ total matches

   $10 \cdot 20 = 200$ total trials

   $126 \div 200 = 0.63 = 63\%$

   (The theoretical probability is actually $1 - \frac{11 \cdot 10 \cdot 9 \cdot 8}{12 \cdot 12 \cdot 12 \cdot 12} = 1 - \frac{7{,}920}{20{,}736} \approx 61.81\%$.)

Challenge Problem

4. a. If 40% of the students are girls, 4 out of every 10 students is a girl. So, 4 out of 10 digits would represent a girl (perhaps 0, 1, 2, and 3).

   b. Answers will vary. Possible answer:
   Strings of 10 random digits could be looked at to determine whether 0, 1, 2, or 3 come up a total of 3 or more times. There would need to be a large set of trials—perhaps 100—to establish the experimental probability. For example, 76 of the 100 sets of 10 random numbers contain the digits 0, 1, 2, or 3 three or more times; so, the probability is 76%.

LESSON 9: DEPENDENT COMPOUND EVENTS ANSWERS

ANSWERS

1. a. $\frac{1}{17}$

   b. $\frac{1}{221}$

   c. $\frac{48}{221}$

   d. $\frac{1}{5,525}$

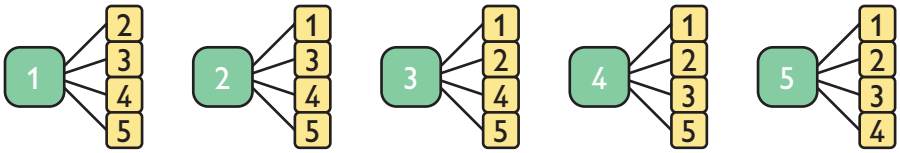
2. **D** $\approx 6.7\%$

   There are 30 total outcomes. Once the first name is drawn out of 6 it can be paired with each of the 5 remaining names. Of those 30 pairs one includes one friend being drawn first and then the other. Another pair is the second friend being drawn first and then the first friend. So, there are 2 favorable outcomes out of 30 total outcomes:

   $\frac{2}{30} = 0.0\overline{6}$, or $\approx 6.7\%$

3. **C** 0.60

   This is a good situation for a tree diagram so that you can see all of the outcomes.

   Looking at the sums you see that 12 out of 20 total outcomes are odd:

   $\frac{12}{20} = \frac{6}{10} = 0.60$

4. a. About 11%

   Each of the 10 tickets can be paired with each of the remaining 9 tickets ($10 \cdot 9 = 90$); so, there are 90 outcomes. Each of Jack's 5 tickets can be paired with Marcus's ticket and Marcus's ticket can be paired with each of Jack's tickets, for a total of 10 favorable outcomes:

   $\frac{10}{90} = \frac{1}{9} \approx 11\%$

LESSON 9: DEPENDENT COMPOUND EVENTS ANSWERS

b. About 0.87

Since either Jack or Marcus can win, at first it seems like you can just add the probabilities of each event. But these events are not mutually exclusive because some of each person's winning pairs involves the other person.

Since there are 10 possible outcomes for the first ticket drawn and 9 possible outcomes for the second ticket, there are 90 total outcomes. In this situation complementary events can be very helpful. You can subtract the probability that neither Jack nor Marcus wins from 1 because the remaining probability reflects wins by either boy.

Jack and Marcus only lose if their tickets are not chosen either time. This means that only the combinations in which the 4 other tickets are chosen are considered. Each of these can be paired with the 3 remaining tickets for a total of 12 combinations:

$\frac{12}{90} \approx 0.13$

So, Jack and Marcus win about 0.87 of the time (1 – 0.13 = 0.87).

This table shows all of the combinations, with A representing Jack's tickets, B representing Marcus' ticket, and C representing the remaining tickets.

	A	A	A	A	A	B	C	C	C	C
A		AA	AA	AA	AA	AB	AC	AC	AC	AC
A	AA		AA	AA	AA	AB	AC	AC	AC	AC
A	AA	AA		AA	AA	AB	AC	AC	AC	AC
A	AA	AA	AA		AA	AB	AC	AC	AC	AC
A	AA	AA	AA	AA		AB	AC	AC	AC	AC
B	BA	BA	BA	BA	BA		BC	BC	BC	BC
C	CA	CA	CA	CA	CA	CB		CC	CC	CC
C	CA	CA	CA	CA	CA	CB	CC		CC	CC
C	CA	CA	CA	CA	CA	CB	CC	CC		CC
C	CA	CA	CA	CA	CA	CB	CC	CC	CC	

5. Maya's probability of drawing a 4 and then another 4 is $\frac{1}{221}$.

There are many events that are less likely than this one—such as drawing three 4s in a row or drawing all four kings in a row.

