8th Grade Learning Guide Math
Grade: 8 Subject: Math (most worksheets/images from enVision Mathematics, Common Core, 2020, Grade 8)

Topic: Bivariate Data

What Your Student is Learning:
- Constructing/using a scatter plot to identify and interpret the relationship between two sets of data (paired data).
- Determining whether the paired data has a linear association (data appears to make a straight line), non-linear, or no association (there’s no pattern to how the data changes).
- If there is a linear association, draw a trend line to determine whether it is positive (increasing left to right) or negative (decreasing left to right) and strong (data closely follows trend line) or weak (loosely follows the trend line).
- Use what they learned previously about slope and y-intercept to use the trend line to make a prediction about the data. Also, make a prediction when there isn’t an equation by drawing their own trend lines and writing the linear equation to represent that trend line.
- Organize paired categorical data (data that can be grouped) into a two-way frequency table (and two-way relative frequency tables) and use that table to compare/make conjectures about the data.

Background and Context for Parents: This unit is an application of the work students previously did with linear equations. As data is all around us, it is important that students learn how to organize data, read it, and decide what conclusions can be drawn from the data (and what conclusions can’t be drawn).

Conceptual Understanding
- **Paired Data** Topic 4 allows students to explore the idea that two sets of data may show a relationship to each other. In Lessons 4-1 and 4-2, students create scatter plots for numerous sets of paired measurement data and examine the plots for evidence of an association. Students categorize the associations between the paired data as positive, negative, linear, nonlinear, or no association at all.
- **Linear Associations and Models** Lessons 4-2 and 4-3 extend the examination of bivariate data that show a linear association. Students sketch and find equations for trend lines and use these lines as models to make predictions for the data.
- **Two-Way Frequency Tables** In Lessons 4-4 and 4-5, students work with paired sets of categorical data, using frequency tables to compare two sets of data. Students use the two-way frequency and two-way relative frequency tables to make evidence-based conjectures about the data.

Paired Data
- **Scatter Plots** In Lesson 4-1, students will construct and interpret scatter plots that show the relationship between two sets of data. Scatter plots give a visual representation of the relationship between the two quantities being measured. Students decide whether the data have a positive or negative association, or no association at all.
- **Linear Associations** In Lesson 4-2, students extend their work with scatter plots to begin drawing trend lines to represent the relationship that exists between the quantities. The students will use trend lines to decide whether the paired data show a linear association, a nonlinear association, or no association.

The scatter plot shows a positive association between hours of sleep and math test scores.
Ways to support your student:

- Do the Adult/Student pages (2 sets) with your student (there are two in this packet with explanations).
- Provide blank/ lined paper/graph paper so they have enough space to try different strategies.
- Watch and discuss the Khan Academy videos together (linked below) .
- Before giving your student the answer to their question or specific help, ask them “What have you tried so far?, What do you know?, What might be a next step?
- After your student has solved it, and before you tell them it’s correct or not, have them explain to you how they got their solution and if they think their answer makes sense.

Online Resources for Students:

- [https://www.desmos.com/calculator](https://www.desmos.com/calculator) - Free online graphing calculator that allows students to check their work by inputting the data in a table. For troubleshooting how to make scatter plots using desmos: [https://support.desmos.com/hc/en-us/articles/202529229-Scatter-Plots](https://support.desmos.com/hc/en-us/articles/202529229-Scatter-Plots)
- [https://www.khanacademy.org/math/cc-eight-grade-math/cc-8th-data](https://www.khanacademy.org/math/cc-eight-grade-math/cc-8th-data) - All data topics
- [https://mathbitsnotebook.com/Algebra1/StatisticsReg/ST2TwoWayPractice.html](https://mathbitsnotebook.com/Algebra1/StatisticsReg/ST2TwoWayPractice.html) - Practice for two-way tables
Learning Support for Mathematics

For students that are approaching grade level and have learning gaps/differences in mathematics, provide numerous opportunities for explorations at the concrete (manipulatives) and representational (visual) levels before progressing to the abstract (numbers) level. Students that need learning supports should be provided with:

- Intensive Direct Instruction and daily guided practice
- scaffolded supports
- the use of visuals as models and aids
- numerous opportunities to think out loud
- support to help them understand the why
- use of manipulatives and tools to support understanding
- Bar Modeling Representations to decode word problems
- the use of mnemonics to enhance retention of skills
- daily practice with basic facts
- the presentation of content in varied contexts and varied levels
- opportunities to use diagrams and draw math concepts
- graph paper to support understanding
- numerous opportunities to draw pictures of word problems
- the use of smaller numbers to address number operations
- opportunities for success to build a growth mindset
- computer time to allow for needed practice
- opportunities to engage in metacognition (the building and reinforcing of thinking and reasoning) skills

See examples for each bulleted item on the following pages
· **Intensive Direct Instruction and daily guided practice**
(Intensive Direct Instruction means to explain the skill / concept to the student with several examples repeatedly to help them understand)

· **Scaffolded Supports**
(Scaffolded supports means to introduce the skill one step at a time – allowing the student to understand one section part, before moving on to the next part) ex. 5+ 1=6, 9+1=10, 24+1=25- it is the same as “what number comes after 5, after 9, after 24
[https://youtu.be/5hWDbSx_kdo](https://youtu.be/5hWDbSx_kdo)

· **Visuals as models and aides**
(Pictures of objects that can be used to help students understand the math)

· **Thinking out loud**
(Allows students to talk and think about the skills they are learning, which allows them to better remember the skill)
[https://youtu.be/f-4N7OxSMok](https://youtu.be/f-4N7OxSMok)

· **Understanding the why**
(When students understand why a strategy works, they will apply it to other skills) ex. 5x = 5, 45x1=45, 320x1=320

· **Manipulatives and Tools**
(Manipulatives can be counters, beans, blocks, etc. – Tools can be rulers, calculators, scales, etc.)  [https://youtu.be/uWBZF-Lyq58](https://youtu.be/uWBZF-Lyq58)

· **Bar Modeling Representations**
(Bar Modeling Representations consist of visuals that help students under the skill they are learning. Ex.

