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The Mathematics in Context Development Team

Development 2003–2005

Models You Can Count On was developed by Mieke Abels and Monica Wijers. It was adapted for use in American schools by Margaret A. Pligge and Teri Hedges.

Wisconsin Center for Education

Research Staff

Thomas A. Romberg  
Director

Gail Burriill  
Editorial Coordinator

Freudenthal Institute Staff

David C. Webb  
Coordinator

Margaret A. Pligge  
Editorial Coordinator

Jan de Lange  
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Content Coordinator

Truus Dekker  
Coordinator

Monica Wijers  
Content Coordinator

Project Staff

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Jill Vettrus  

Jean Krusi  

Elaine McGrath
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Dear Student,

Welcome to the unit *Models You Can Count On*. Math students today can no longer be comfortable merely doing pencil and paper computations. Advances in technology make it more important for you to do more than perform accurate computations. Today, it is important for you to make sense of number operations. You need to be able solve problems with the use of a calculator, confident that your result is accurate. When shopping in a store, you need to be able to estimate on the spot to make sure you are getting the best deal and that the cash register is working properly.

In this unit, you will look at different number models to help you improve your understanding of how numbers work. You will examine various recipes that could be used to feed large groups of people. You will consider how students can share garden plots. You will observe computer screens during a program installation. You will make sense of signs along a highway or bike trail. In each situation, a special model will help you make sense of the situation. You will learn to use these models and count on them to solve any problem!

We hope you enjoy this unit.

Sincerely,

*The Mathematics in Context Development Team*
Today, both men and women prepare food in the kitchen. Have you ever worked in the kitchen? Think about your favorite recipe.

1. Make a list of the ingredients you need for this recipe. What else do you need to prepare your recipe?

Ms. Freeman wants to make a treat for her class. This is her favorite recipe. It makes 50 Cheese Puffles.

Cheese Puffles (makes 50)

Ingredients:
- 2 cups wheat flour
- 1 cup unsalted butter
- 2 cups grated cheese
- 4 cups rice cereal

Directions: Preheat the oven to 400°F. Cream the flour, butter, and cheese together in a large bowl. Add rice cereal and mix into a dough. Shape Puffles into small balls, using your hands. Bake until golden, about 10-15 minutes. Let cool.

There are 25 students in Ms. Freeman’s class.

2. a. How many Cheese Puffles will each student get if Ms. Freeman uses the amounts in the recipe?

b. If she wants each student to have four Cheese Puffles, how can you find out how much of each ingredient she needs?

Ms. Freeman invites her colleague, Ms. Anderson, to help her make the Cheese Puffles. They decide to make enough Puffles to treat the entire sixth grade. There are four sixth-grade classes with about 25 students in each class.

3. How much of each ingredient should they use? Explain.
School Supplies

Jason manages the school store at Springfield Middle School. Students and teachers often purchase various school items from this store.

One of Jason’s responsibilities is to order additional supplies from the Office Supply Store.

Today Jason has to make an order sheet and calculate the costs.

Use **Student Activity Sheet 1** to record your answers to questions 4–6.

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 boxes of rulers</td>
<td>$____</td>
</tr>
<tr>
<td>25 packs of notebooks</td>
<td>$____</td>
</tr>
<tr>
<td>9 boxes of protractors</td>
<td>$____</td>
</tr>
<tr>
<td>5 boxes of red pens</td>
<td>$____</td>
</tr>
<tr>
<td>8 boxes of blue pens</td>
<td>$____</td>
</tr>
</tbody>
</table>

**Total Cost** $____

Jason starts with 6 boxes of rulers. He uses a previous bill to find the cost. The last bill shows:

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 boxes of rulers</td>
<td>$150</td>
</tr>
</tbody>
</table>

4. Find the price for 6 boxes of rulers. Explain how you found the price.

Jason's last order was for 10 packs of notebooks.