LESSON 9: DEPENDENT COMPOUND EVENTS ANSWERS

Challenge Problem

6. A You pull out a sock, replace it, and then pull out another sock.

In this situation there are 48 • 48 outcomes because any of the 48 socks can be chosen each time. This makes 2,304 total outcomes. Each of the 24 red socks can be paired with each of the same 24 red socks for 576 outcomes. The number of outcomes for the blues socks would be the same:

576 + 576 = 1,152

$$\frac{1,152}{2,304} = \frac{1}{2} \text{ or } 0.50$$

In the second situation there are 48 • 47 outcomes because the sock is not replaced. This makes 2,256 total outcomes. Each of the 24 red socks can be paired with each of the remaining 23 red socks for 552 outcomes. The number of outcomes for the blue socks would be the same:

552 + 552 = 1,104

$$\frac{1,104}{2,256} \approx 0.49$$

LESSON 12: SAMPLES AND POPULATIONS ANSWERS

ANSWERS

1. C Thirty students are randomly sampled about their eye color.

   A random sample is most likely to give a valid conclusion. A small sample size (as in A and D) or a biased question (as in B) will not give valid results.

2. C Do you prefer a beautiful, sunny day or a depressing, rainy day?

   The question is leading the person being surveyed to a certain conclusion.

3. D The students are not part of the population.

   The sample size is too small and not representative of the population (it is a convenience sample). The question is likely to give biased results because the sampled students are playing outside. The students are part of the population but are not representative.

4. Answers will vary. Possible answer:
   There are too many students in the school to survey everyone, so a sample is needed. If each class has about 30 students, Lucy could choose 5 randomly from each class list (possibly using a random number generator). In this way each grade would be represented proportionally, even if the grades were not the same size. Students need to be asked an unbiased question—perhaps being shown a list of food available at the cafeteria in alphabetical order to choose from.

5. Answers will vary. Possible answer:
   More than half of the people entering the library between 2:00 and 3:00 p.m. are between the ages of 10 and 30 (15 out of 25 people), and most of them are between 10 and 20 (10 out of 15). This result gives a pretty clear conclusion about the ages of people entering the library *during that hour.* However, the data could not be used to represent any hour of the day. This sample of people is not necessarily representative of the population.

Challenge Problem

6. Answers will vary. Possible answer:
   The company could conduct a biased survey with a biased question that leads people to the desired conclusion ("Do you think our soap is better than that of leading competitors because of its superior scent?"). The survey could be conducted in stores where the company knows its product sells well.

LESSON 14: ANALYZING SAMPLE DATA ANSWERS

ANSWERS

1. C 100 students

   Although surveying the whole population would result in the most accurate conclusions about the population, such a survey defeats the purpose of a sample, which is to look at a smaller part of the population. A sample size of 30 is too small and 60 is probably too small, but 100 should be about the right size.

2. C 175 students

   Two ratios must be equal to each other: 35 out of 50 students play soccer and some number of students (x) out of 250 students play soccer.

   $$\frac{35}{50} = \frac{x}{250}$$
   $$x = 175$$

3. B 7

   The sum of the data values is 56 (3 + 5 + 6 + 7 + 8 + 8 + 9 + 10 = 56), and there are eight data values: 56 ÷ 8 = 7.

4. C 7.5

   The median is the middle value. There are eight data values, with four in each half. So, the median is halfway between the two middle values:

   3, 5, 6, 7 **7.5** 8, 8, 9, 10

   Half of the values are greater than 7.5 and half are less than 7.5.

5. Answers will vary. Possible answer:
   The sample is not random because all of the data is from the same class. However, if there were five seventh grade classes in the school then one out of every five students was measured, which is a fairly large sample. Also, the mean, median, and mode are all the same, with a fairly narrow range. All of those measures indicate that the data are tightly clustered and most likely indicate the typical height. Because the data are so conclusive it is likely that this height will be the typical height in the school.

6. Answers will vary. Possible answer:

   The sample is probably not large enough to draw valid conclusions. There are gaps in the data and the data are not really clustered. The sample does show that the full range of scores is represented.

LESSON 14: ANALYZING SAMPLE DATA ANSWERS

Challenge Problem

7. Answers will vary. Possible answer:
The sample is random and representative and the data are tightly clustered (particularly the middle 50%); so, the sample is probably a pretty good indicator of how students did overall.

   Half of the students scored between 13 and 16, with a median of 14; so 14 is probably the typical score. You could say that 75% of the students scored 13 or higher and 25% of the students scored 16 or higher.