<table>
<thead>
<tr>
<th>70</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
</tr>
</tbody>
</table>

[https://youtu.be/TbayTZvS_bc](https://youtu.be/TbayTZvS_bc)
· Mnemonics
(Mnemonics consist of strategies to help students remember skills – ex.

https://youtu.be/dXvvGc9TldY

· Basic Facts
(Basic facts include addition, subtraction, division, multiplication facts –
ex. 8+2=10, 2+8=10, 10-2=8, 10-8=2 / 2x5=10, 5x2=10, 10/2=5, 10/5=2
https://youtu.be/TbayTZvS_bc

· Content with varied contexts and varied levels
Means to show student how to solve a problem different ways to allow them to use the skill that
way they understand best
https://youtu.be/FVg9n0l0Gf0

· Diagrams
(Diagrams provide students with visuals / pictures that help them solve the problem and they help
them read the problem with less words)
https://youtu.be/TbayTZvS_bc

· Graph paper
(Graph paper helps students to solve the problem by making it visual / easier to see the answer)
https://youtu.be/mX43cn3lASI

· Drawing Pictures
(Drawing pictures allow students to show they can solve the problem without using words that they
may not know or be able to write)
https://youtu.be/TbayTZvS_bc
· **Smaller Numbers**
(The use of smaller numbers can help students understand the process of a skill, so that when they move on to bigger numbers, they will see that the process is still the same, they acquire understanding of the skill)  
  ex. 5x = 5, 45x1= 45, 320x1=320

· **Growth Mindset**
(A growth mindset is a process that helps to improve intelligence (thinking), ability (skill) and performance (actions). This means that by helping students to develop a growth mindset, we can help them to learn to think and be problem solvers. This is a process that occurs over time by helping them improve by building success over time.  

· **Computer Time**
(Computer time allows students to use websites, games, activities that will help them learn math skills and concepts)  
  mathgametime.com, pbs.com, bestkidsolutions.com, firstinmath.com, helpingkidsrise.org

· **Metacognition**
(Metacognition means to help students think about what they are thinking, the steps they are using, the words and numbers that they are using- It helps students to better focus on the skills they are using- it is a process that occurs over time) /  
[https://youtu.be/HKFOhd5sMEc/](https://youtu.be/HKFOhd5sMEc/)  
1. Which point is located at (2, -5)?

- Point A
- Point B
- Point C
- Point D

2. What is the slope of the line that passes through the points (-2, 2) and (13, -7)?

- $-1.67$
- $-0.6$
- $0.6$
- $1.67$

3. Ivy graphs how much money she earns for hours of babysitting. She finds that the data tends to be linear and draws a line that passes through the points (2, 17) and (5, 42.50). About how much does Ivy earn per hour?

- $8.50$
- $25.50$
- $17$
- $42.50$

4. What is the equation of a line that passes through the points (-3, 4) and (2, 8)?

- $y = 0.8x + 5$
- $y = 1.25x + 6.75$
- $y = 0.8x + 6.4$
- $y = 0.8x - 8$

5. Which statement is true about the graph below? Select all that apply.

- The graph is nonlinear.
- The function increases at the same rate.
- The rate decreases after $x = 2$.
- The graph is a function.
- The graph is increasing in two intervals.

6. In a survey, 7 out of 8 people preferred cooking to washing dishes. How would you write this ratio as a percent?

- 7.8%
- 12.5%
- 87.5%
- 114%
7. Find the equation of the line shown below.

- y = -0.2x + 2
- y = -5x + 2
- y = 0.2x + 5
- y = 5x + 2

8. A taxi company charges the rates shown in the following table.

<table>
<thead>
<tr>
<th>Distance (mi)</th>
<th>Fare ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>13.50</td>
</tr>
<tr>
<td>15</td>
<td>33.75</td>
</tr>
<tr>
<td>22</td>
<td>49.50</td>
</tr>
</tbody>
</table>

What would the company charge for a 10-mile ride?
- A $15.80
- B $18.10
- C $19.00
- D $22.50

9. Which statement is true?
- A If a relationship is non-linear, it is not a function.
- B A graph of a curve is linear.
- C A graph that shows a constant rate of change is linear.
- D A non-linear relationship has a constant slope.

10. Describe what is happening in the graph below.

- A The function is steady, and then it increases.
- B The function decreases sharply, and then it stays the same.
- C The function increases a little, and then it decreases sharply.
- D The function stays constant, and then it decreases sharply.

11. A water tank fills as shown in the graph below.

What is the slope of the line?
- A \( \frac{1}{3} \)
- B \( \frac{2}{3} \)
- C \( \frac{3}{2} \)
- D 3
Review What You Know!

Vocabulary
Choose the best term from the box to complete each definition.

1. ____________ is the change in $y$ divided by the change in $x$.
   - ratio
   - slope
   - $x$-axis
   - $y$-axis

2. A relationship where for every $x$ units of one quantity there are $y$ units of another quantity is a ____________.

3. The ____________ is the horizontal line in a coordinate plane.

4. The ____________ is the vertical line in a coordinate plane.

Graphing Points
Graph and label each point on the coordinate plane.

5. $(-2, 4)$

6. $(0, 3)$

7. $(3, -1)$

8. $(-4, -3)$

Finding Slope
Find the slope between each pair of points.

9. $(4, 6)$ and $(-2, 8)$

10. $(-1, 3)$ and $(5, 9)$

11. $(5, -1)$ and $(-3, -7)$

Writing Fractions as Percents
12. Explain how to write $\frac{35}{60}$ as a percent.
Associations in Data Does This Predict That?

This week your student will work with scatter plots. Scatter plots show us how two different variables are related. In the example below, each plotted point corresponds to a dog, and its coordinates tell us the height and weight of that dog. The point on the lower left of the graph, for example, might represent a dog that is 8 inches tall and weighs about 5 pounds. The plot shows that, generally speaking, taller dogs weigh more than shorter dogs.

Since a larger value for one characteristic (height) generally means a larger value for the other characteristic (weight), we say that there is a positive association between dog height and dog weight.

In the next example, each point corresponds to a car, and its coordinates tell us the weight and fuel efficiency of the car. This time, we see that larger values for one characteristic (car weight) generally have lower values for the other characteristic (fuel efficiency), and so we say that there is a negative association between car weight and fuel efficiency.
Here is a task to try with your student:

The following scatter plot shows the relationship between average temperature and gas usage in a building.

1. How many points in the graph describe the building on 70-degree days? Approximately how much gas was used on each of these days?

2. Do the variables in the gas usage for a building scatter plot show a positive association or a negative association?

3. On a 78-degree day, would the building be most likely to use (a) 1,800 therms of gas, (b) 4,200 therms of gas, or (c) 5,800 terms of gas?

