Pretest: **Circle** the number of your proficiency in the following areas.
Posttest: Put an **X** on the number of your proficiency in the following areas.

**Level:** GED  
**Unit:** Data, Statistics, and Probability  
**Standard:** CCR.MA.GED.Q.6.a, CCR.MA.GED.Q.6.b, CCR.MA.GED.Q.6.c, CCR.MA.GED.Q.8.a

**Learning Goal:** Students will be able to interpret categorical data, calculate mean, median, mode, and range. Students will be able to calculate missing data when given the median. Students will be able to use counting techniques to determine probabilities.

<table>
<thead>
<tr>
<th></th>
<th>GOALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Students will be able to calculate missing data when given the median. Students will be able to use counting techniques to determine probabilities.</td>
</tr>
<tr>
<td>3</td>
<td>Students will be able to find the value of missing data when the median is given and will be able to interpret and calculate the value of missing data.</td>
</tr>
<tr>
<td>2</td>
<td>Students will be able to interpret categorical data, calculate mean, median, mode, and range.</td>
</tr>
<tr>
<td>1</td>
<td>Students will recognize or recall specific vocabulary, including: mean, median, mode, and range.</td>
</tr>
</tbody>
</table>
This is a packet for Data, Statistics, and Probability.

The time frame should be about 7 days, including review and post-test.
Directions: You MAY use your calculator.

Questions 1 and 2 refer to the following graph.

![Graph of National Aircraft Orders for New Planes 2005–2010]

1. The mean number of aircraft orders for the six years shown on the graph is 573 planes. In which year was the number of orders closest to the mean?
   A. 2006
   B. 2007
   C. 2008
   D. 2009

2. By about what percent did orders at National Aircraft decrease from 2008 to 2009?
   A. 30%
   B. 40%
   C. 68%
   D. 75%

3. At a convention, Jim and his three friends each bought three raffle tickets. At the time of the drawing, 400 tickets had been sold. What is the probability that either Jim or one of his friends will win?
   A. \( \frac{3}{100} \)
   B. \( \frac{1}{25} \)
   C. \( \frac{3}{50} \)
   D. \( \frac{9}{100} \)

Questions 4 through 6 are based on the following table.

<table>
<thead>
<tr>
<th>Area</th>
<th>High Temp.</th>
<th>Low Temp.</th>
<th>Precipitation (in inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downtown</td>
<td>65°F</td>
<td>53°F</td>
<td>0.45</td>
</tr>
<tr>
<td>Airport</td>
<td>62°F</td>
<td>50°F</td>
<td>0.63</td>
</tr>
<tr>
<td>Woodland Hills</td>
<td>68°F</td>
<td>50°F</td>
<td>1.34</td>
</tr>
<tr>
<td>East Village</td>
<td>56°F</td>
<td>48°F</td>
<td>3.53</td>
</tr>
<tr>
<td>Ventura</td>
<td>62°F</td>
<td>49°F</td>
<td>2.57</td>
</tr>
<tr>
<td>Highland Park</td>
<td>64°F</td>
<td>55°F</td>
<td>0.84</td>
</tr>
</tbody>
</table>

4. Based on the data in the table, what was the median low temperature for March 9?
   A. 62.8°F
   B. 51.5°F
   C. 50.8°F
   D. 50°F

5. What was the mean amount of precipitation (in inches) on March 9 for the areas listed in the table?
   A. 0.65
   B. 1.09
   C. 1.56
   D. 1.99

6. For which area on the table was there the greatest range, or difference, between the high and low temperatures?
   A. Ventura
   B. East Village
   C. Woodland Hills
   D. Downtown
4. 720 This is a permutations problem, because order matters. 
   \[ 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720. \]
5. C. 360 This is a permutations problem, in which you are counting possible sequences of four out of six tasks. 
   \[ 6 \times 5 \times 4 \times 3 = 360. \]
6. B. 6 This is a permutations problem: the question asks you how many possible sequences of three types of flowers are possible. 
   \[ 3 \times 2 \times 1 = 6. \]
7. D. 5,040 This is a permutations problem, because you are told that the role of Bystander #1 is different from the role of Bystander #4. (Notice the phrase “specific roles” in the question.) Thus, order matters. The question is asking how many sequences of four are possible given ten people. 
   \[ 10 \times 9 \times 8 \times 7 = 5040. \]
8. B. 20 This is a combinations problem asking how many groups of three out of six are possible. Use a table or an organized list.
9. C. 120 This is a permutations problem asking how many sequences of three people are possible from ten people.

Data, Statistics, and Probability Practice Questions, pages 308–313

1. B. 2007 Only the bar for 2007 falls between 500 and 600 on the scale.
   \[ \frac{260}{650} = 0.4 = 40\%. \]
3. A. 300 Tim and his friends bought a total of 12 tickets (4 per person \( \times \) tickets). Then 12 out of 400 = \( \frac{12}{400} = \frac{3}{100} \)
4. D. 50° Arranges the low temperatures in order: 55°, 53°, 50°, 50°, 49°, and 48°. Find the middle of the list. Since there are two temperatures in the middle and both are 50°, the mean of the two must be 50°.
5. C. 1.56 Add the six amounts, and divide by 6. \[ 0.45 + 0.63 + 1.34 + 3.53 + 2.57 + 0.84 = 9.36, \] and 9.36 + 6 = 1.56 inches. It makes sense to use your calculator on this question.
6. C. Woodland Hills Mentally subtract the low temperature from the high temperature for each area. The greatest difference is in Woodland Hills, 68° – 58° = 10°. 7. B. 2005 Ticket sales increased each year from 2001 through 2004. The first year in which they declined was 2005.
8. C. 2008 The line graph shows the steepest increase (line rising from left to right) from 2007 to 2008.
9. C. 32% Eight customers chose a mouse pad. 8 + 25 = 32 = 32%.
10. A. 1 in 2 Of the 52 cards, 26 are red. 
   \[ \frac{26}{52} = \frac{1}{2} \]
11. 3.5 or \( \frac{7}{2} \) Add the hours, and divide by 6, the number of weeks: 
   \[ 5 + 3.5 + 4 + 0.1 + 1.5 + 7 = 21 \text{ hours,} \]
   and 21 hours ÷ 6 = 3.5 hours.
12. \( \frac{5}{2} \) Only the numbers 4 and 5 are greater than 3. The probability is 2 out of 5, or \( \frac{2}{5} \) or 0.4.
13. B. 41% The three candidates who received the smallest percentages of the vote also received the smallest number of votes. Add. 9% + 14% + 18% = 41%.
14. C. Bowen and Utley Since \( \frac{3}{4} = 60\% \), look for two candidates whose combined percent is close to 60%. Since 24% + 35% = 59%, the correct answer is choice (C).
15. D. 5100 x 0.09 Grace Reiner received 9%, which equals 0.09. You know the percent and the base. Multiply to find the part.
16. B. March The lines for both companies cross in March.
17. B. 5900 Company A's orders continue to climb at about the same rate. Imagine extending the solid line to the next month. The line would reach almost 6000. Choice (A) is too high an increase.
18. C. 540 The graph indicates that about 3000 orders were placed in April. Multiply: \( 3000 \times 18\% = 540. \)
19. B. 24.5 Use only the Shots Attempted column. Put the numbers in order, and find the middle: 29, 27, 26, 25, 24, 24, 23, 18. The two in the middle are 24 and 24. Find the mean of those numbers: 25 + 24 = 49, and 
   \[ 49 + 2 = 24.5. \]
20. D. 10 Use the Shots Made column. The mode is the number that occurs most often. In this case the mode is 10, which occurs three times.
21. B. \( \frac{4}{2} \) The probability that a marble is red is \( \frac{8}{25} \), or \( \frac{32}{100} \). The chance that a marble is white is \( \frac{16}{25} \), or \( \frac{64}{100} \). Because the first marble is replaced, the two events are independent. Multiply: \( \frac{1}{5} \times \frac{32}{100} = \frac{32}{500} = \frac{8}{125}. \)
22. B. \( \frac{4}{3} \) To find the mean, add the three numbers and divide by 3, the number of months in the list. There are 50 employees, but you don't need this number to solve the problem.
23. \( \frac{1}{3} \) The probability of rolling one "one" is \( \frac{1}{6} \). Multiply to find the chance of rolling two ones: 
   \[ \frac{1}{6} \times \frac{1}{6} = \frac{1}{36}. \]
24. 210 Arranges the numbers in order, and finds the middle number: 205, 276, 210, 158, 54.
25. 625 Use the fundamental counting principle: \( 5 \times 5 \times 5 \times 5 = 625. \)
26. 4 This is a combinations problem. Use a table or an organized list.
27. 720 This is a permutations problem, because the board is not simply picking three members; rather, those members will also be ordered in a specific way. Multiply: 
   10 options for president × 9 options for secretary × 8 options for treasurer = 720.
28. 20% First find the total number of patients: 16 (colds and flu) + 13 (colds and flu) + 12 (sprained muscles) + 7 (tetanus shots) + 12 (severe headaches) = 60. Now find what percent of 60 is represented by 12: \( \frac{12}{60} \) \times 100 = 20%.
29. B. 4:3 The ratio of patients with colds or flu to the number of patients with severe headaches is 16:12, which simplifies to 4:3.
30. B. 180–199 lbs The bar corresponding to this weight range is the tallest bar on the graph.
31. B. Participants weighing less than 200 lbs. Choices (C) and (D) are both subsets of choice (B), and so cannot be correct. Add the totals of the columns in the graph to reveal that the total for choice (B) is greater than that of (A).
Data, Statistics, and Probability

Tables and Pictographs

Data are facts and information. By analyzing data, we can make predictions, draw conclusions, and solve problems. To be useful, data must be organized in some way. A table organizes data in columns and rows. The labels on the table will help you understand what the data mean.