   If another student took the test there would be a 50% chance that he or she would score from 13 to 16.

LESSON 15: SAMPLE SIZE

ANSWERS

ANSWERS

1. B 225 students

   30% of 750 is 225: 0.3 • 750 students = 225 students

2. B 27

   The sum of the samples is 162 (26 + 25 + 25 + 30 + 27 + 29 = 162) and there are six data values: 162 ÷ 6 = 27.

3. B 185 marbles

   $\frac{37}{100} = \frac{x}{500}$

   $x = 185$ (37 • 5 = 185)

4. The sample is said to be representative so the assumption is that it is large enough to represent the contents of the jar.

   Red: $\frac{52}{100} = 0.52 \approx 0.5$ or $\frac{1}{2}$

   Yellow: $\frac{31}{100} = 0.31 \approx 0.333...$, or $\frac{1}{3}$

   Blue: $\frac{17}{100} = 0.17 \approx 0.183...$, or $\frac{1}{6}$

   There are probably twice as many yellow marbles as blue marbles ($\frac{1}{3}$ is $\frac{2}{6}$) and three times as many red marbles as blue marbles ($\frac{1}{2}$ is $\frac{3}{6}$).

   Or:

   Red: $\frac{52}{17} \approx 3.05 \approx 3$

   Yellow: $\frac{31}{17} \approx 1.82 \approx 2$

   Blue: $\frac{17}{17} = 1$

   So, the ratio of the colors in the jar is 3 red : 2 yellow : 1 blue.

LESSON 15: SAMPLE SIZE

ANSWERS

5. About 270 marbles

The sum of the samples is 225 (45 + 42 + 44 + 47 + 47 = 225) and there are five data values: 225 ÷ 5 = 45. So, about $\frac{45}{100}$ marbles are blue. The jar contains six times this amount (100 • 6 = 600); so, about 45 • 6, or 270, marbles are blue.

Challenge Problem

6. There are about 2,000 fish in the lake.

Out of the whole population p, 100 fish are tagged: $\frac{100}{p}$. A sample shows that 5 out of 100 are tagged: $\frac{5}{100}$. These two ratios should be equal to each other:

$$\frac{5}{100} = \frac{100}{p}$$

$$\frac{5}{100} \cdot \frac{20}{20} = \frac{100}{2,000}$$

$p = 2,000$

LESSON 16: COMPARING DATA SETS ANSWERS

ANSWERS

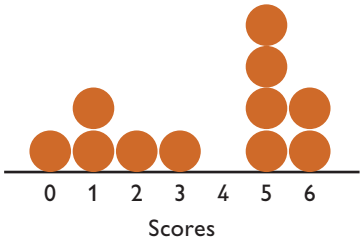
1. C

Each box plot has the same range but C has the greatest median and the narrowest box. Also, the upper quartile is the greatest (along with B).

2. C 9, 9, 9, 9, 10, 10

Sets A and D have a mean of 9, and set B has a mean of 8. Set C has a mean greater than 9 because all the values are 9 or greater.

3. B Math Quiz Scores Class 2



The median for sets A and D is 3 and for set C the median is 4. Set B has a median of 5, which is the greatest of the four classes.

4. Answers will vary. Possible answer:
No, because an argument could be made for either class. Although Class A has a slightly higher median it also has a wider range and a wide interquartile range. 50% of Class A's students are taller than 75% of Class B's students. However, Class B has 50% of its students clustered close to the median.

This is a situation in which knowing the mean or the MAD (mean absolute deviation) would be very helpful, because it is not known how the data are spread among each quartile.

5. Answers will vary. Possible answer:
Class A could have an outlier at the upper extreme. This outlier would "pull" the mean up but not affect the median. Alternately, Class B could have an outlier at the lower extreme, which would "pull" its mean down but not affect the median.

LESSON 16: COMPARING DATA SETS ANSWERS

Challenge Problem

6. 78%

There are 29 students in each class; so, there are 29 • 29 = 841 ways to pair the students. The favorable pairs are scores in Class A that pair with higher scores in Class B. For the first 16 students (starting from 0) all 29 scores in Class B are higher, for 464 outcomes so far. For each of the remaining students the line plots can be used to see the combinations:

9:	28
9:	28
10:	27
10:	27
11:	26
12:	24
15:	16
17:	7
18:	4
18:	4
19:	2
19:	2
20:	+ 0
	195

There are a total of 659 favorable outcomes (464 + 195 = 659) out of 841 total outcomes:

$\frac{659}{841} \approx 0.78$, or about 78%

LESSON 17: COMPARING TWO DATA SETS ANSWERS

ANSWERS

1. (D) 94 seconds for an interval of 100 seconds

   Although 9 seconds compared to 10 is off by only 1 second, it is 90% of 10:

   $\frac{9}{10} = 90\%$

   $\frac{22}{25} = 88\%$

   $\frac{46}{50} = 92\%$

   $\frac{94}{100} = 94\%$

   So, even though (D) is the furthest away in seconds, it is the closest relative to the time estimated.