Grade 8 Unit 6
CC BY Open Up Resources. Adaptations CC BY IM.
Associations in Data
A scatter plot is a graph in the coordinate plane that shows the relationship between two sets of data.

The data in the table below can be written as ordered pairs: (8, 0), (12, 12), (14, 20), and (16, 28). The scatter plot shows the ordered pairs on the graph.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Number of Text Messages</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>14</td>
<td>20</td>
</tr>
<tr>
<td>16</td>
<td>28</td>
</tr>
</tbody>
</table>

Paul recorded several of his friends’ scores on the latest science test and the number of minutes they spent reading the previous weekend. How can Paul construct a scatter plot of his data?

1. A scatter plot has been started at the right. Add a title for the scatter plot and a label for the x-axis.

2. Write the data in the table as ordered pairs.

3. Complete the scatter plot by graphing your ordered pairs from Exercise 2.

4. Is there a relationship between the time students spent reading and their science test scores?

On the Back!

5. After 5 minutes, Pablo jumped 14.6 feet. After 10 minutes, he jumped 14.1 feet. What are the two ordered pairs?
Name ________________________________

Read the problem and connect it to the graph.

The scatter plot shows the relationship between the age of the students in a club and the number of hours they participated in a dance-a-thon to raise money for their club during one month. Identify the cluster in the scatter plot and tell what it means. Then identify any gaps or outliers.

1. Underline the words in the problem that describe what a correct answer will contain.

2. On the scatter plot, underline the words that describe the quantity represented by the x-values of each data point. Circle the words that describe the quantity represented by the y-values.

3. Choose any point from the scatter plot and write its coordinates. Describe the meaning of this point.

4. What is a cluster on a scatter plot? What is a gap?

5. What is an outlier? How can you use a scatter plot to identify an outlier?

6. Circle the outlier on the scatter plot.
Use the list below to complete the sentences. Use each term once.

ordered pair  
measurement data  
scatter plot

cluster  
gap  
outlier

The graph shows the number of customers at a car wash for various outdoor temperatures.

1. The graph is a __________________ that uses points to display the relationship between the number of customers and the temperature.

2. The number of customers and the temperature represented by each point are paired ____________________.

3. Each point in the scatter plot can be represented by a(n) ____________________.

4. The point (42, 2) does not seem to fit with the rest of the graph. It is a(n) ____________________.

5. The graph shows that from the point (17, 8) to the point (25, 12) there is a ____________________.

6. From the point (25, 12) to the point (40, 16) there is a ____________________.
A trend line is a line on a scatter plot, drawn through the middle of the plotted points, that approximates the association between the paired data.

A trend line is a good model of a data set if:
- There is approximately the same number of data points above and below the trend line. Many of the points are about the same distance on either side of the line.
- Most of the data points are close to the trend line (strong association).

Use the scatter plot and the information in the table to determine which trend line is the best model of the data.

Record the answers to Exercises 1–3 in the table.

1. How many data points lie on the line?

2. How many points are above the line?

3. How many points are below the line?

4. Compare the trend lines using the information in the table. Which trend line is a better model of the relationship and what is the relationship? Explain.

On the Back!

5. Which trend line is a better model of the relationship indicated by the scatter plot? Explain.
Read the problem below. Then answer the questions to understand the problem.

The scatter plot shows the maximum water depth, in inches, of tanks in a pet store and the time it takes each tank to drain. Does the graph show a linear or a nonlinear association? If linear, is the association positive or negative?

1. Underline the two questions that you need to answer.

2. What does each point of the graph represent?

3. How do you decide if an association is linear or nonlinear?

4. A linear association can be positive or negative. How can you use a trend line to determine whether the association is positive or negative?

5. How do you distinguish between a positive linear association and a negative linear association on a scatter plot?
Refer to the diagrams. Use each of these words or phrases once to complete the sentences.

<table>
<thead>
<tr>
<th>linear association</th>
<th>negative</th>
<th>no association</th>
</tr>
</thead>
<tbody>
<tr>
<td>nonlinear association</td>
<td>positive</td>
<td>strong</td>
</tr>
<tr>
<td>trend line</td>
<td>weak</td>
<td></td>
</tr>
</tbody>
</table>

1. You can draw a __________________ for data on a scatter plot when points have a _____________________.

2. Points that cluster closely along a trend line with a slope that rises from left to right have a linear association that is ____________________ and _____________________.

3. Points that are less close to a trend line with a slope that falls from left to right have a linear association that is ____________________ and _____________________.

4. Points that are spread out without a pattern in the coordinate plane have _____________________.

5. Points that cluster into a curved shape in the coordinate plane have a _____________________.

18
The scatter plot shows the amount of time customers use a newly purchased exercise bike over several weeks. The equation of the trend line is \( y = -0.5x + 8 \). Predict the length of time a customer uses the bike 6 weeks after buying it.

\[
y = -0.5x + 8 \\
y = -0.5(6) + 8 \\
y = 5
\]

Six weeks after buying an exercise bike, a customer is likely to ride it about 5 hours per week.

Andy made a scatter plot comparing minutes he played and points he scored in last season’s basketball games. The equation of the trend line, rounded to the nearest tenth, is \( y = 0.7x + 1.7 \). Predict how many points Andy might have scored if he had played 20 minutes.

1. What is the given \( x \)-value that can be used to make the prediction?

2. Show the \( x \)-value substituted into the equation of the trend line. Then solve the equation and round the answer to the nearest whole number.

3. Predict how many points Andy might have scored if he played 12 minutes. Round the answer to the nearest whole number.

On the Back!

4. Jacob made a scatter plot showing the number of hours students watched TV the night before a test and their test scores. The equation of the trend line is \( y = -6x + 89 \). Predict the score of a student who watched 2 hours of television the night before a test.
Read the problem below. Then answer the questions to understand the problem and connect it to the graph.

Ten trees in a pine grove were measured, and points relating the height of each tree to its circumference are shown in the scatter plot. Predict the height of a tree that has a circumference of 25 inches.

1. In what units is the answer?

2. What is a linear model for a scatter plot?

3. Highlight the equation in the graph. What does this equation represent?

4. On the graph, underline the words that describe the quantity represented by the variable $x$ in the equation. Circle the words that describe the quantity represented by the variable $y$ in the equation.

5. How can you use the equation of the trend line to solve the problem?

6. How can you use the graph of the trend line to solve the problem?
Use the list below and the graph to complete the sentences.