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 packs of notebooks</td>
<td>$124</td>
</tr>
</tbody>
</table>

5. Calculate the price for 25 packs of notebooks. Show your calculations.
Here is the rest of the bill.

<table>
<thead>
<tr>
<th>Number of Boxes</th>
<th>Price (in Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 boxes of protractors</td>
<td>$420</td>
</tr>
<tr>
<td>20 boxes of red pens</td>
<td>$240</td>
</tr>
<tr>
<td>10 boxes of blue pens</td>
<td>$120</td>
</tr>
</tbody>
</table>

6. a. Use the information from this bill to calculate the price for nine boxes of protractors. Show your work.

b. Complete the order sheet on **Student Activity Sheet 1**.

Jason uses a **ratio table** to make calculations like the ones in the previous problems. Here is his reasoning and work.

“I know that the price of 20 boxes of red pens is $240. I use this information to set up the labels and the first column of the ratio table. Now I can calculate the price of five boxes of red pens.”

<table>
<thead>
<tr>
<th>Number of Boxes of Red Pens</th>
<th>20</th>
<th>10</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price (in Dollars)</td>
<td>240</td>
<td>120</td>
<td>60</td>
</tr>
</tbody>
</table>
7. a. Explain how Jason found the numbers in the second and third columns.

b. Use the information in Jason’s ratio table to calculate the price of 15 boxes of red pens. Explain how you found your price.

c. Use the ratio table below to calculate the price for 29 boxes of red pens. (You may add more columns if you need them.) Explain how you found the numbers in your columns.

<table>
<thead>
<tr>
<th>Number of Boxes of Red Pens</th>
<th>20</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Price (in dollars)</td>
<td>240</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When using a ratio table, there are many different operations you can use to make the new columns.

8. Name some operations you can use to make new columns in a ratio table. You may want to look back to problem 7.

Packages shipped to the school store contain different amounts of items; for example, one box of protractors contains one dozen protractors.

9. Use Student Activity Sheet 2 to find the number of protractors in 8, 5, and 9 boxes.

a. 8 boxes:

<table>
<thead>
<tr>
<th>Number of Boxes</th>
<th>1</th>
<th>2</th>
<th>4</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Protractors</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How did you find the number of protractors in the last column?

b. 5 boxes:

<table>
<thead>
<tr>
<th>Number of Boxes</th>
<th>1</th>
<th>10</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Protractors</td>
<td>12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How did you find the number of protractors in the last column?

c. 9 boxes:

<table>
<thead>
<tr>
<th>Number of Boxes</th>
<th>1</th>
<th>10</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Protractors</td>
<td>12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How did you find the number of protractors in the last column?
10. Jason ordered a supply of 132 protractors. How many boxes will be shipped? You can use the ratio table on Student Activity Sheet 2.

<table>
<thead>
<tr>
<th>Number of Boxes</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Protractors</td>
<td>12</td>
</tr>
</tbody>
</table>

A math teacher at Springfield Middle School would like to have calculators for her class. The school store offers calculators for $7 each. She asked her sixth-grade students to calculate the total price for 32 calculators. Here are strategies from three of her students.

Romero

<table>
<thead>
<tr>
<th>Number of Calculators</th>
<th>1</th>
<th>2</th>
<th>4</th>
<th>8</th>
<th>16</th>
<th>32</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price (in dollars)</td>
<td>7</td>
<td>14</td>
<td>28</td>
<td>56</td>
<td>112</td>
<td>224</td>
</tr>
</tbody>
</table>

11. Describe the steps Romero used.

Cindy

<table>
<thead>
<tr>
<th>Number of Calculators</th>
<th>1</th>
<th>10</th>
<th>30</th>
<th>32</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price (in dollars)</td>
<td>7</td>
<td>70</td>
<td>210</td>
<td>212</td>
</tr>
</tbody>
</table>

Cindy did something wrong when she filled in the last column.

12. a. Explain how Cindy found the numbers in the last column. Explain why this is not correct.

b. What should the numbers in the last column be?

Sondra

<table>
<thead>
<tr>
<th>Number of Calculators</th>
<th>1</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>2</th>
<th>32</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price (in dollars)</td>
<td>7</td>
<td>70</td>
<td>140</td>
<td>210</td>
<td>14</td>
<td>224</td>
</tr>
</tbody>
</table>

13. Describe the steps Sondra used for her ratio table.
A ratio table is a convenient tool you can use to solve problems. You start with two numbers that are related to each other as a ratio. Then you can use an operation to create a column with new numbers in the table so that they have the same ratio. Using arrows, you can keep track of the operations you used.