2. (B) 4, 7, 7, 9, 12, 15

   All four sets of data have the same mean of 9. Set (C) will have the lowest MAD because it has the narrowest range. The range for set (A) is narrower than that in sets (B) or (D), so the MAD in set (A) will be lower. So, sets (B) and (D) need to be looked at more closely.

Set (B)	Difference from Mean	Set (D)	Difference from Mean
4	9 – 4 = 5	3	9 – 3 = 6
7	9 – 7 = 2	7	9 – 7 = 2
7	9 – 7 = 2	9	9 – 9 = 0
9	9 – 9 = 0	9	9 – 9 = 0
12	12 – 9 = 3	12	12 – 9 = 3
15	15 – 9 = 6	14	14 – 9 = 5
	18 ÷ 6 = 3		16 ÷ 6 ≈ 2.7

   So, set (B) has the highest MAD at 3.

LESSON 17: COMPARING TWO DATA SETS ANSWERS

3. B Sophie got 36 out of 37 correct.

   36 out of 37 is a slightly higher score than 95 out of 98.

   $\frac{24}{25} = 0.960$

   $\frac{36}{37} \approx 0.973$

   $\frac{54}{56} \approx 0.964$

   $\frac{95}{98} \approx 0.969$

4. Karen has had more at bats than Maya.

   If Maya had 5 hits in 8 at bats ($\frac{5}{8} = 0.625$) and Karen had 50 hits in 200 at bats ($\frac{50}{100} = 0.250$), then Karen would have 10 times as many hits.

   On average, Maya is a better hitter.

5. Answers will vary. Possible answer:

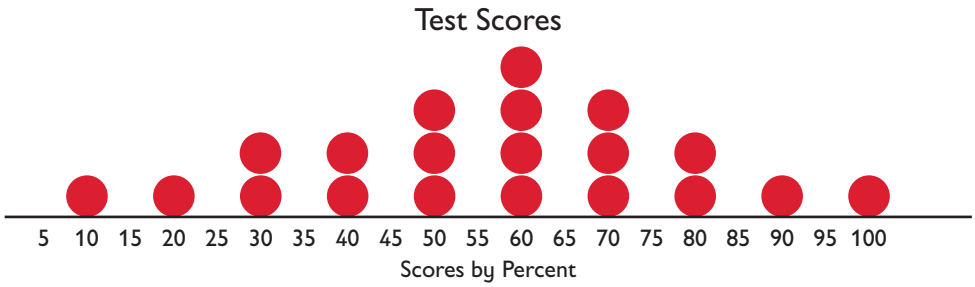
   The basketball players are probably taller than most of their classmates—on average by about 5 inches. The range for the seventh grade is much wider than that for the basketball team. Since the MAD is small for the basketball team the heights of the players are closer to the mean, with a small range. You would expect a specialized group to be more uniform than a general population group.

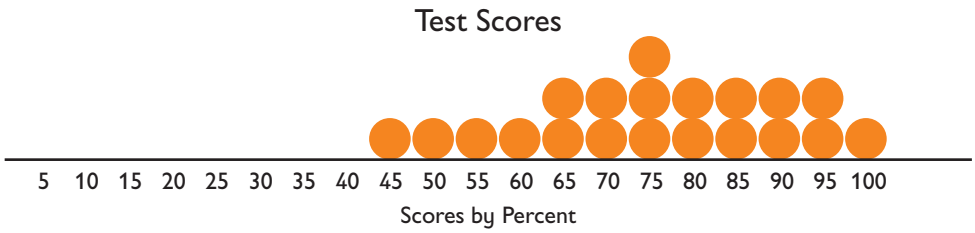
LESSON 17: COMPARING TWO DATA SETS

ANSWERS

Challenge Problem

6.





If the scales were converted to the percent of the total points possible, the scales would be the same and the line plots could be compared.

For the scores out of 10, each point is 10% of the total points. For the scores out of 20, each point is 5% of the total points. The second graph does not need to be redrawn, just relabeled. The first graph becomes more spread out because all of its scores are multiples of 10.

The mode and median for the first group is 60 and the mode and median for the second group is 75. The means are close to these numbers for each graph (56 and 75.25) because the data are clustered around the mode. The range is much narrower for the second group, with a higher lower extreme. So, the second group scored higher.