<table>
<thead>
<tr>
<th>equation</th>
<th>trend line</th>
<th>scatter plot</th>
</tr>
</thead>
<tbody>
<tr>
<td>slope</td>
<td>x-value</td>
<td>y-intercept</td>
</tr>
<tr>
<td></td>
<td>y-value</td>
<td></td>
</tr>
</tbody>
</table>

1. A graph in the coordinate plane that shows the relationship between two sets of data is a _____________.

2. The ____________ of the ____________ on the scatter plot is the point (0, 0).

3. The ____________ of the trend line is 5.

4. The ____________ of the trend line is $y = 5x$.

5. When the ____________ is 50, the corresponding ____________ is 10.
Associations in Categorical Data

This week your student will use two-way tables. Two-way tables are a way of comparing two variables. For example, this table shows the results of a study of the relation between meditation and state of mind of athletes before a track meet.

<table>
<thead>
<tr>
<th></th>
<th>meditated</th>
<th>did not meditate</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>calm</td>
<td>45</td>
<td>8</td>
<td>53</td>
</tr>
<tr>
<td>agitated</td>
<td>23</td>
<td>21</td>
<td>44</td>
</tr>
<tr>
<td>total</td>
<td>68</td>
<td>29</td>
<td>97</td>
</tr>
</tbody>
</table>

23 of the people who meditated were agitated, while 21 of the people who did not meditate were agitated. Does this mean that meditation has no impact or even a slight negative association with mood? Probably not. When we look for associations between variables it can be more informative to know the percentages in each category, like this:

<table>
<thead>
<tr>
<th></th>
<th>meditated</th>
<th>did not meditate</th>
</tr>
</thead>
<tbody>
<tr>
<td>calm</td>
<td>66%</td>
<td>28%</td>
</tr>
<tr>
<td>agitated</td>
<td>34%</td>
<td>72%</td>
</tr>
<tr>
<td>total</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Of the people who meditated, 66% were calm, and 34% were agitated. When we compare that to the percentages for people who did not meditate, we can now see more easily that the group of people who meditated has a lower percentage of athletes who are agitated. The percentages in this table are called relative frequencies.
Here is a task to try with your student:

The following table contains data about whether people in various age groups use their cell phone as their main alarm clock.

<table>
<thead>
<tr>
<th></th>
<th>use cell phone as alarm</th>
<th>do not use cell phone as alarm</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 to 29 years old</td>
<td>47</td>
<td>16</td>
<td>63</td>
</tr>
<tr>
<td>30 to 49 years old</td>
<td>66</td>
<td>23</td>
<td>87</td>
</tr>
<tr>
<td>50+ years old</td>
<td>31</td>
<td>39</td>
<td>70</td>
</tr>
<tr>
<td>total</td>
<td>144</td>
<td>78</td>
<td>220</td>
</tr>
</tbody>
</table>

1. Fill in the blanks in the table below with the relative frequencies for each row. These will tell us the percentage of people in each age group who use their phone as an alarm.

<table>
<thead>
<tr>
<th></th>
<th>use cell phone as alarm</th>
<th>do not use cell phone as alarm</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 to 29 years old</td>
<td>75%, since $\frac{47}{63} = 0.75$</td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>30 to 49 years old</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50+ years old</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Comparing just the 18 to 29 year olds and the 30 to 49 year olds, is there an association between cell phone alarm use and age?

3. Comparing the two youngest age brackets with the 50+ age bracket, is there an association between cell phone alarm use and age?
Of the 30 students in Alex’s class, 7 boys and 6 girls have one or more pets, while 7 boys and 10 girls do not have any pets. The two-way frequency table displays the relationship between the paired categorical data.

<table>
<thead>
<tr>
<th>Own Pets</th>
<th>Students</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td>Yes</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>No</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>16</td>
</tr>
</tbody>
</table>

Shauna asked several seventh-grade and eighth-grade students whether they participated in after-school sports.

How can you display Shauna’s data in a two-way frequency table?

<table>
<thead>
<tr>
<th>7th Grade</th>
<th>8th Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 yes</td>
<td>26 yes</td>
</tr>
<tr>
<td>12 no</td>
<td>22 no</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Seventh Grade</th>
<th>Eighth Grade</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Write the column category in the box at the top of the table. Write the row category in the box at the left of the table.

2. Write the data Shauna collected in the appropriate cells of the table.

3. Find the totals for each row and column and write them in the table.

On the Back!

4. In the winter, Rodney asked his classmates whether they walked to school or were driven. He asked the same question again in the spring. What categories could Rodney use to display his data in a two-way frequency table?
Read the problem below. Then answer the questions to help you connect the problem to the two-way frequency table.

A survey asked middle school and high school students whether they prefer action movies or comedies. Does the data in the two-way frequency table support the following statement? Explain.

<table>
<thead>
<tr>
<th>Students</th>
<th>Movie Preference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Action</td>
</tr>
<tr>
<td>Middle School</td>
<td>24</td>
</tr>
<tr>
<td>High School</td>
<td>65</td>
</tr>
<tr>
<td>Total</td>
<td>89</td>
</tr>
</tbody>
</table>

1. Highlight the question you need to answer.

2. What category is represented by the rows of the table?

3. What category is represented by the columns of the table?

4. Circle the cell that contains the number 24. What does this number represent for the survey?

5. Underline the words in the statement at the top of the page that tell you which cells to look at in order to answer the question.

6. Highlight the cells in the table that contain the information you need to answer the question, and then answer the question.
Name

Darcy asked people on her street and at school whether they preferred cats or dogs. The two-way frequency table displays her data.

To make a total two-way relative frequency table, write the ratio of each data value to the total of the entire data set, 50. Express each ratio as a percent.

<table>
<thead>
<tr>
<th>Animal Preferred</th>
<th>People</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>On Street</td>
</tr>
<tr>
<td>Cats</td>
<td>9</td>
</tr>
<tr>
<td>Dogs</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Animal Preferred</th>
<th>People</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>On Street</td>
</tr>
<tr>
<td>Cats</td>
<td>18%</td>
</tr>
<tr>
<td>Dogs</td>
<td>22%</td>
</tr>
<tr>
<td>Total</td>
<td>40%</td>
</tr>
</tbody>
</table>

The two-way frequency table shows where the parents and teenagers surveyed buy most of their music. Make a total two-way relative frequency table of the data.