Here are operations you can use.

### Doubling or Multiplying by Two

<table>
<thead>
<tr>
<th>packages</th>
<th>1</th>
<th>2</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>pencils</td>
<td>15</td>
<td>30</td>
<td>60</td>
</tr>
</tbody>
</table>

### Halving or Dividing by Two

<table>
<thead>
<tr>
<th>crates</th>
<th>8</th>
<th>4</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>crayons</td>
<td>480</td>
<td>240</td>
<td>120</td>
<td>60</td>
</tr>
</tbody>
</table>

### Times Ten

<table>
<thead>
<tr>
<th>packages</th>
<th>1</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>pencils</td>
<td>15</td>
<td>150</td>
</tr>
</tbody>
</table>

### Multiplying

<table>
<thead>
<tr>
<th>packages</th>
<th>1</th>
<th>2</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>pens</td>
<td>15</td>
<td>30</td>
<td>150</td>
</tr>
</tbody>
</table>

### Dividing

<table>
<thead>
<tr>
<th>crates</th>
<th>500</th>
<th>5</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>markers</td>
<td>2000</td>
<td>20</td>
<td>4</td>
</tr>
</tbody>
</table>

For the two operations below, you would choose two columns in the ratio table and add them together or find the difference.

### Adding Columns

<table>
<thead>
<tr>
<th>packages</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>pencils</td>
<td>15</td>
<td>30</td>
<td>45</td>
</tr>
</tbody>
</table>

### Subtracting Columns

<table>
<thead>
<tr>
<th>packages</th>
<th>1</th>
<th>10</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>pencils</td>
<td>15</td>
<td>150</td>
<td>135</td>
</tr>
</tbody>
</table>
You can use more than one operation in one ratio table. For example, here is Walter’s solution for the problem “How many pencils are in 90 packages?”

### Walter

<table>
<thead>
<tr>
<th>Packages</th>
<th>1</th>
<th>2</th>
<th>4</th>
<th>8</th>
<th>9</th>
<th>90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pencils</td>
<td>15</td>
<td>30</td>
<td>60</td>
<td>120</td>
<td>135</td>
<td>1,350</td>
</tr>
</tbody>
</table>

14. What operations did Walter use? How will he answer the question?

The Office Supply Store where Jason buys the supplies for the school store displays a poster of some products sold.

<table>
<thead>
<tr>
<th>Office Supply Store</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Item</strong></td>
</tr>
<tr>
<td>Bottle of Glue</td>
</tr>
<tr>
<td>Calculator</td>
</tr>
<tr>
<td>Notebook, lined</td>
</tr>
<tr>
<td>Pen: blue, black, or red</td>
</tr>
<tr>
<td>Gel Pen</td>
</tr>
<tr>
<td>Pencil with eraser</td>
</tr>
<tr>
<td>Protractor</td>
</tr>
<tr>
<td>Ruler (30 cm)</td>
</tr>
<tr>
<td>Tape</td>
</tr>
</tbody>
</table>

Jason ordered 720 pens and received 15 boxes. He wants to know how many pens are in each box. He sets up the following ratio table.

<table>
<thead>
<tr>
<th>Boxes</th>
<th>15</th>
<th>......</th>
<th>......</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pens</td>
<td>720</td>
<td>......</td>
<td>......</td>
</tr>
</tbody>
</table>

15. How many pens are in one box? You may copy and use Jason’s ratio table to find the answer.
The Ratio Table

For the school store Jason wants to create notes for single-priced items. He uses a ratio table to calculate the price for one gel pen.

<table>
<thead>
<tr>
<th>Number of Gel Pens</th>
<th>20</th>
<th>10</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price (in dollars)</td>
<td>7</td>
<td>3.50</td>
<td>0.35</td>
</tr>
</tbody>
</table>

16. a. What operations did Jason use in his ratio table?

b. Ahmed buys 3 gel pens. How much does he have to pay for them?