Example 1: The table below shows population figures for selected counties in 2000 and 2010 and the land area in square miles for each county.

<table>
<thead>
<tr>
<th>County</th>
<th>2000 Pop.</th>
<th>2010 Pop.</th>
<th>Land Area in sq. mi.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adams</td>
<td>11,128</td>
<td>15,295</td>
<td>4,255</td>
</tr>
<tr>
<td>Bell</td>
<td>25,199</td>
<td>22,707</td>
<td>2,523</td>
</tr>
<tr>
<td>Cook</td>
<td>6,532</td>
<td>6,518</td>
<td>2,398</td>
</tr>
<tr>
<td>Davis</td>
<td>82,204</td>
<td>90,834</td>
<td>1,139</td>
</tr>
<tr>
<td>Evans</td>
<td>139,510</td>
<td>130,748</td>
<td>921</td>
</tr>
</tbody>
</table>

Which county showed the greatest percent of increase in population from 2000 to 2010?

1. Read the labels. The first column shows the county names. The second and third columns show population figures. The fourth column shows land area data. You don’t need land area to answer this question.

2. Analyze the data. Only Adams and Davis counties show increases from 2000 to 2010.

3. Use the data. Find the percent of increase for Adams and Davis counties.

Adams: \[
\frac{15,295 - 11,128}{11,128} = 0.374 = 37\% \]

Davis: \[
\frac{90,834 - 82,204}{82,204} = 0.105 = 10\% \]

Adams County shows the greatest percent of increase in population from 2000 to 2010.

A pictograph is another way to display data. Pictographs use symbols to compare data. A key shows what value each symbol represents.

Example 2: A city has three public library branches. A librarian kept track of the numbers of books checked out from each branch in a week. He used the data to create the pictograph below.

<table>
<thead>
<tr>
<th>Branches</th>
<th>Books checked out from March 4 to March 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td>![North Pictograph]</td>
</tr>
<tr>
<td>South</td>
<td>![South Pictograph]</td>
</tr>
<tr>
<td>West</td>
<td>![West Pictograph]</td>
</tr>
</tbody>
</table>

Key: \[\text{10} = 150 \text{ books}\]
From March 4 to March 10, how many books were checked out from the South and West branches combined?

1. There are 4 1/2 symbols for the South Branch and 9 symbols for the West branch. Add:
   \[ 4 \frac{1}{2} + 9 = 13 \frac{1}{2} \text{ symbols.} \]

2. Find the value of the symbols. The key states that each symbol equals 150 books. Multiply by 150: \( 13 \frac{1}{2} \times 150 = 2025 \text{ books.} \)

DATA, STATISTICS, AND PROBABILITY ► PRACTICE 1

A. Use the table on page 282 to answer questions 1 and 2. Use the pictograph on page 282 to answer questions 3 and 4. You MAY use a calculator.

1. On average, how many people were there per square mile in Bell County in 2010?
2. To the nearest percent, what was the percent of decrease in Evans County’s population from 2000 to 2010?
3. How many more books were checked out from North Branch than from South Branch during the week of March 4?
4. How many books were checked out from all three branches combined?

B. Choose the one best answer to each question.

Questions 5 and 6 refer to the following table.

| Percent of 3-year-old children with school-readiness skills for the years 2004 and 2010 |
|---------------------------------------------------------------|-----|-----|
| Recognizes all letters | 11% | 17% |
| Counts to 20 or higher | 37% | 47% |
| Writes own name | 22% | 34% |
| Reads or pretends to read | 66% | 67% |

5. If 100,000 children were surveyed in each year, which category showed the least percent of increase from 2004 to 2010?
   A. Recognizes all letters
   B. Counts to 20 or higher
   C. Writes own name
   D. Reads or pretends to read

6. A community had 350 three-year-old children in 2010. If the chart is representative of the community, how many were able to write their own name?
   A. 34
   B. 97
   C. 119
   D. 134

Questions 7 and 8 refer to the following graph.

<table>
<thead>
<tr>
<th>Time of Day</th>
<th>Average Number of Cars</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 A.M. - noon</td>
<td>![Pictograph]</td>
</tr>
<tr>
<td>12:01 - 4:30 P.M.</td>
<td>![Pictograph]</td>
</tr>
<tr>
<td>4:31 - 6:30 P.M.</td>
<td>![Pictograph]</td>
</tr>
</tbody>
</table>

Key: 1 car = 50 cars

7. How many cars are parked in the garage from 12:01 to 4:30 P.M.?
   A. 275
   B. 350
   C. 375
   D. 650

8. How many more cars are parked from 8 A.M. to noon than are parked after 4:30 P.M.?
   A. 75
   B. 100
   C. 175
   D. 200

Answers and explanations begin on page 661.
Lesson 2

Data, Statistics, and Probability

Bar and Line Graphs

Working with Bar Graphs

A bar graph uses bars to represent values. Bar graphs have two axis lines. One line shows a number scale, and the other shows labels for the bars. By comparing the length of a bar to the scale, you can estimate what value the bar represents.

Example 1: A national corporation made a bar graph (shown below) to show the number of discrimination complaints made by employees during a six-year period. About how many more complaints were made in 2010 than in 2009?

1. Read the labels. Each bar represents the number of complaints made within a year. The years are shown beneath the bars.

2. Analyze the data. Compare the bars for 2009 and 2010 to the scale. There were 20 complaints in 2009 and about 32 complaints in 2010.

3. Use the data. Subtract:
   \[32 - 20 = 12\]
   There were about 12 more complaints in 2010 than in 2009.

A double-bar graph compares more than one type of data.

Example 2: A studio released four films in one year. The graph below compares the cost of making each movie to its box-office receipts, or ticket sales. Film B’s cost is what percent of its box-office receipts?

1. Read the labels. Read the key to find the meaning of the bars. Notice that the scale represents millions of dollars.

2. Analyze the data. Film B’s cost is about $30 million. It brought in about $65 million in receipts.

3. Use the data. Find what percent $30 is of $65.
   \[
   \frac{30}{65} = 0.462 = 46\%
   \]
DATA, STATISTICS, AND PROBABILITY ➤ PRACTICE 2.1

A. For questions 1 through 3, use the bar graph entitled “Employee Discrimination Complaints” on page 284. For questions 4 through 6, use the bar graph entitled “Profit Analysis for Four Films” on page 284.

1. To the nearest 10, how many employee discrimination complaints were there in 2006 and 2007?
2. To the nearest 5, how many more complaints were there in 2011 than in 2006?
3. By what percent did the number of complaints decrease from 2008 to 2009?

B. Choose the one best answer to each question.

Questions 7 and 8 refer to the following graph.

7. Approximately how many more T-shirts were sold than books and toys combined?
   A. 40
   B. 70
   C. 80
   D. 90

8. One-half of the games sold during the week of September 20 were on sale for $16. The rest sold for the full price of $24. Approximately how much money did the store take in for games sold during the week of September 20?
   A. $400
   B. $600
   C. $800
   D. $1000

4. About how much more did it cost to make Film A than Film D?
5. Which film made the greatest amount of profit? (Hint: profit = receipts - cost)
6. Film C’s cost was what percent of its box-office receipts?

Questions 9 and 10 refer to the following graph.

9. In May, what was the ratio of the number of 2-day permits to the number of 5-day permits?
   A. 2:5
   B. 3:17
   C. 14:3
   D. 14:17

10. In which month was there a total of 80 permits issued?
    A. June
    B. July
    C. August
    D. September

Answers and explanations begin on page 661.
Working with Line Graphs

A line graph is useful for showing changes over time. By analyzing the rise and fall of the line, you can tell whether something is increasing, decreasing, or staying the same. Like a bar graph, a line graph has two axis lines. One is marked with a scale; the other is marked in regular time intervals.

Example 3: The graph below shows the number of patients who visited an emergency room for the treatment of scooter-related injuries.

In which month did the greatest increase in scooter-related injuries occur?

The points on the graph are positioned above the months, which are arranged in calendar order. By examining the line that connects the points, you can tell whether there was an increase or decrease from one month to the next.

A steeper line shows a greater increase; therefore, the greatest increase was from July to August.

If a line graph has more than one line, a key will tell you what the lines represent.

Example 4: The graph below shows the changes in ticket prices for two amusement parks.

What was the last year in which the admission price to Park B was greater than the admission price to Park A?