1. Complete the equation.

\[
\frac{\text{number of parents who buy in stores}}{\text{total number of people surveyed}} = \square \times 100\% = \square \%
\]

2. Complete to make a total two-way frequency table.

<table>
<thead>
<tr>
<th>Place to Buy Music</th>
<th>People</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parents</td>
</tr>
<tr>
<td>Store</td>
<td>%</td>
</tr>
<tr>
<td>Internet</td>
<td>%</td>
</tr>
<tr>
<td>Total</td>
<td>%</td>
</tr>
</tbody>
</table>

On the Back!

3. Jonah asked a total of 60 students in grades 7 and 8, half of which were in grade 8, about their primary home language. Eighteen seventh-graders answered “English.” In a total two-way relative frequency table, what is the relative frequency for these seventh-graders?
Name

Read the problem below. Then answer the questions to help you connect the problem to the two-way relative frequency table.

The two-way relative frequency table shows the results of a survey in which middle school and high school students were asked whether they prefer indoor or outdoor fitness activities. Which type of activity is more popular among all of the students surveyed?

<table>
<thead>
<tr>
<th>Students</th>
<th>Activity Preference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Indoor</td>
</tr>
<tr>
<td>Middle School</td>
<td>26%</td>
</tr>
<tr>
<td>High School</td>
<td>15%</td>
</tr>
<tr>
<td>Total</td>
<td>41%</td>
</tr>
</tbody>
</table>

1. Underline the question that you need to answer.

2. What does it mean for one type of activity to be more popular than the other?

3. The table is a total two-way relative frequency table. What does this table show?

4. Does looking at the individual cells for the middle school and high school percentages help you answer the question? Explain.

5. Highlight the cells in the table that contain the data you must compare to answer the question. Explain.
Use each of these words once to complete the sentences.

<table>
<thead>
<tr>
<th>column</th>
<th>relative frequency</th>
<th>row</th>
<th>total</th>
</tr>
</thead>
</table>

1. The ratio of the number of data in each category to the total number of data items, expressed as a fraction, decimal, or percent, is a __________ table.

2. In a __________ two-way relative frequency table, the percents in each row add up to 100%.

3. A __________ two-way relative frequency table gives the percent of the population that is in each group.

4. In a __________ two-way relative frequency table, the percents in each column add up to 100%.

Use the two-way frequency table on the right to answer the following questions.

<table>
<thead>
<tr>
<th>Students</th>
<th>Music Preference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rap</td>
</tr>
<tr>
<td>Middle School</td>
<td>45</td>
</tr>
<tr>
<td>High School</td>
<td>200</td>
</tr>
<tr>
<td>Total</td>
<td>245</td>
</tr>
</tbody>
</table>

5. To make a two-way relative frequency table, what number is the divisor for finding the percent for middle school students/rap?

6. To make a two-way relative frequency table by columns, what number is the divisor for finding the percent for middle school students/rap?

7. To make a two-way relative frequency table by rows, what number is the divisor for finding the percent for middle school students/rap?
A two-way relative frequency table by row can be used to compare data in two different rows, and a two-way relative frequency table by column can be used to compare data in two different columns.

Lena asked 120 middle school and high school students whether they prefer art or English. Her data is in the table on the right.

<table>
<thead>
<tr>
<th>Subject Preference</th>
<th>Art</th>
<th>English</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle School</td>
<td>33</td>
<td>37</td>
<td>70</td>
</tr>
<tr>
<td>High School</td>
<td>11</td>
<td>39</td>
<td>50</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
<td>76</td>
<td>120</td>
</tr>
</tbody>
</table>

1. Create a two-way relative frequency table by row and a two-way relative frequency table by column for Lena's data. Round to the nearest percent.

2. Describe the comparisons you can make using the two-way relative frequency table by row.

3. Describe the comparisons you can make using the two-way relative frequency table by column.
Answer Keys
1. Which point is located at (2, −5)?

- Point A
- Point B
- Point C
- Point D

2. What is the slope of the line that passes through the points (−2, 2) and (13, −7)?

- $-1.67$
- $-0.6$
- $0.6$
- $1.67$

3. Ivy graphs how much money she earns for hours of babysitting. She finds that the data tends to be linear and draws a line that passes through the points (2, 17) and (5, 42.50). About how much does Ivy earn per hour?

- $8.50$
- $25.50$
- $17$
- $42.50$

4. What is the equation of a line that passes through the points (−3, 4) and (2, 8)?

- $y = 0.8x + 5$
- $y = 1.25x + 6.75$
- $y = 0.8x + 6.4$
- $y = 0.8x − 8$

5. Which statement is true about the graph below? Select all that apply.

- The graph is nonlinear.
- The function increases at the same rate.
- The rate decreases after $x = 2$.
- The graph is a function.
- The graph is increasing in two intervals.

6. In a survey, 7 out of 8 people preferred cooking to washing dishes. How would you write this ratio as a percent?

- 7.8%
- 12.5%
- 87.5%
- 114%
7. Find the equation of the line shown below.

\[ y = -0.2x + 2 \]  
\[ y = -5x + 2 \]  
\[ y = 0.2x + 5 \]  
\[ y = 5x + 2 \]

8. A taxi company charges the rates shown in the following table.

<table>
<thead>
<tr>
<th>Distance (mi)</th>
<th>Fare ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>13.50</td>
</tr>
<tr>
<td>15</td>
<td>33.75</td>
</tr>
<tr>
<td>22</td>
<td>49.50</td>
</tr>
</tbody>
</table>

What would the company charge for a 10-mile ride?

A. $15.80  
B. $18.10  
C. $19.00  
D. $22.50

9. Which statement is true?

A. If a relationship is non-linear, it is not a function.  
B. A graph of a curve is linear.  
C. A graph that shows a constant rate of change is linear.  
D. A non-linear relationship has a constant slope.

10. Describe what is happening in the graph below.

A. The function is steady, and then it increases.  
B. The function decreases sharply, and then it stays the same.  
C. The function increases a little, and then it decreases sharply.  
D. The function stays constant, and then it decreases sharply.

11. A water tank fills as shown in the graph below.

What is the slope of the line?

A. \( \frac{1}{3} \)  
B. \( \frac{2}{3} \)  
C. \( \frac{3}{2} \)  
D. 3
Review What You Know!

**Vocabulary**

- Choose the best term from the box to complete each definition.
- 1. **Slope** is the change in y divided by the change in x.
- 2. A relationship where for every x units of one quantity there are y units of another quantity is a **ratio**.
- 3. The **x-axis** is the horizontal line in a coordinate plane.
- 4. The **y-axis** is the vertical line in a coordinate plane.