Ms. Anderson wants all of her students in sixth grade to have a lined notebook. She buys the notebooks from the school store and sells them to her students. There are 23 students in her class.

17. Create and use a ratio table to calculate how much Ms. Anderson has to pay for 23 lined notebooks.

Recipe

Play Dough (1 portion)

Ingredients:  
- 2 1/2 cups flour  
- 1/2 cup salt  
- 1 tablespoon food coloring  
- 1/2 cup water  
- 2 tablespoons salad oil  
- powdered alum

Directions:  
- In a large bowl, mix flour, salt, and alum together; set aside.  
- In a medium saucepan, bring water and oil to a boil. Remove from heat and pour over flour mixture.  
- Knead the dough. Color dough by adding a few drops of food coloring. Store in covered container.

Ms. Anderson plans to make play dough for her class. She finds the recipe above on the Internet.
18. a. Copy and use the ratio table below to find out how many cups of flour Ms. Anderson needs in order to make two portions of play dough.

<table>
<thead>
<tr>
<th>Number of Portions</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cups Flour</td>
<td></td>
<td>$2\frac{1}{2}$</td>
</tr>
</tbody>
</table>

b. How many cups of flour does Ms. Anderson need for 11 portions?

Ms. Anderson has a 5-pound bag of flour. She wonders how many cups of flour are in the bag. She looks in a cookbook and finds that one cup of flour weighs 4 ounces (oz). Her bag of flour weighs 80 oz.

19. How many cups of flour are in Ms. Anderson’s bag of flour? You may use the following ratio table.

<table>
<thead>
<tr>
<th>Cups Flour</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (in ounces)</td>
<td></td>
</tr>
</tbody>
</table>

Suppose Ms. Anderson uses the entire bag of flour to make play dough.

20. a. How many portions can she make? You may want to use the ratio tables from problems 18 and 19.

b. How much of each ingredient will she need for this number of portions? You may want to use an extended ratio table like this one. Note that tbsp means “tablespoon” and tsp means “teaspoon.”

<table>
<thead>
<tr>
<th>Number of Portions</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cups Flour</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cup Salt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tbsp Alum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cups Water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tbsp Salad Oil</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A ratio table is a useful tool to organize and solve problems. To set up a ratio table, label each row and set up the first-column ratio.

You can use several operations to make a column with new numbers. Here are some examples of operations you can use.

### Multiplying

<table>
<thead>
<tr>
<th>Servings</th>
<th>1</th>
<th>2</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cups Sugar</td>
<td>$\frac{1}{2}$</td>
<td>1</td>
<td>$\frac{1}{2}$</td>
</tr>
</tbody>
</table>

### Adding Columns

<table>
<thead>
<tr>
<th>Servings</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cups Water</td>
<td>$2\frac{1}{2}$</td>
<td>5</td>
<td>$7\frac{1}{2}$</td>
</tr>
</tbody>
</table>

When using ratio tables, you often use a combination of operations to get the desired result. The examples below show different possibilities using combinations of operations that have the same result.

### Combination of Operations

#### Districts

<table>
<thead>
<tr>
<th>Voters</th>
<th>2500</th>
<th>500</th>
<th>1500</th>
<th>4000</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>6</td>
<td>18</td>
<td>48</td>
<td></td>
</tr>
</tbody>
</table>

#### Districts

<table>
<thead>
<tr>
<th>Voters</th>
<th>2500</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>3</td>
<td>6</td>
<td>12</td>
<td>24</td>
<td>48</td>
<td>30</td>
</tr>
</tbody>
</table>
Check Your Work

Notebooks are shipped with 25 notebooks in one package.

1. How many notebooks are in 16 packages? Show your solution in a ratio table.

<table>
<thead>
<tr>
<th>Number of Packages</th>
<th>Number of Notebooks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Jason ordered 575 notebooks for Springfield Middle School. How many packages will he receive?