The admission prices for Park A are represented by a solid line. Park B's prices are shown with a dotted line. The graph begins in 2005. In 2005, Park B's ticket price is greater than Park A's. Follow the two lines to the right. Between 2007 and 2008, the lines cross, and Park A's prices climb higher than Park B's. The year 2007 was the last time that Park B charged more than Park A for a ticket.

Note: The steepest line shows the greatest increase or decrease, but it may not show the greatest percent of change. When the original value is small, a small change may result in a high percent of change.
DATA, STATISTICS, AND PROBABILITY ▶ PRACTICE 2.2

A. For questions 1 through 3, use the graph from Westside Hospital on page 286. For questions 4 through 6, use the graph "Comparison of Admission Prices" on page 286.

1. In which month did the number of scooter-related injuries decrease?
2. To the nearest 10, how many emergency room visits were due to scooter injuries in August, September, and October combined?
3. Which of the following shows the greater percent of increase: the change in injuries from June to July or the change from August to September?
4. About how much more did it cost to buy a ticket to Park A than a ticket to Park B in 2009?
5. What was the percent of increase in the ticket prices at Park B from 2005 to 2010?
6. To the nearest 10, how much more did it cost to buy a ticket to Park A in 2010 than in 2005?

B. Choose the one best answer to each question.

Questions 7 and 8 refer to the graph below.

Questions 9 and 10 refer to the graph below.

Lamp Depot has two stores. The graph shows the sales data from the two stores for an 8-week period.

7. Over what period of time did the price of goods actually decrease?
   A. 1930 to 1940
   B. 1940 to 1950
   C. 1960 to 1970
   D. 1970 to 1980

8. Goods purchased in 1970 were about what fraction of their cost in the year 2000?
   A. \( \frac{4}{5} \)
   B. \( \frac{1}{4} \)
   C. \( \frac{1}{3} \)
   D. \( \frac{1}{5} \)

9. About how many more sales were there at Store 2 than at Store 1 in week 6?
   A. 110
   B. 50
   C. 40
   D. 25

10. During which week did Store 1 experience the greatest increase in sales from the week before?
    A. Week 2
    B. Week 3
    C. Week 4
    D. Week 5

Answers and explanations begin on page 661.
Circle Graphs

A circle graph is used to show how a whole amount is broken into parts. The sections of a circle graph are often labeled with percents. The size of each section corresponds to the fraction it represents. For example, a section labeled 25% is \( \frac{1}{4} \) of the circle.

Example 1: A graph below shows how a children's sports camp spends its weekly budget.

![Circle Graph of Sports Camp Weekly Budget]

How much does the sports camp spend on lunches each week?

1. **Analyze the graph.** According to the heading, the entire circle represents the camp’s weekly budget of $2250. Find the section labeled “lunches.” According to the section label, lunches make up 35% of the weekly budget.

2. **Use the data.** To find the amount spent on lunches, find 35% of $2250: $2250 \times 0.35 = $787.50.

A circle graph may also be labeled using fractions or decimals. One common kind of circle graph labels each section in cents to show how a dollar is used.

Example 2: According to the graph, what percent of the average energy bill is spent on drying clothes, lighting, and heating water?

![Circle Graph of Energy Dollars Go]

1. **Analyze the graph.** The entire circle represents $1. The amounts in the sections mentioned in the problem are $0.03, $0.05, and $0.17.

2. **Use the data.** Add the amounts: $0.03 + $0.05 + $0.17 = $0.25. Since $0.25 is 25% of a dollar, then 25% of an average bill is spent on these items.
DATA, STATISTICS, AND PROBABILITY  PRACTICE 3

A. For questions 1 through 3, use the sports camp budget on page 288. For questions 4 through 6, use the circle graph on energy on page 288.

1. What percent of the total sports camp budget is spent on equipment and uniforms?
2. What fraction of the sports camp budget is spent on permits?
3. What amount does the camp spend each week on busing?

4. A family's energy bill is $180. Assuming the family's energy use is typical, how much did the family spend on water heating?
5. Which section is greater than 50% of an energy dollar?
6. Which energy cost is about $\frac{1}{10}$ of the energy dollar?

B. Choose the one best answer to each question.

Questions 7 and 8 refer to the following graph.

Time Spent on Tasks by Records Clerks, Woods County Recorders Office

- Service Desk: 25%
- Preparing Documents: 25%
- Filing: 6%
- Data Entry: 44%

7. During a 40-hour workweek, how many hours does a records clerk spend preparing documents?
   A. 10
   B. 15
   C. 25
   D. 30

8. What percent of a records clerk's time is spent on tasks other than data entry?
   A. 25%
   B. 31%
   C. 44%
   D. 56%

Questions 9 and 10 refer to the following graph.

The employees of National Bank are given the following graph to explain how their retirement fund is invested.

- Private Bonds: 30 cents
- Stock Market: 3 cents
- Real Estate: 7 cents
- Public Bonds: 40 cents
- Mortgages: 20 cents

9. What percent of each retirement dollar is invested in real estate and the stock market?
   A. 4%
   B. 10%
   C. 40%
   D. 90%

10. Steve contributes $120 of each paycheck to his National Bank retirement fund. How much of each contribution is invested in public bonds?
    A. $36
    B. $40
    C. $48
    D. $84

Answers and explanations begin on page 661.
**DATA, STATISTICS, AND PROBABILITY**

**Measures of Central Tendency**

**Using a Frequency Table**

A frequency table shows how often an item appears in a data set. The data is in the form of tally marks next to a list of items.

**Example 1:** The sales manager at Montana Motors asked her sales staff to keep a record of the color of the cars that were chosen for test-drives in one month. Then she combined the data to make the frequency table shown below.

<table>
<thead>
<tr>
<th>Montana Motors—Car Color Preferences</th>
</tr>
</thead>
<tbody>
<tr>
<td>white</td>
</tr>
<tr>
<td>black</td>
</tr>
<tr>
<td>red</td>
</tr>
<tr>
<td>green</td>
</tr>
<tr>
<td>silver</td>
</tr>
<tr>
<td>other</td>
</tr>
</tbody>
</table>

What was the ratio of black cars driven to silver cars driven?

1. Count the tally marks. There are 27 marks for black and 9 for silver.
2. Write the ratio and reduce to lowest terms, \( \frac{27}{9} = \frac{3}{1} \)

The ratio of black to silver is 3 to 1. You can also say that the black cars are 3 times as popular as the silver cars.

Numerical data is often grouped in intervals. The table below shows data grouped in intervals of 18 to 24, 25 to 40, and so on. This way of presenting data is called a grouped frequency table.

**Example 2:** The table below shows the ages of the customers at Louise’s Diner for a four-day period. What percent of the customers were from 25 to 40 years old?

<table>
<thead>
<tr>
<th>Louise’s Diner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customers by Age Group, February 19–22</td>
</tr>
<tr>
<td>under 18</td>
</tr>
<tr>
<td>18–24</td>
</tr>
<tr>
<td>25–40</td>
</tr>
<tr>
<td>41–55</td>
</tr>
<tr>
<td>over 55</td>
</tr>
</tbody>
</table>

1. Find the data you need. There are 28 marks for the 25–40 age group. Add the tally marks for all age groups to find the total number of customers for the three-day period: \( 6 + 18 + 28 + 10 + 8 = 70 \).
2. Find the percent. The base is 70, the total number of customers. The pair is 28, the number of customers in the desired age group. Solve for the rate: \( \frac{28}{70} = \frac{4}{10} = 0.4 = 40\% \).
DATA, STATISTICS, AND PROBABILITY ➤ PRACTICE 4.1

A. For questions 1 through 3, use the frequency table from Montana Motors on page 290. For questions 4 through 6, use the frequency table from Louise’s Diner on page 290.

1. What was the total number of test drives of black and white cars combined?
2. How many more drivers chose red than silver cars?
3. What was the ratio of red cars to white cars chosen for test-drives?

4. What is the ratio of customers under 18 to those over 55?
5. What was the total number of customers from 18 to 40 years of age?
6. What percent of the total customers were from 41 to 55 years of age? (Round your answer to the nearest whole percent.)

B. Choose the one best answer to each question.

Questions 7 and 8 refer to the following information.
The frequency table shows the reasons customers gave for returning clothing merchandise to a store.

<table>
<thead>
<tr>
<th>Reason</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrong size</td>
<td>HH</td>
</tr>
<tr>
<td>Unwanted gift</td>
<td>HH</td>
</tr>
<tr>
<td>Found flaw after purchase</td>
<td>H</td>
</tr>
<tr>
<td>Changed mind</td>
<td>H</td>
</tr>
</tbody>
</table>

7. What is the ratio of customers saying the clothes were the wrong size to all the returns represented?
   A. \( \frac{4}{15} \)
   B. \( \frac{4}{11} \)
   C. \( \frac{4}{7} \)
   D. \( \frac{4}{5} \)

8. Approximately what percent of the customers who returned clothing said that the clothes were an unwanted gift?
   A. 20%
   B. 25%
   C. 45%
   D. 50%

Questions 9 and 10 refer to the following information.
A personnel office gives typing tests to people applying for a job. The test shows how many words per minute (wpm) a job applicant can enter correctly. After testing 90 applicants, the manager made the following table.