**Graphing Points**

Graph and label each point on the coordinate plane.

- 5. (-2, 4)
- 6. (0, 3)
- 7. (3, -1)
- 8. (-4, -3)

**Finding Slope**

Find the slope between each pair of points.

- 9. (4, 6) and (-2, 8) \(-\frac{1}{3}\)
- 10. (-1, 3) and (5, 9) \(\frac{1}{4}\)
- 11. (5, -1) and (-3, -7) \(\frac{2}{4}\)

**Writing Fractions as Percents**

12. Explain how to write \(\frac{36}{60}\) as a percent.

Sample answer: Divide 36 by 60: \(36 \div 60 = 0.6\); Multiply by 100: \(0.6 \times 100 = 60\); Add a percent symbol: 60%.
Solution to Adult/Student task

1. There are two points that describe gas usage for 70-degree days. On one of those days, the building used a little less than 4,000 therms of gas. On the other, the building used a little more than 6,000 therms.

2. Since less gas is used on warmer days, there is a negative association.

3. Following the trend in the graph, the building would likely use about 1,800 therms on a 78-degree day. You may draw in a line as in the dog and car scatter plots to help see this.
A scatter plot is a graph in the coordinate plane that shows the relationship between two sets of data.

The data in the table below can be written as ordered pairs: \((8, 0), (12, 12), (14, 20),\) and \((16, 28)\). The scatter plot shows the ordered pairs on the graph.

<table>
<thead>
<tr>
<th>Text Messages Sent Today</th>
<th>Number of Text Messages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

Paul recorded several of his friends’ scores on the latest science test and the number of minutes they spent reading the previous weekend. How can Paul construct a scatter plot of his data?

1. A scatter plot has been started at the right. Add a title for the scatter plot and a label for the \(x\)-axis.

   **See graph.**

2. Write the data in the table as ordered pairs.

   \((62, 75), (63, 65), (64, 65), (65, 90), (66, 70)\)

3. Complete the scatter plot by graphing your ordered pairs from Exercise 2.

   **See graph.**

4. Is there a relationship between the time students spent reading and their science test scores?

   **The scatter plot shows no association between the time spent reading and science test scores.**

**On the Back!**

5. After 5 minutes, Pablo jumped 14.6 feet. After 10 minutes, he jumped 14.1 feet. What are the two ordered pairs?

   \((5, 14.6), (10, 14.1)\)
Name ____________________________

Read the problem and connect it to the graph.

The scatter plot shows the relationship between the age of the students in a club and the number of hours they participated in a dance-a-thon to raise money for their club during one month. Identify the cluster in the scatter plot and tell what it means. Then identify any gaps or outliers.

1. Underline the words in the problem that describe what a correct answer will contain.

   **Check students’ work.**

2. On the scatter plot, underline the words that describe the quantity represented by the $x$-values of each data point. Circle the words that describe the quantity represented by the $y$-values.

   **Check students’ work.**

3. Choose any point from the scatter plot and write its coordinates. Describe the meaning of this point.

   **Sample answer:** (16, 8); A 16-year-old club member spent 8 hours at the dance-a-thon to raise money for the club.

4. What is a cluster on a scatter plot? What is a gap?

   A cluster is a group of points that lie close together.

   A gap is an area on the graph that contains no data.

5. What is an outlier? How can you use a scatter plot to identify an outlier?

   An outlier is a data point that is set off from the rest of the data set. To find an outlier, look for any data point that is far from the other data points.

6. Circle the outlier on the scatter plot.

   **Check students’ work.** The outlier is at (32, 18).
Use the list below to complete the sentences. Use each term once.

<table>
<thead>
<tr>
<th>ordered pair</th>
<th>measurement data</th>
<th>scatter plot</th>
</tr>
</thead>
<tbody>
<tr>
<td>cluster</td>
<td>gap</td>
<td>outlier</td>
</tr>
</tbody>
</table>

The graph shows the number of customers at a car wash for various outdoor temperatures.

1. The graph is a **scatter plot** that uses points to display the relationship between the number of customers and the temperature.

2. The number of customers and the temperature represented by each point are paired **measurement data**.

3. Each point in the scatter plot can be represented by a(n) **ordered pair**.

4. The point (42, 2) does not seem to fit with the rest of the graph. It is a(n) **outlier**.

5. The graph shows that from the point (17, 8) to the point (25, 12) there is a **cluster**.

6. From the point (25, 12) to the point (40, 16) there is a **gap**.
A trend line is a line on a scatter plot, drawn through the middle of the plotted points, that approximates the association between the paired data.

A trend line is a good model of a data set if:

- There is approximately the same number of data points above and below the trend line. Many of the points are about the same distance on either side of the line.
- Most of the data points are close to the trend line (strong association).

Use the scatter plot and the information in the table to determine which trend line is the best model of the data.

Record the answers to Exercises 1–3 in the table.

1. How many data points lie on the line?
2. How many points are above the line?
3. How many points are below the line?

4. Compare the trend lines using the information in the table. Which trend line is a better model of the relationship and what is the relationship? Explain.

The solid line does a better job of going through the middle of the plotted points. There is a weak positive association.

On the Back!

5. Which trend line is a better model of the relationship indicated by the scatter plot? Explain.

The dashed line does a better job of modeling the relationship because the data points are generally closer to the dashed line.
Read the problem below. Then answer the questions to understand the problem.

The scatter plot shows the maximum water depth, in inches, of tanks in a pet store and the time it takes each tank to drain. Does the graph show a linear or a nonlinear association? If linear, is the association positive or negative?

1. Underline the two questions that you need to answer. **Check students’ work.**

2. What does each point of the graph represent? **Each point represents the time needed in minutes for a tank with a given maximum depth in inches to drain.**

3. How do you decide if an association is linear or nonlinear? **The points in a linear association can be approximated by a line, while a straight line cannot be used to approximate a nonlinear association.**

4. A linear association can be positive or negative. How can you use a trend line to determine whether the association is positive or negative? **If the trend line has a positive slope, the association is positive. If the slope is negative, the association is negative.**

5. How do you distinguish between a positive linear association and a negative linear association on a scatter plot? **Sample answer: A positive linear association has a grouping of points that rises from left to right, whereas a negative linear association has points that fall from left to right.**
Refer to the diagrams. Use each of these words or phrases once to complete the sentences.