3. a. Refer to the Office Supply Store price list on page 7 and write down the prices for black pens, protractors, and rulers.
   b. Use ratio tables to calculate the price of these items: one black pen, one protractor, one ruler.
   c. Calculate the cost for seven of each item.
Kim and Jamila plan to make a special snack for their class of 20 students. They found this recipe.

**Banana Pops** (8 servings)

**Ingredients:**
- 4 just-ripe bananas
- 1 cup topping, such as ground toasted almonds, toasted coconut, or candy sprinkles
- 8 wooden craft sticks
- \( \frac{1}{2} \) cup honey

**Directions:** Spread toppings of your choice on a plate or plates. Peel bananas and cut in half crosswise. Insert a craft stick into each cut end. Pour honey onto a paper plate. Roll the banana in honey until it is fully coated. Roll banana in topping of choice until coated on all sides, pressing with fingers to help topping adhere. Place pops on waxed paper-lined cookie sheet. Serve at once.

4. How much of each ingredient do they need if they make 20 servings?

**For Further Reflection**

Explain why this problem cannot be solved with a ratio table.

Usually Stefanie boils an egg in six minutes. How many minutes does she need to boil four eggs?

Make up a problem that can be solved with a ratio table.
School Garden

Every spring, Springfield Middle School allows groups of students to sign up and maintain garden plots. All garden plots are the same size. Below is a portion of the school garden with seven plots in it. Each group divides a plot into equal pieces for each student.

Inez, Kewan, Tim, and Waya maintain Plot A. They used string to divide their garden plot into four equal pieces.

1. a. Explain how they used string to equally divide Plot A.

   b. Use a fraction to describe what part of the plot each student claims.
Marc, Melinda, and Joyce maintain Plot B. They also want to divide their plot into equal pieces using strips of tape.

Use **Student Activity Sheet 3** for problems 2–4.

2. a. Cut out one length of the paper strip. Use the strip to divide Plot B into three equal parts.

   b. Label each part of Plot B with a fraction.

The other plots will be divided among groups of 5, 6, 2, and 8 students. One plot is unclaimed.

3. a. Use the paper strip to divide Plots C–F into the number of equal pieces indicated.

   b. Label each part with a fraction. Be prepared to explain how you used the strip to divide the plots.

4. Choose a different number of students to share the last garden plot, Plot G. Divide Plot G accordingly.

In problems 2–4 above, you used a paper strip as a kind of measuring strip to make equal parts. You used fractions to describe each part; for example:

\[
\begin{array}{cccc}
\frac{1}{4} & \frac{1}{4} & \frac{1}{4} & \frac{1}{4} \\
\text{Tim} & \text{Waya} & \text{Inez} & \text{Kewan}
\end{array}
\]

Tim, Waya, and Inez share three-fourths of Plot A. A fraction relationship to describe this situation is \( \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{3}{4} \).

5. Use garden Plots B–G to describe five other fraction relationships.

Measuring strips can be used to find parts of a whole.

If you have three parts out of four, you can express this as the fraction \( \frac{3}{4} \) on a **fraction bar**.

\[
\begin{array}{cccc}
0 & \frac{1}{4} & \frac{1}{2} & \frac{3}{4} & 1
\end{array}
\]

6. **Reflect** How are a measuring strip and a fraction bar the same? How are they different?
Students use a supply of rainwater, stored in tanks, to water the garden plots.

The largest tank in the garden holds 400 liters (L) of water. However, during a dry spell, it usually has less than 400 L of water.

The outside of the tank has a gauge that shows the level of the water in the tank.

You can use a gauge like a fraction bar.

7. Here is a drawing of the water gauge on four different days.

<table>
<thead>
<tr>
<th></th>
<th>Monday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>400 L</td>
<td>400 L</td>
<td>400 L</td>
<td>400 L</td>
</tr>
<tr>
<td></td>
<td>200 L</td>
<td>300 L</td>
<td>50 L</td>
<td>80 L</td>
</tr>
<tr>
<td></td>
<td>0 L</td>
<td>0 L</td>
<td>0 L</td>
<td>0 L</td>
</tr>
</tbody>
</table>

On Student Activity Sheet 4, shade each gauge to show the water level indicated for that day.