<table>
<thead>
<tr>
<th>Typing Speed</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 30 wpm</td>
<td>HH</td>
</tr>
<tr>
<td>30–45 wpm</td>
<td>HH</td>
</tr>
<tr>
<td>46–60 wpm</td>
<td>HH</td>
</tr>
<tr>
<td>Over 60 wpm</td>
<td>HH</td>
</tr>
</tbody>
</table>

9. What percent of the applicants had a speed of under 30 wpm?
   A. 14%
   B. 25%
   C. 28%
   D. 39%

10. What is the ratio of applicants who could type at a speed above 45 wpm to those who could type at a speed of 45 wpm or less?
    A. 1:3
    B. 1:2
    C. 2:3
    D. 6:5

Answers and explanations begin on page 662.
Mean, Median, and Mode

Suppose you were asked how much money you usually spend on groceries in a week. Some weeks, you may spend a great deal; other weeks, much less. You would probably choose an amount in the middle to represent what you typically spend. This middle value is called an average, or measure of central tendency.

The most common type of average is the mean, or the arithmetic average.

Example 3: In five football games, a team scored 14, 21, 3, 20, and 10 points. What is the mean, or average, score per game?

1. Add the values. $14 + 21 + 3 + 20 + 10 = 68$
2. Divide by the number of items in the data set. $68 \div 5 = 13.6$ points per game

Although it is impossible for a football team to score 13.6 points in a game, the number represents the center of the scores from the five games.

A calculator is useful for finding the mean. Do the calculations in two steps. Enter the addition operations. Then, if you are using the TI-30XS MultiView RM, press enter to find the sum. Then key in the division operation. Try Example 1 above with a calculator.

Another measure of average is the median. The median is the middle value in a set of data.

Example 4: During a 7-hour period, a bookstore recorded the following numbers of sales. Find the median number of sales.

<table>
<thead>
<tr>
<th>Hour 1</th>
<th>Hour 2</th>
<th>Hour 3</th>
<th>Hour 4</th>
<th>Hour 5</th>
<th>Hour 6</th>
<th>Hour 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
<td>28</td>
<td>24</td>
<td>36</td>
<td>32</td>
<td>37</td>
<td>48</td>
</tr>
</tbody>
</table>

1. Arrange the values by size. $24, 28, 32, 36, 37, 43, 48$
2. Find the middle number. $24, 28, 32, 36, 37, 43, 48$

If there is an even number of values, the median is the mean of the two middle values.

Example 5: Robert has the following test scores in his math class: 90, 72, 88, 94, 91, and 80. What is the median score?

1. Arrange the values by size and find the middle. $72, 80, 88, 90, 91, 94$
2. Find the mean of the two middle values. The median score is 89.
   
   Add: $88 + 90 = 178$
   
   Divide by 2: $178 \div 2 = 89$

The mode is the value that occurs most often in a set of data. A set of data could have more than one mode if several items occur the same number of times. If each item of data occurs only once, there is no mode.

Example 6: Six weather stations recorded the following temperatures at 3:00 P.M.: 45°, 44°, 45°, 47°, 46°, and 45°. What is the mode of the data?

The temperature 45° occurs most often (3 times). The mode is 45°.
DATA, STATISTICS, AND PROBABILITY ➤ PRACTICE 4.2

A. For each data set, find the mean, median, and mode. Round calculations to the nearest hundredth or cent. You MAY use a calculator.

1. Golf scores for 7 rounds:
   76, 82, 75, 87, 80, 82, and 79

2. Sales totals for 6 weeks:
   $5,624; $10,380; $8,102; $6,494; $12,008; and $8,315

3. Cost of lunch for 8 days:
   $4.50, $5.25, $4.50, $3.75; $4.50, $5.25, $6.10, and $4.25

4. Miles driven per day for 5 days:
   330, 286, 342, 300, and 287

5. Grocery bills for 4 weeks:
   $97.48, $106.13, $110.98, and $92.74

6. Scores on 7 quizzes:
   90, 72, 86, 100, 88, 78, and 88

7. High temperatures for 10 days:
   96°, 103°, 98°, 101°, 98°, 100°, 100°, 97°, 98°, and 100°

8. Inches of rainfall over 3-day period:
   2.5, 1.8, and 1.4

9. Attendance figures at a play:
   305, 294, 328, 296, 305, 315, and 292

10. Hours worked per week for 5 weeks:
     36, 40, 38, 40, and 40

B. Choose the one best answer to each question. You MAY use your calculator.

Questions 11 and 12 refer to the following information.

<table>
<thead>
<tr>
<th>Homes Sold in Fairfield Heights in June</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Home</strong></td>
<td><strong>Asking Price</strong></td>
</tr>
<tr>
<td>#1</td>
<td>$124,600</td>
</tr>
<tr>
<td>#2</td>
<td>$132,400</td>
</tr>
<tr>
<td>#3</td>
<td>$118,900</td>
</tr>
<tr>
<td>#4</td>
<td>$98,500</td>
</tr>
<tr>
<td>#5</td>
<td>$105,800</td>
</tr>
<tr>
<td>#6</td>
<td>$122,400</td>
</tr>
</tbody>
</table>

11. What was the mean asking price of the homes sold in Fairfield Heights in June?
   A. $117,100  
   B. $116,500  
   C. $115,450  
   D. $114,800

12. What was the median selling price of the homes sold in Fairfield Heights in June?
   A. $112,750  
   B. $114,800  
   C. $116,500  
   D. $117,450

13. The numbers of patients enrolled at four health clinics are 790, 1150, 662, and 805. Which expression could be used to find the mean number of patients per clinic?
   - A. \( \frac{790 + 1150 + 662 + 805}{4} \)
   - B. \( 790 + 1150 + 662 + 805 \)
   - C. \( \frac{662 + 1150}{2} \)
   - D. \( (790 + 1150 + 662 + 805) + 2 \)

14. What is the median value of $268, $1258, $654, $1258, $900, $1558, and $852?
   - A. $1258  
   - B. $964  
   - C. $900  
   - D. $852

15. What is the mode of the following points scored: 14, 17, 14, 12, 13, 15, 22, and 11?
   - A. 13.5  
   - B. 14  
   - C. 14.75  
   - D. 16.5

Answers and explanations begin on page 662.
DATA, STATISTICS, AND PROBABILITY

Line Plots

The same kind of information that can be expressed in a frequency table (see page 290) can also be expressed in a line plot. A line plot shows the frequency of data along a number line. Study the following example.

Example 1: The student health services department at a university surveyed several students and asked them how many times per week they visited the school's gym. The following frequency table shows the results for several students.

<table>
<thead>
<tr>
<th>Weekly Gym Visits</th>
<th>Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
</tr>
</tbody>
</table>

Next, the health services department decided to create a line plot in order to see the distribution of gym visits. Each x represents a student.

You can see from this line plot that there is an uneven distribution, or arrangement, of students across the numbers of possible gym visits. Three visits per week has the highest frequency, meaning that more students go to the gym three times per week than any other number of visits. You can also see that the data range extends from zero visits per week to seven visits per week—no student visits the gym more often than that. The data point showing the one student who visits the gym seven times per week is an outlier—that is, a data point that is distant from where most of the data is clustered.

The Mathematical Reasoning Test may ask you to identify highest frequency, range, and outliers, or it may give you some data and ask you to place x's or dots on a number line to create a line plot.

Use the following example to study these concepts further.

Example 2: Students in Ms. Jones's class took a math test. Their scores on the test are displayed on the line plot below. Each dot represents a student. Which grade displayed the highest frequency?

More students received a C than received any other grade. Therefore, grade C has the highest frequency of any grade on the line plot.

The range of grades on the math test was from D (the lowest grade received by any student) to A (the highest grade received by any student).
DATA, STATISTICS, AND PROBABILITY ➤ PRACTICE 5

For questions 1 and 2, choose the line plot that matches each frequency table. Use choices A–D below for both questions.

1. Zoologists have counted the number of stripes on certain zebras in a zoo. The set of data from these observations is represented by the following frequency table:

<table>
<thead>
<tr>
<th>Number of stripes per side</th>
<th>Number of zebras with that many stripes</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>1</td>
</tr>
<tr>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>26</td>
<td>11</td>
</tr>
<tr>
<td>27</td>
<td>0</td>
</tr>
<tr>
<td>28</td>
<td>11</td>
</tr>
<tr>
<td>29</td>
<td>0</td>
</tr>
<tr>
<td>30</td>
<td>11</td>
</tr>
<tr>
<td>31</td>
<td>0</td>
</tr>
<tr>
<td>32</td>
<td>1</td>
</tr>
</tbody>
</table>

Which line plot below represents this data?