- Linear association
- Negative
- No association
- Nonlinear association
- Positive
- Strong
- Trend line
- Weak

1. You can draw a **trend line** for data on a scatter plot when points have a linear association.

2. Points that cluster closely along a trend line with a slope that rises from left to right have a linear association that is **strong** and **positive**.

3. Points that are less close to a trend line with a slope that falls from left to right have a linear association that is **weak** and **negative**.

4. Points that are spread out without a pattern in the coordinate plane have **no association**.

5. Points that cluster into a curved shape in the coordinate plane have a **nonlinear association**.
The scatter plot shows the amount of time customers use a newly purchased exercise bike over several weeks. The equation of the trend line is \( y = -0.5x + 8 \). Predict the length of time a customer uses the bike 6 weeks after buying it.

\[
\begin{align*}
y &= -0.5x + 8 \\
y &= -0.5(6) + 8 \\
y &= 5
\end{align*}
\]

Six weeks after buying an exercise bike, a customer is likely to ride it about 5 hours per week.

Andy made a scatter plot comparing minutes he played and points he scored in last season’s basketball games. The equation of the trend line, rounded to the nearest tenth, is \( y = 0.7x + 1.7 \). Predict how many points Andy might have scored if he had played 20 minutes.

1. What is the given \( x \)-value that can be used to make the prediction?

20

2. Show the \( x \)-value substituted into the equation of the trend line. Then solve the equation and round the answer to the nearest whole number.

Sample answer: \( y = 0.7(20) + 1.7 = 15.7 \).
This rounds to 16 points.

3. Predict how many points Andy might have scored if he played 12 minutes. Round the answer to the nearest whole number.

10 points

On the Back!

4. Jacob made a scatter plot showing the number of hours students watched TV the night before a test and their test scores. The equation of the trend line is \( y = -6x + 89 \). Predict the score of a student who watched 2 hours of television the night before a test.

77
Read the problem below. Then answer the questions to understand the problem and connect it to the graph.

Ten trees in a pine grove were measured, and points relating the height of each tree to its circumference are shown in the scatter plot. Predict the height of a tree that has a circumference of 25 inches.

1. In what units is the answer? **feet**

2. What is a linear model for a scatter plot? **A trend line**

3. Highlight the equation in the graph. What does this equation represent? **Check students’ work. It is the equation of the trend line, which is relating circumference of a pine to its height.**

4. On the graph, underline the words that describe the quantity represented by the variable \(x\) in the equation. Circle the words that describe the quantity represented by the variable \(y\) in the equation. **Check students’ work.**

5. How can you use the equation of the trend line to solve the problem? **Substitute 25 for \(x\) in the equation to find the height, \(y\).**

6. How can you use the graph of the trend line to solve the problem? **Move right along the \(x\)-axis to find 25 inches, and then move up to find the corresponding \(y\)-value.**
Use the list below and the graph to complete the sentences.

<table>
<thead>
<tr>
<th>equation</th>
<th>trend line</th>
<th>scatter plot</th>
</tr>
</thead>
<tbody>
<tr>
<td>slope</td>
<td>x-value</td>
<td>y-intercept</td>
</tr>
<tr>
<td></td>
<td></td>
<td>y-value</td>
</tr>
</tbody>
</table>

1. A graph in the coordinate plane that shows the relationship between two sets of data is a **scatter plot**.

2. The **y-intercept** of the **trend line** on the scatter plot is the point (0, 0).

3. The **slope** of the trend line is 5.

4. The **equation** of the trend line is **y = 5x**.

5. When the **y-value** is 50, the corresponding **x-value** is 10.
Solution to Adult/Student task

Solution:

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Use cell phone as alarm</th>
<th>Do not use cell phone as alarm</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 to 29 years old</td>
<td>75%, since ( \frac{47}{63} = 0.75 )</td>
<td>25%, since ( \frac{16}{63} = 0.25 )</td>
<td>100%</td>
</tr>
<tr>
<td>30 to 49 years old</td>
<td>76%, since ( \frac{66}{87} = 0.76 )</td>
<td>24%, since ( \frac{23}{87} = 0.24 )</td>
<td>100%</td>
</tr>
<tr>
<td>50+ years old</td>
<td>44%, since ( \frac{31}{70} = 0.44 )</td>
<td>56%, since ( \frac{39}{70} = 0.56 )</td>
<td>100%</td>
</tr>
</tbody>
</table>

2. No: the relative frequencies are very similar.

3. Yes: using a cell phone as an alarm is associated with being in the younger age brackets. About 75% of 18 to 29 and 30 to 49-year olds use their cell phone as an alarm, but only 44% of people 50 years or older do.
Of the 30 students in Alex’s class, 7 boys and 6 girls have one or more pets, while 7 boys and 10 girls do not have any pets.

The two-way frequency table displays the relationship between the paired categorical data.

<table>
<thead>
<tr>
<th>Own Pets</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
</tr>
<tr>
<td>Yes</td>
<td>7</td>
</tr>
<tr>
<td>No</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
</tr>
</tbody>
</table>

Shauna asked several seventh-grade and eighth-grade students whether they participated in after-school sports.

How can you display Shauna’s data in a two-way frequency table?

<table>
<thead>
<tr>
<th>Play Sports</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Seventh Grade</td>
</tr>
<tr>
<td>Yes</td>
<td>18</td>
</tr>
<tr>
<td>No</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
</tr>
</tbody>
</table>

1. Write the column category in the box at the top of the table.
   Write the row category in the box at the left of the table.
   For Exercises 1–3, see completed table above.

2. Write the data Shauna collected in the appropriate cells of the table.

3. Find the totals for each row and column and write them in the table.

On the Back!

4. In the winter, Rodney asked his classmates whether they walked to school or were driven. He asked the same question again in the spring. What categories could Rodney use to display his data in a two-way frequency table?
   Season, Walk or Ride to School
Read the problem below. Then answer the questions to help you connect the problem to the two-way frequency table.

A survey asked middle school and high school students whether they prefer action movies or comedies. Does the data in the two-way frequency table support the following statement? Explain.

There are more middle school students who prefer comedies than there are high school students who prefer action movies.