8. Next to your shading, write the fraction that best describes the water level on each day.

9. Make your own drawing of the gauge on Tuesday. You will need to select the amount of water (in liters) in the tank, shade the part on the gauge, and describe this part with a fraction.
There are different-sized water tanks available at the school garden. By looking at the gauge on a tank, the students can see how much water is inside the tank.

Here are two tanks, one with a water capacity of 50 L and the other 300 L.

10. a. Explain which of these two water tanks has more water. How did you find out?

b. What fraction of the tank contains water? In your notebook, write the fraction for the shaded area of each gauge.

c. How many liters of water are there in each tank? Write the number of liters in each tank next to the shaded part.

Below are the gauges of three other tanks in the school garden. The maximum capacity of each tank is indicated on top of each gauge.

11. a. What part of each tank is filled? Write each answer as a fraction on Student Activity Sheet 4 next to the shaded area of the gauge.

b. How many liters of water are in each tank now? Write the number of liters in each tank next to the shaded part.
This week, Tim and Waya have to take care of watering all of the plots. They will connect a hose to one of the water tanks. They want to use the tank that has the most water.

12. Describe how Tim and Waya might determine which tank they will use.

13. What part of each tank is filled? Write your answer as a fraction next to the shaded part of each tank on Student Activity Sheet 5.

14. How many liters of water are in each tank? Write your answer next to the shaded part of each tank.

15. Reflect Which tank would you suggest Tim and Waya use?
Percents on the Computer

Manita found a program on a website, and she wants to install the program on her computer. First she starts to download the file. After a while, she sees this window on her screen.

16. a. Describe the information given in this window.

b. Describe how to find the total time it will take Manita to download the file.

When the program is downloaded, Manita starts to install it. A new window appears with a bar.

Then the bar changes into:

17. What does this bar tell you?
Eight minutes after she started to install the program, the bar shows:

18. Estimate how many more minutes Manita has to wait until the program is installed.

Manita wonders how she can make an exact calculation for the total installation time. She starts to draw the following percent bar.

19. Copy the bar in your notebook and show how you can use this model to find the total installation time.

Manita installs a second program. After 3 minutes, the window shows:

20. a. Estimate how many more minutes it will take Manita to install the program.

To make an accurate calculation, you can set up a percent bar like this one.

b. Copy the percent bar in your notebook and calculate the total time it will take Manita to install this program.
Percent bars can be used to find parts of a whole, expressed in a percentage. A fully shaded strip or bar represents the whole, or 100%. Half of the bar represents 50%, and $\frac{1}{4}$ of the bar represents 25%.

Percent bars can be used to solve problems using estimations or exact calculations.

21. Reflect Make up your own story of downloading or installing a program. Create a percent bar to illustrate the situation.

A Final Tip

22. If the bill for your lunch were $6.99, what would you leave as a tip for the waiter in each of these situations?
   a. The food and service were excellent.
   b. The food and service were average.
   c. The food was good, but the service was poor.

Most waiters depend on tips for their income. Most waiters are paid less than minimum wage, so the standard tip for good service is usually 15% to 20% of the total bill before the sales tax is added. Of course, leaving a tip is optional, and customers often leave more or less than 15% to 20%, depending on the quality of the food and service.
23. a. Copy the percent bar below and write each of your tips from problem 22 in an appropriate position.

```
0% 100%
```

b. Which of your three tips from problem 22 was between 10% and 15%? Use the percent bar to help you to figure this out.

24. Estimate tips of 10%, 15%, and 20% for the following bills: $39.90, $80.10, and $14.50.

Use **Student Activity Sheet 6** to answer the following question.