A.

```
  x x x x x x
  24 25 26 27 28 29 30 31 32
```

B.

```
  x x x x x x
  24 25 26 27 28 29 30 31 32
```

2. At a certain elementary school, classes may have different numbers of students. The following frequency table represents how many students are in the classes this year:

<table>
<thead>
<tr>
<th>Number of students</th>
<th>Number of classes with that many students</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>0</td>
</tr>
<tr>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>26</td>
<td>0</td>
</tr>
<tr>
<td>27</td>
<td>1</td>
</tr>
<tr>
<td>28</td>
<td>1</td>
</tr>
<tr>
<td>29</td>
<td>11</td>
</tr>
<tr>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>31</td>
<td>1</td>
</tr>
<tr>
<td>32</td>
<td>11</td>
</tr>
</tbody>
</table>

Which line plot below represents this data?

C.

```
  x x x x x x
  24 25 26 27 28 29 30 31 32
```

D.

```
  x x x x x x
  24 25 26 27 28 29 30 31 32
```

Questions 3 and 4 are based on the following information.

Juana runs a community garden. She is interested in how many different types of vegetables garden members are planting. She collects the following data:

<table>
<thead>
<tr>
<th>Garden Member</th>
<th>Types of Vegetables Planted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alberta</td>
<td>4</td>
</tr>
<tr>
<td>Paul</td>
<td>3</td>
</tr>
<tr>
<td>Eileen</td>
<td>6</td>
</tr>
<tr>
<td>Donato</td>
<td>2</td>
</tr>
<tr>
<td>Vijay</td>
<td>3</td>
</tr>
<tr>
<td>Janelle</td>
<td>2</td>
</tr>
<tr>
<td>Zara</td>
<td>1</td>
</tr>
<tr>
<td>Wahib</td>
<td>8</td>
</tr>
<tr>
<td>Bill</td>
<td>4</td>
</tr>
<tr>
<td>Yeo</td>
<td>3</td>
</tr>
</tbody>
</table>

3. The line plot below is based on the information in the table. Each point represents one of the members of the community garden. Place as many additional points as necessary to complete the line plot.

```
  x x x x x x
  1 2 3 4 5 6 7 8
```

4. Which value (number of types of vegetables) has the highest frequency in the data?

A. 2
B. 3
C. 4
D. 8

Answers and explanations begin on page 662.
Data, Statistics, and Probability

Histograms

Like line plots, histograms display frequencies, but they do so in a very different way. Consider the following example:

Example 1: Graham is a veterinarian. Last year he decided to track client appointments for spring shots. The following table and histogram represent his results:

<table>
<thead>
<tr>
<th>Week of</th>
<th>Number of Appointments</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 1–7</td>
<td>2</td>
</tr>
<tr>
<td>March 8–14</td>
<td>4</td>
</tr>
<tr>
<td>March 15–21</td>
<td>8</td>
</tr>
<tr>
<td>March 22–28</td>
<td>11</td>
</tr>
<tr>
<td>March 29–April 4</td>
<td>14</td>
</tr>
<tr>
<td>April 5–11</td>
<td>17</td>
</tr>
<tr>
<td>April 12–18</td>
<td>13</td>
</tr>
<tr>
<td>April 19–25</td>
<td>7</td>
</tr>
<tr>
<td>April 26–May 2</td>
<td>5</td>
</tr>
</tbody>
</table>

The histogram above on the right has two axes: a vertical axis (or y-axis) representing numbers of appointments and a horizontal axis (also called an x-axis) that has increments representing the weeks. The area of each bar represents the number of appointments for that week. Thus, you can see not only how many appointments were in any given week but also how the frequency of appointments changed over the weeks in the chart.

Finally, histograms can also be used to show percentages. If we alter the histogram about Graham’s appointments so that each bar represents the percent of total appointments each week, it would look like the one on the right.

Because the percentages add up to 100%, the areas of all the bars add up to 100.
Example 2: What percent of appointments for spring shots occurred during the first two weeks of March?

You can figure this out by adding the percentages for those weeks (you can approximate based on the histogram): for March 1–7, about 2%; for March 8–14, about 5%. Approximately 7% of appointments for spring shots occurred during those two weeks.

**DATA, STATISTICS, AND PROBABILITY ➤ PRACTICE 6**

A. Choose the histogram that matches each frequency table. Use choices A–D below for both questions 1 and 2.

1. Josefina runs a retail business. She posted a coupon to a social media site from 9:00 A.M. to 5:00 P.M. The table shows how many people downloaded or printed the coupon.

<table>
<thead>
<tr>
<th>Hour beginning with</th>
<th>Number of people who downloaded or printed coupon</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00 A.M.</td>
<td>30</td>
</tr>
<tr>
<td>10:00 A.M.</td>
<td>56</td>
</tr>
<tr>
<td>11:00 A.M.</td>
<td>80</td>
</tr>
<tr>
<td>12:00 P.M.</td>
<td>71</td>
</tr>
<tr>
<td>1:00 P.M.</td>
<td>56</td>
</tr>
<tr>
<td>2:00 P.M.</td>
<td>31</td>
</tr>
<tr>
<td>3:00 P.M.</td>
<td>22</td>
</tr>
<tr>
<td>4:00 P.M.</td>
<td>14</td>
</tr>
</tbody>
</table>

2. Mike administered a skills assessment to his employees. Possible scores on the skills assessment ranged from 200 to 1800. The following table shows how his employees performed on the assessment:

<table>
<thead>
<tr>
<th>Score range</th>
<th>Number of employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>200–399</td>
<td>15</td>
</tr>
<tr>
<td>400–599</td>
<td>22</td>
</tr>
<tr>
<td>600–799</td>
<td>35</td>
</tr>
<tr>
<td>800–999</td>
<td>62</td>
</tr>
<tr>
<td>1000–1199</td>
<td>80</td>
</tr>
<tr>
<td>1200–1399</td>
<td>69</td>
</tr>
<tr>
<td>1400–1599</td>
<td>47</td>
</tr>
<tr>
<td>1600–1800</td>
<td>20</td>
</tr>
</tbody>
</table>

B. Choose the one best answer to each question.

**Question 3** refers to the following histogram and information.

Influenza, or “flu,” season in the United States tends to last from fall through spring.

![](Percent_of_Total_Flu_Cases_Reported_to_CDC_per_Week_2012_2013_Flu_Season_in_the_U.S._chart.png)

3. Approximately what percentage of flu cases was reported to the CDC during the 2012–2013 season during the time period of December 9 to January 5?

    A. 7%
    B. 15%
    C. 36%
    D. 50%

Answers and explanations begin on page 662.
Probability

Simple Probability

Probability tells whether something is likely or unlikely to happen. The probability of any event can be expressed by a number from 0 to 1. If an event has 0 probability, the event is impossible. An event with a probability of 1 is certain to happen. Most events are somewhere in between.

To find the probability of a simple random event, we must identify favorable and possible outcomes. A favorable outcome is the event that we are interested in. The possible outcomes are all the possible events that could occur. Theoretical probability (sometimes called simple probability) is the ratio of favorable outcomes to possible outcomes.

Example 1: The spinner is divided into 8 equal sections. What is the probability of spinning a 4 on the spinner?

1. There are two sections labeled 4 on the spinner, and there are 8 sections in all.
2. Use the probability ratio: \( \frac{\text{favorable outcomes}}{\text{possible outcomes}} = \frac{2}{8} = \frac{1}{4} \).

The probability of spinning a 4 on the spinner is 1 out of 4, or \( \frac{1}{4} \) or 0.25, or 25%.

In Example 1, probability was based on what we knew could happen. Another type of probability, called experimental probability, is based on what actually happens during the trials of an experiment. The number of trials are the number of times you try the experiment.

Example 2: Ricardo and Scott used the same spinner to play a game. They kept track of the numbers that they got on each spin for 20 spins. The numbers are shown below.

2, 4, 4, 6, 4, 3, 4, 6, 4, 3, 1, 6, 2, 2, 5, 2, 4, 2, 1, 2

Based on their results, what is the experimental probability of spinning a 4?

1. Ricardo and Scott spun a 4 six times out of twenty.
2. Use this ratio: \( \frac{\text{favorable outcomes}}{\text{number of trials in experiment}} = \frac{6}{20} = \frac{3}{10} \) or 0.3, or 30%.

Notice that experimental probability is close to, but not necessarily equal to, theoretical probability. Theoretical probability can tell you what will probably happen, but it can’t predict what will actually happen.
A. Express probability as a fraction, decimal, and percent for questions 1 through 5. Do not use a calculator.

1. A game has 50 wooden tiles. Players draw tiles to spell words. If 20 of the tiles are marked with vowels, what is the probability of drawing a vowel from the tiles?

2. A spinner has five equal sections colored either red, white, or blue. After 40 spins, a player has the following results:

<table>
<thead>
<tr>
<th>Color</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>red</td>
<td>+H</td>
</tr>
<tr>
<td>white</td>
<td>+H +H</td>
</tr>
<tr>
<td>blue</td>
<td>+H +H +H</td>
</tr>
</tbody>
</table>

What is the experimental probability of not spinning blue on the spinner?

3. There are four red, four blue, and two green marbles in a bag. If one marble is chosen at random from the bag, what is the probability that the marble will be green?