<table>
<thead>
<tr>
<th>Students</th>
<th>Movie Preference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Action</td>
</tr>
<tr>
<td>Middle School</td>
<td>24</td>
</tr>
<tr>
<td>High School</td>
<td>65</td>
</tr>
<tr>
<td>Total</td>
<td>89</td>
</tr>
</tbody>
</table>

1. Highlight the question you need to answer.
   **Check students’ work.**

2. What category is represented by the rows of the table?
   **Students: Middle School or High School**

3. What category is represented by the columns of the table?
   **Movie Preference: Action or Comedy**

4. Circle the cell that contains the number 24. What does this number represent for the survey?
   **Check students’ work. This number represents the 24 middle school students surveyed who prefer action movies.**

5. Underline the words in the statement at the top of the page that tell you which cells to look at in order to answer the question.
   **Check students’ work.**

6. Highlight the cells in the table that contain the information you need to answer the question, and then answer the question.
   **Check students’ work; No, there are not more middle school students who prefer comedies than high school students who prefer action movies.**
Name __________________________

Darcy asked people on her street and at school whether they preferred cats or dogs. The two-way frequency table displays her data.

To make a total two-way relative frequency table, write the ratio of each data value to the total of the entire data set, 50. Express each ratio as a percent.

<table>
<thead>
<tr>
<th>Animal Preferred</th>
<th>People</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>On Street</td>
<td>At School</td>
</tr>
<tr>
<td>Cats</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td>Dogs</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>30</td>
</tr>
</tbody>
</table>

The two-way frequency table shows where the parents and teenagers surveyed buy most of their music. Make a total two-way relative frequency table of the data.

1. Complete the equation.

\[
\frac{\text{number of parents who buy in stores}}{\text{total number of people surveyed}} = \frac{14}{40} \cdot 100\% = 35\%
\]

2. Complete to make a total two-way frequency table.

<table>
<thead>
<tr>
<th>Place to Buy Music</th>
<th>People</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parents</td>
</tr>
<tr>
<td>Store</td>
<td>35 %</td>
</tr>
<tr>
<td>Internet</td>
<td>12.5 %</td>
</tr>
<tr>
<td>Total</td>
<td>47.5 %</td>
</tr>
</tbody>
</table>

On the Back!

3. Jonah asked a total of 60 students in grades 7 and 8, half of which were in grade 8, about their primary home language. Eighteen seventh-graders answered “English.” In a total two-way relative frequency table, what is the relative frequency for these seventh-graders? 30\%
Name ________________________________

Read the problem below. Then answer the questions to help you connect the problem to the two-way relative frequency table.

The two-way relative frequency table shows the results of a survey in which middle school and high school students were asked whether they prefer indoor or outdoor fitness activities. Which type of activity is more popular among all of the students surveyed?

<table>
<thead>
<tr>
<th>Students</th>
<th>Activity Preference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Indoor</td>
</tr>
<tr>
<td>Middle School</td>
<td>26%</td>
</tr>
<tr>
<td>High School</td>
<td>15%</td>
</tr>
<tr>
<td>Total</td>
<td>41%</td>
</tr>
</tbody>
</table>

1. Underline the question that you need to answer.

Check students’ work.

2. What does it mean for one type of activity to be more popular than the other?

One type of activity is more popular if more of the students surveyed prefer that type of activity than any other activity.

3. The table is a total two-way relative frequency table. What does this table show?

The table shows for each set of paired data the percent of the total group that is represented by the cell.

4. Does looking at the individual cells for the middle school and high school percentages help you answer the question? Explain.

No; Sample answer: The individual cells in the table give percentages related to each school level for each activity, but not the total for both grade levels.

5. Highlight the cells in the table that contain the data you must compare to answer the question. Explain.

Check students’ work. To find the more popular activity you must compare the total percent who liked indoor versus outdoor activities.
Use each of these words once to complete the sentences.

- column
- relative frequency
- row
- total

1. The ratio of the number of data in each category to the total number of data items, expressed as a fraction, decimal, or percent, is a **relative frequency** table.

2. In a **row** two-way relative frequency table, the percents in each row add up to 100%.

3. A **total** two-way relative frequency table gives the percent of the population that is in each group.

4. In a **column** two-way relative frequency table, the percents in each column add up to 100%.

Use the two-way frequency table on the right to answer the following questions.

<table>
<thead>
<tr>
<th>Students</th>
<th>Music Preference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rap</td>
</tr>
<tr>
<td>Middle School</td>
<td>45</td>
</tr>
<tr>
<td>High School</td>
<td>200</td>
</tr>
<tr>
<td>Total</td>
<td>245</td>
</tr>
</tbody>
</table>

5. To make a two-way relative frequency table, what number is the divisor for finding the percent for middle school students/rap? **550**

6. To make a two-way relative frequency table by columns, what number is the divisor for finding the percent for middle school students/rap? **245**

7. To make a two-way relative frequency table by rows, what number is the divisor for finding the percent for middle school students/rap? **300**
A two-way relative frequency table by row can be used to compare data in two different rows, and a two-way relative frequency table by column can be used to compare data in two different columns.

Lena asked 120 middle school and high school students whether they prefer art or English. Her data is in the table on the right.

<table>
<thead>
<tr>
<th>Students</th>
<th>Subject Preference</th>
<th>Art</th>
<th>English</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle School</td>
<td>47%</td>
<td>53%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>High School</td>
<td>22%</td>
<td>78%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>37%</td>
<td>63%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

1. Create a two-way relative frequency table by row and a two-way relative frequency table by column for Lena’s data. Round to the nearest percent.

<table>
<thead>
<tr>
<th>Students</th>
<th>Subject Preference</th>
<th>Art</th>
<th>English</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle School</td>
<td>75%</td>
<td>49%</td>
<td>58%</td>
<td></td>
</tr>
<tr>
<td>High School</td>
<td>25%</td>
<td>51%</td>
<td>42%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

2. Describe the comparisons you can make using the two-way relative frequency table by row.

Sample answer: The two-way relative frequency table by row can be used to compare subject preferences for students who are in the middle school and for students who are in the high school. You can compare the total row to find the overall subject preference for all the students.

3. Describe the comparisons you can make using the two-way relative frequency table by column.

Sample answer: The two-way relative frequency table by column can be used to compare the percent of students who prefer art in the middle school with the percent of students who prefer art in the high school. Similarly, the preference between the two schools can be compared for English. You can also compare the percents in the total column for the two school levels to see that there were more respondents in the middle school.