4. A movie theater sells 180 adult tickets and 60 children's tickets to a movie. As part of a special promotion, one ticket will be chosen at random, and the winner will receive a prize. What is the probability that the winner will be a child?

5. A spinner has six equal sections numbered from 1 to 6. What is the probability of spinning either a 5 or 6?

B. Choose the one best answer to each question. You MAY use your calculator.

Questions 6 and 7 refer to the following information.

A deck of 12 cards is marked with the following symbols.

6. If a card is chosen at random, what is the probability of selecting a diamond (♦)?
   A. 6%
   B. 12%
   C. 50%
   D. 60%

7. If a card is chosen at random, what is the probability of selecting something other than a club (♣)?
   A. \( \frac{3}{2} \)
   B. \( \frac{3}{4} \)
   C. \( \frac{1}{3} \)
   D. \( \frac{2}{100} \)

Questions 8 and 9 refer to the following information.

Erin flipped a coin 40 times and made this table to show how many outcomes were "heads" and how many were "tails."

<table>
<thead>
<tr>
<th></th>
<th>+H</th>
<th>+H</th>
<th>+H</th>
<th>+H</th>
<th>+H</th>
<th>+H</th>
<th>+H</th>
<th>+H</th>
<th>+H</th>
<th>+H</th>
</tr>
</thead>
<tbody>
<tr>
<td>heads</td>
<td>+H</td>
<td>+H</td>
<td>+H</td>
<td>+H</td>
<td>+H</td>
<td>+H</td>
<td>+H</td>
<td>+H</td>
<td>+H</td>
<td>+H</td>
</tr>
<tr>
<td>tails</td>
<td>+H</td>
<td>+H</td>
<td>+H</td>
<td>+H</td>
<td>+H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. Based on Erin's data, what is the experimental probability of getting tails on a coin flip?
   A. 3 out of 5
   B. 3 out of 4
   C. 2 out of 3
   D. 2 out of 5

9. Based on Erin's data, what is the experimental probability of getting heads on a coin flip?
   A. 3 out of 5
   B. 3 out of 4
   C. 2 out of 3
   D. 1 out of 2

Answers and explanations begin on page 662.
Dependent and Independent Probability

You know how to find the probability of a single event. You can use this knowledge to find the probability of two or more events.

Example 3: Brad tosses two quarters into the air. What is the probability that both will land so that the heads' sides are showing?

One way to solve the problem is to list or diagram all the possible outcomes.

If quarter #1 is heads,
- quarter #2 could be heads. \[ H \ H \]
- quarter #2 could be tails. \[ H \ T \]

If quarter #1 is tails,
- quarter #2 could be heads. \[ T \ H \]
- quarter #2 could be tails. \[ T \ T \]

There are four possible outcomes, and only one is favorable (HH). Therefore, the probability of having both land with the heads side up is \[ \frac{1}{4} \], or 25%.

You can also use multiplication to find the probability.

1. Find the probability of the individual events. The probability that one coin will be heads is \[ \frac{1}{2} \], and the probability that the other will be heads is \[ \frac{1}{2} \].
2. Multiply to find the probability of both events: \[ \frac{1}{2} \times \frac{1}{2} = \frac{1}{4} \].

The two coin tosses in Example 3 are independent events. When events are independent, one does not affect the probability of another. In Example 4 below, the events are dependent. Once the first event takes place, the probability of the second event is changed.

Example 4: A box contains four blue marbles and two red marbles. If you select two marbles, what is the probability that both will be blue?

(Hint: Even though the marbles in the box are taken out at the same time, think of one as the first marble and the other as the second marble.)

1. There are six marbles in the box, and four are blue. The probability that the first marble will be blue is \[ \frac{4}{6} \], which reduces to \[ \frac{2}{3} \].
2. Assume the first marble selected is blue. Now there are only five marbles in the box, and three are blue. The probability that the second marble will be blue is \[ \frac{3}{5} \].
3. Multiply to find the probability of the two events: \[ \frac{2}{3} \times \frac{3}{5} = \frac{6}{15} \], or \[ \frac{2}{5} \].

The probability that both marbles will be blue is \[ 2 \text{ out of } 5 \].

Note: The events in Example 4 would not be dependent if the first marble were replaced before the second marble was selected. Always think carefully about the situation to decide whether two events are dependent or independent.
A. Solve as directed. Express answers as fractions.

1. Kim rolls two standard six-sided dice. What is the chance that both will be 4s?

2. Ten cards are numbered from 1 to 10. Tori draws out a card, replaces it, and then draws another card. What is the probability that both cards will be numbers greater than 5?

3. A spinner has four equal sections. Two sections are red, one is green, and one is blue. If the spinner is spun three times, what is the probability that all three spins will be red?

4. Twenty marbles are placed in a bag. Ten are red, and ten are black. One marble is drawn from the bag and set aside. Another marble is drawn from the bag. What is the chance that both marbles will be red?

5. Allison tosses a coin four times. What is the chance that the coin will be heads all four times?

6. If you roll two standard dice, what is the probability that both will be an odd number?

B. Choose the one best answer to each question. You MAY use your calculator.

Questions 7 and 8 refer to the following information.

In a game a player rolls a die, numbered from 1 to 6, and spins a spinner. The spinner is shown below.

![Spinner Diagram]

7. What is the probability of rolling a 5 and then spinning an even number?

A. \( \frac{1}{9} \)
B. \( \frac{1}{6} \)
C. \( \frac{2}{3} \)
D. \( \frac{5}{6} \)

8. What is the chance that a player will get the same number on both the die and the spinner?

A. \( \frac{5}{6} \)
B. \( \frac{2}{3} \)
C. \( \frac{1}{3} \)
D. \( \frac{1}{6} \)

9. Daniel uses the ten cards below in a magic trick.

![Card Diagram]

9. Daniel shuffles the cards and asks an audience member to choose and hold two cards. If the cards are chosen randomly, what is the chance that both will be marked with a square?

A. 8 out of 14
B. 3 out of 5
C. 1 out of 3
D. 1 out of 5

10. There are 15 colored chips in a bag. Eight are green, and seven are white. Five white chips are removed. What is the probability that the next chip selected will be green?

A. 100%
B. 80%
C. 75%
D. 25%

Answers and explanations begin on page 663.
22. C. $2464 Use the formula for finding simple interest: $I = prt$.
   $I = 2200 \times 0.08 \times 1.5 = 264$. To find the amount in the account at the end of the time, add the interest to the original investment:
   $2200 + 264 = 2464$.

23. B. $328 Once you find the discount by multiplying 0.2 by $410, you will need to subtract the discount from $410 to find the sale price.

24. D. 330 After changing $2 \frac{3}{4}$ to the decimal 2.75, write a proportion and solve: $\frac{2.75}{x} = \frac{228}{60}; 60 \times 2.75 + 0.5 = 330$.

25. C. $\frac{140 - 91}{140} \times 100$ There were 140 customers on Sunday, and 91 made a purchase. Therefore, $140 - 91$ did not make a purchase. To find the percent rate, divide the difference by 140, the total number of customers on Sunday (the base). Then move the decimal point two places to the right or multiply by 100 to change the answer to a percent. Only choice (C) shows this sequence of operations.

26. 270 Write a proportion and solve: $\frac{2}{x} = \frac{3}{5}$.

27. $\frac{1}{4}$ If Marcie spends 15 hours answering telephones, she spends 40 - 15, or 25 hours doing other tasks. Write a ratio and reduce: $\frac{1}{4}$.

7. C. 375 There are $7 \frac{1}{2}$ car symbols. Each symbol represents 50 cars. Multiply: $7 \frac{1}{2} \times 50 = 375$.

8. A. 75 Compare the symbols for the two rows. There are $1 \frac{1}{2}$ more symbols for 8 a.m. to noon than there are after 4:30 p.m. Multiply: $1 \frac{1}{2} \times 50 = 75$

Lesson 2: Bar and Line Graphs

Practice 2.1, page 285

1. 50
   3. 20% The number of complaints decreased by 5, from 25 to 20. This represents a $\frac{5}{25} = 20\%$ decrease.
   4. about $20 million Estimate values from the graph and subtract. Be sure to use the black bars that represent cost.
   5. Film A Film A has the biggest difference in size between the bar representing box-office receipts and the bar representing cost.
   6. 150% Calculate: $\frac{25}{16} = \frac{5}{3} = 150\%$
   7. A. 40 There are approximately 110 T-shirts, more than 40 books, and a little fewer than 30 toys sold. Combined, about 70 books and toys were sold. Subtract 70 from 110, and you have about 40.
   8. D. $1000 There were about 50 games sold, so 25 sold for $16 and 25 sold for $24. Calculate: $(25 \times 16) + (25 \times 24) = 1000$.
   9. C. 143 Write a ratio and simplify: $\frac{25}{16} = \frac{25}{16}$
   10. D. September Add the 2-day and 5-day permits for each month. Only September's permits equal 80.

Practice 2.2, page 287

1. October The point representing October is lower than the point representing the previous month, and the line leading to it slopes downward. This indicates a decrease.
   2. 270 Estimate totals for the three months and add.

Lesson 3: Circle Graphs

Practice 3, page 289

1. 29% Find those two categories on the circle graph and add.
2. 41 & 8% = $\frac{10}{21}$ = $\frac{8}{21}$
3. $630 Use the total budget. $2250 \times 28\% = $630.
4. $30.6017 cents of every dollar are spent on water heating: $180 \times 0.17 = $30.60.$
5. Heating and Air-Conditioning The section labeled "Heating and Air-Conditioning" takes up more than half the circle.
6. Cooking and Refrigeration This section is 11 cents of every dollar, which is about 10%.
7. A. 10 According to the graph, a records clerk spends 25%, or $\frac{1}{4}$, of his or her time preparing documents. Then 25% of 40 hours is 10 hours.
8. D. 56% If 44% of the time is spent on data entry, then $100\% - 44\%$ which equals 56%, is spent on other tasks.
9. B. 10% Add: 3 cents plus 7 cents in 10 cents. Then 10 cents out of 100 cents is \(\frac{10}{100} = 0.10\) or 10%.

10. C. $48 40 cents out of every dollar, or 40%, is spent on public bonds. Then 40% of $120 is found by multiplying: $120 \times 0.4 = $48.

Lesson 4: Measures of Central Tendency

Practice 4.1, page 291

1. 57 Count the number of tally marks and add.
2. 6 Count the number of tally marks and subtract.
3. 1:2 Calculate: \(\frac{15}{30} = \frac{1}{2}\)
4. 3:4 Calculate: \(\frac{3}{4} = \frac{3}{4}\)
5. 46 Count the tally marks and add.
6. 14% Count the total number of tally marks, then divide: \(\frac{28}{200} = 0.14 = 14\%\).
7. B. \(\frac{3}{11}\) There are 16 tally marks next to the reason “wrong size.” Add all the tally marks: 16 + 20 + 3 + 5 = 44. Write a ratio and reduce: \(\frac{44}{44} = \frac{1}{1}\).
8. C. 45% Adding all the tally marks, you find that there were 44 clothing returns in all. Since there are 20 tally marks by “unwanted gift,” \(\frac{20}{44}\) or \(45\%\) of the total reasons given were “unwanted gift.”
9. D. 39% Calculate: 35 applicants had a speed under 30 wpm, out of a total of 90 applicants, so \(\frac{35}{90} = 39\%\).
10. B. 12 To find those who could type above 45 wpm, add: 18 + 12 = 30. The number typing below 45 wpm is found by adding 35 + 25 = 60. Write a ratio and reduce: \(\frac{60}{60} = \frac{1}{2}\).

Practice 4.2, page 293

1. mean: 80.14 median: 80 mode: 82
2. mean: $8,487.17 median: $8,208.50 mode: none
3. mean: $4.76 median: $4.50 mode: $4.50
4. mean: 309 miles median: 300 miles mode: none
5. mean: $101.83 median: $101.81 mode: none
6. mean: 86 median: 88 mode: 88
7. mean: 99.1° median: 99° mode: 98° and 100°
8. mean: 1.9 inches median: 1.8 inches mode: none
9. mean: 305 median: 305 mode: 305
10. mean: 38.8 hours median: 40 hours mode: 40 hours
11. A. $117,100 Add the amounts in the column labeled “Asking Price” and divide by 6, the number of prices listed.
12. C. $116,500 Arrange the selling prices in order: $124,800; $118,400; $116,500; $116,500; $109,000; $103,600. Since the number of items is even, there are two in the middle: $116,500 and $116,500. Since these are the same amount, the average of the two is also $116,500.
13. A. \(\frac{290 + 150 + 60 + 805}{4}\) To find the mean, add the numbers and divide by the number of items in the set. In this case, there are 4 numbers.
14. C. $900 The median is the middle amount. Arrange the amounts in order and find the middle amount.
15. B. 14 The mode is the number that occurs most often. Only 14 occurs more than once in the data.

Lesson 5: Line Plots

Practice 5, page 295

1. C. Look for a line plot that reflects that two zebras have 26 stripes, two have 28, two have 30, etc.
2. B. Look for a line plot that reflects three classes with 29 students, two classes with 32, etc.
3. Draw a dot for each person not already represented in the line plot. Your completed line plot should look like this:

```
1 2 3 4 5 6 7 8
3
2
1
```

4. B. 3 Three people grew three vegetables—that’s more people than grew any other specific number of vegetables.

Lesson 6: Histograms

Practice 6, page 297

1. C. Look for the histogram that begins with 30 and that has a second bar at 56, a third bar at 80, etc.
2. D. Look for the histogram that begins with 15 and that has a second bar at 22, a third bar at 35, etc.
3. C. 36% Estimate the percentages represented by the four bars that cover the time period of December 9 through January 5: 8%, 9%, 9%, and 10%. Add those estimates to find the approximate percentage of cases reported during that entire time period, resulting in 35%.

Lesson 7: Probability

Practice 7.1, page 299

1. \(\frac{1}{4}, 0.4, 40\%\) Calculate: \(\frac{20}{50} = \frac{2}{5}\)
2. \(\frac{1}{2}, 0.3, 30\%\) There were 12 non-blue spins out of 40 total spins.
3. \(\frac{3}{10}, 0.2, 20\%\) Calculate: \(\frac{\frac{3}{10}}{2} = \frac{3}{20} = 15\%\)
4. \(\frac{4}{1}, 0.25, 25\%\) Calculate: \(\frac{20}{80} = \frac{1}{16} = \frac{5}{25}\) or 25%.
5. \(\frac{1}{3}, 0.33, 33\frac{1}{3}\%\) Calculate: \(\frac{1}{3} = \frac{1}{3}\)
6. C. 50% There are 12 cards in the deck, and 6 are diamonds: \(\frac{12}{24} = \frac{1}{2}\)

9. A. \(\frac{1}{4}\) There are 3 clubs, so 9 are not clubs: \(\frac{9}{12} = \frac{3}{4}\)
10. D. 2 out of 5 Twenty-four out of 40 trials resulted in tails: \(\frac{24}{40} = \frac{3}{5}\)
11. A. 3 out of 5 Twenty-four out of 40 trials resulted in heads: \(\frac{24}{40} = \frac{3}{5}\)
Lesson 8: Combinations

Practice 8.1, page 303

1. 5 Since Rob is choosing 4 team members, each possible team leaves out exactly 1 employee. There are 5 possible employees Rob could leave out, so there are 5 possible teams.

2. 10 Either an organized list or a table will work. To solve this problem using a list organized in columns, assign the books letters: A, B, C, D, and E. Count possible combinations:

<table>
<thead>
<tr>
<th>A and B combinations</th>
<th>A and C combinations</th>
<th>A and D combinations</th>
<th>B and C combinations</th>
<th>B and D combinations</th>
<th>C and D combinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABC</td>
<td>ACD</td>
<td>ADE</td>
<td>BCD</td>
<td>BDE</td>
<td>CDE</td>
</tr>
<tr>
<td>ABD</td>
<td>ACE</td>
<td>BCE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. 4 Use either a table or an organized list, as above.

4. 10 The problem does not give the names of the friends, so assign them letters: A, B, C, D, E. Then use a table or organized list, as above, to find possible combinations of two.

5. 5 Use a table or an organized list.

6. 6 Even though three people are going to the conference, you already know that one of them will be Regan. So the question is really asking how many combinations of two out of Regan’s four employees could also go. Name the employees A, B, C, and D and use a table or organized list.

7. 10 The gender of the people sent to the signing is not relevant to answering this question, so you are being asked for possible combinations of 3 out of 5. Use a table or an organized list.

8. 20 Assign letters to the six people (A, B, C, D, E, and F), and then use a table or organized list.

9. 20 This question asks you to add the number of possible groups of two out of five to the number of possible groups of 3 out of 5. Perform each of those tasks separately, or realize that they will have the same solution because choosing 3 to be in the group is the same as choosing 2 to be out of the group. Then, add the possible combinations together.

Practice 8.2, page 305

1. 48 Use the fundamental counting principle:

4 (types of bread) \times 3 (types of meat) \times 4 (condiments) = 48.

2. 24 Use the fundamental counting principle: 3 (restaurant certificates) \times 2 (T-shirts) \times 4 (hats) = 24.

3. 27 Use the fundamental counting principle: 3 \times 3 \times 3 = 27.

4. 24 On Friday, Julio has 2 choices. On Saturday, he has 3. On Sunday, he has 4 choices. Use the fundamental counting principle: 2 \times 3 \times 4 = 24

5. 4, 5, 184 There are three words in the passphrase: 24 choices for the first, 9 for the second, 24 for the third. Use the fundamental counting principle: 24 \times 9 \times 24 = 5184.

6. A. 10 You are asked for combinations from one set of items. Use either a table or an organized list. You can assign the superpowers letters A–E to make it easier to see how to combine them.

7. 1,024 Use the fundamental counting principle:

4 (meats) \times 4 (vegetables) \times 4 (noodles) \times 4 (broth) \times 4 (spices) = 1,024.

8. A. 125 Use the fundamental counting principle:

5 (medications) \times 5 (diary changes) \times 5 (vitamins) = 125.

Lesson 9: Permutations

Practice 9, page 307

1. 120 This is a permutation problem, because order matters. The question asks how many sequences of five items are possible. 5 \times 4 \times 3 \times 2 \times 1 = 120.

2. 24 This question asks you how many sequences of four items are possible. 4 \times 3 \times 2 \times 1 = 24.

3. 10 This is a combinations problem: you are being asked how many groups of three are possible, given five students. Order does not matter. Use a table or an organized list; you may name the students A–E if that is easier.
Questions 7 and 8 refer to the graph.

Platinum Cinemas Ticket Sales

<table>
<thead>
<tr>
<th>Ticket Sales (in thousands)</th>
<th>Years from 2001 to 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>600</td>
<td>01</td>
</tr>
<tr>
<td>500</td>
<td>02</td>
</tr>
<tr>
<td>400</td>
<td>03</td>
</tr>
<tr>
<td>300</td>
<td>04</td>
</tr>
<tr>
<td>200</td>
<td>05</td>
</tr>
<tr>
<td>100</td>
<td>06</td>
</tr>
</tbody>
</table>

7. Platinum Cinemas opened its first theaters in 2001. The company’s ticket sales increased steadily until what year, when there was a drop in sales?

A. 2004  
B. 2005  
C. 2008  
D. 2009

8. Which year had the sharpest increase in ticket sales over the previous year?

A. 2002  
B. 2006  
C. 2008  
D. 2009

9. At Nelson Stationers, the first 25 customers who visited the store on Monday morning received their choice of a gift. The table below shows how many customers chose each gift.

<table>
<thead>
<tr>
<th>Gift</th>
<th>Number of Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>pen and pencil set</td>
<td>11</td>
</tr>
<tr>
<td>calculator</td>
<td>12</td>
</tr>
<tr>
<td>mouse pad</td>
<td>2</td>
</tr>
</tbody>
</table>

What percent of the customers chose a mouse pad?

A. 17%  
B. 25%  
C. 32%  
D. 33 1/3%

10. A standard deck of playing cards has 52 cards, with 13 cards each of hearts, diamonds, clubs, and spades. If a card is drawn randomly from the deck, what is the probability that it will be either hearts or diamonds?

A. 1 in 2  
B. 1 in 4  
C. 1 in 8  
D. 1 in 16

11. Nita worked the following overtime hours over a six-week period.

Week 1: 5 hours  
Week 2: 3 1/2 hours  
Week 3: 4 hours  
Week 4: 0 hours  
Week 5: 1 1/2 hours  
Week 6: 7 hours

What is the mean number of overtime hours Nita worked each week?

Write your answer on the line below.

12. A spinner has five equal sections, and they are numbered from 1 to 5. What is the probability of spinning a number greater than 3? (Express the answer as a fraction.)

Write your answer on the line below.
4. 720 This is a permutations problem, because order matters. 
   \(6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720\).
5. C 360 This is a permutations problem, in which you are counting possible sequences of four out of six tasks. 
   \(6 \times 5 \times 4 \times 3 = 360\).
6. B 6 This is a permutations problem: the question asks you how many possible sequences of three types of flowers are possible. 
   \(3 \times 2 \times 1 = 6\).
7. D 5,040 This is a permutations problem, because you are told that the role of Bystander #1 is different from the role of Bystander #4. (Notice the phrase “specific roles” in the question.) Thus, order matters. The question is asking how many sequences of four are possible given ten people. 
   \(10 \times 9 \times 8 \times 7 = 5040\).
8. B 20 This is a combinations problem, asking how many groups of three out of six are possible. Use a table or an organized list.
9. C 120 This is a permutations problem asking how many sequences of three out of six are possible. 
   \(6 \times 5 \times 4 = 120\).

Data, Statistics, and Probability Practice Questions, pages 308–313

1. B 2007 Only the bar for 2007 falls between 500 and 600 on the scale.
   \(650 - 390 = 260\). Divide by the original number: 
   \(260 \div 650 = 0.4 \times 100 = 40\%\).
3. A 3/10 Jim and his friends bought a total of 12 tickets (4 people \(\times 3\) tickets). Then 12 out of \(400 \div 12 = 33.33\) tickets.
4. D 50° Arrange the low temperatures in order: 55°, 53°, 50°, 50°, 49°, and 48°. Find the middle of the list. Since there are two temperatures in the middle and both are 50°, the mean of the two must be 50°.
5. C 1.56 Add the six amounts, and divide by 6: 
   \(0.45 + 0.63 + 1.34 + 3.53 + 2.57 + 0.84 \times 9.36\), and 
   \(9.36 + 6 = 1.56\) inches. It makes sense to use your calculator on this question.
6. C Woodland Hills Mentally subtract the low temperature from the high temperature for each area. The greatest difference is in Woodland Hills: 
   \(68° - 50° = 18°\).
7. B 2005 Ticket sales increased each year from 2001 through 2004. The first year in which they declined was 2005.
8. C 2008 The line graph shows the steepest increase (line rising from left to right) from 2007 to 2008.
9. C 32% Eight customers chose a mouse pad. 
   \(8 + 25 = 0.32 = 32\%\).
10. A 1 in 2 Of the 52 cards, 26 are either hearts or diamonds. 
    \(26 \div 52 = \frac{1}{2}\).
11. 3.5 or \(\frac{7}{2}\) Add the hours, and divide by 6, the number of weeks: 
    \(5 + 3.5 + 4 + 0 + 1.5 + 7 = 21\) hours, and 
    \(21 + 6 = 3.5\) hours.
12. \(\frac{7}{6}\) Only the numbers 4 and 5 are greater than 3. The probability is 
    \(2 \text{ out of } 5, \frac{2}{5} \text{, or } 0.4\).
13. B 41% The three candidates who received the smallest percentages of the vote also received the smallest number of votes. Add: 
    \(9\% + 14\% + 18\% = 41\%\).
14. C Bowen and Utey Since \(\frac{3}{4} = 60\%\), look for two candidates whose combined percent is close to 60%. Since 24% + 35% = 59%, the correct answer is choice (C).
15. D 5100 \times 0.09 Grace Reiner received 9%, which equals 0.09. You know the percent and the base. Multiply to find the part.
16. B March The lines for both companies cross in March.
17. B 5900 Company A's orders continue to climb at about the same rate. Imagine extending the solid line to the next month. The line would reach almost 6000. Choice (A) is too high an increase.
18. C 540 The graph indicates that about 3000 orders were placed in April. Multiply: 
   \(3000 \times 18\% = 540\).
19. B 24.5 Use only the Shots Attempted column. Put the numbers in order, and find the middle: 
   \(29, 27, 26, 25, 24, 23, 18\). The two in the middle are 25 and 24. Find the mean of those numbers: 
   \(25 + 24 = 49\), and 
   \(49 \div 2 = 24.5\).
20. D 10 Use the Shots Made column. The mode is the number that occurs most often. In this case the mode is 10, which occurs three times.
21. B \(\frac{5}{36}\). The probability that a marble is red is \(\frac{1}{24}\), or \(\frac{1}{3}\). The chance that a marble is white is \(\frac{13}{24}\), or \(\frac{1}{2}\). Because the first marble is replaced, the two events are independent. Multiply: 
   \(\frac{1}{24} \times \frac{1}{24} = \frac{1}{48}\).
22. B \(\frac{34 + 21 + 42}{3}\) To find the mean, add the three numbers and divide by 3, the number of months in the list. There are 36 employees, but you don’t need this number to solve the problem.
23. \(\frac{1}{36}\) The probability of rolling one "one" is \(\frac{1}{6}\). Multiply to find the chance of rolling two ones: 
   \(\frac{1}{6} \times \frac{1}{6} = \frac{1}{36}\).
24. 210 Arrange the numbers in order, and find the middle number: 
   \(305, 276, 210, 158, 54\).
25. 625 Use the fundamental counting principle: 
   \(5 \times 5 \times 5 \times 5 = 625\).
26. A 23 This is a combinations problem, use a table or an organized list.
27. 720 This is a permutations question, because the board is not simply picking three members. Rather, those members will also be ordered in a specific way. Multiply: 
   10 options for president \(\times 9\) options for secretary \(\times 8\) options for treasurer \(= 720\).
28. 28% First find the total number of patients: 
   16 (colds and flu) + 
   13 (cuts and scrapes) + 
   12 (sprained muscles) + 
   7 (tetanus shots) + 
   12 (severe headaches) = 60. Now find what percent of 60 is represented by 
   \(12, \frac{12}{60} \times 100 = 20\%\).
29. B 4:3 The ratio of patients with colds or flu to the number of patients with severe headaches is 16:12, which simplifies to 4:3.
30. B 180-199 lbs The bar corresponding to this weight range is the tallest bar on the graph.
31. B Participants weighing less than 200 lbs Choices (C) and (D) are both subsets of choice (B), and so cannot be correct. Add the totals of the columns in the graph to reveal that the total for choice (B) is greater than that of (A).