25. a. Based on the service and tip indicated, fill in the tip for each bill on **Student Activity Sheet 6**.

```
<table>
<thead>
<tr>
<th>Bill</th>
<th>Excellent Service = 20%</th>
<th>Average Service = 15%</th>
<th>Disappointing to Poor Service = 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>$6.25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$12.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$25.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$100.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$8.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

b. Extend each table with two additional bills and tips of your own.

c. **Reflect** Look at your table entries in the blue columns. Describe anything extraordinary about these tip amounts.
The Bar Model

**Summary**

**Fraction Bar**
If you have three parts out of four, you can express this as a fraction on a fraction bar. The parts are expressed as fractions.

![Fraction Bar Diagram]

**Percent Bar**
A fraction bar with percentages instead of fractions is called a percent bar. A percent bar can be used to find parts of a whole. The parts are expressed as percentages.

![Percent Bar Diagram]

You can use a percent bar to solve problems using estimations or exact calculations. Here are two examples.

**Example 1**
After five minutes, 20% of the time has elapsed. What is the total time?

![Example 1 Diagram]

Here are three different solution strategies.

- Calculate 10% (2.5 minutes) and then 100% (25 minutes).
- Calculate 40% (10 minutes), then 80% (20 minutes), and finally, 100% (25 minutes).
- Use fractions: The shaded part is $\frac{1}{5}$ of the whole, so you need 5 parts ($5 \times 5$ minutes). The total time is 25 minutes.
Example 2
The bill is $32.00. Calculate a 15% tip.

Here are two different solution strategies.
- Calculate 10% ($3.20), then 5% ($1.60), adding for 15% ($4.80).
- Calculate 25% ($8.00), then 10% ($3.20), subtracting for 15% ($4.80).

Check Your Work
Two coffee pots are used for Family Night at Springfield Middle School. Each coffee pot has a gauge that shows how much coffee is in each pot.

Use Student Activity Sheet 7 for problems 1 and 2.

1. One coffee pot holds 60 cups of coffee.

- Shade each gauge to show the coffee level for the number of cups of coffee indicated.
- Next to your shading, write the fraction that best describes the coffee level.
2. The second coffee pot holds 80 cups of coffee. These drawings show the gauge at four different times during the evening.

- **A.**
  - 80 cups
  - 0% 5% 100%

- **B.**
  - 80 cups
  - 0% 60% 100%

- **C.**
  - 80 cups
  - 0% 100%

- **D.**
  - 80 cups
  - 0% 100%

a. For each drawing, what fraction of the coffee pot is filled with coffee? Write your answer as a fraction and as a percent next to each shaded part on **Student Activity Sheet 7**.

b. For each drawing, how many cups of coffee remain in the coffee pot? Write your answer next to each shaded part.

3. Copy these bars in your notebook. The shaded part of each bar is the time elapsed during a download. For each bar, make an accurate calculation of the total time.

- **a.**
  - 8 min
  - 0% 5% 100%

- **b.**
  - 15 min
  - 0% 60% 100%
4. Estimate tips of 10%, 15%, and 20% for the following bills: $20.10 and $11.95.

**For Further Reflection**

Juan went out to dinner on Friday night and left a 20% tip. Marisa went out for breakfast on Sunday morning and left a 15% tip. Marisa claims that she gave a larger tip than Juan. Is this possible? Explain.
Part of Highway 22 is the beltway around Springfield. Signs posted along the road show the distances to the exits. Here is one of these signs.

This line represents the beltway. The mark on the left is the sign. The mark on the right is 1 mile (mi) down the road from the sign.

1. a. Copy the drawing above. Use the information on the sign to position each of the three exits onto the line.

b. Which of these two pairs of exits are farther apart?
   i. the exit from Town Centre to the Zoo
   ii. the exit from the Zoo to Rosewood Forest

Show how you found your answer.

The next sign along the beltway is posted at the Zoo exit. Some information is missing in the sign on the right.

2. a. Copy this sign and fill in the missing distances. To fill in the airport distance, you need to know that the Rosewood Forest exit is exactly halfway between the Zoo exit and the Airport exit.

b. How far is the Airport exit from the first sign?

c. Place your Airport exit on the line you drew for problem 1a.
You can use what you know about fraction strips to order different fractions on a **number line**.

**Fraction strips**

```
\[\frac{1}{2} \quad \frac{1}{2}\]
```

```
\[\frac{1}{3} \quad \frac{1}{3} \quad \frac{1}{3}\]
```

**Number Line**

```
0 \quad \frac{1}{3} \quad \frac{1}{2} \quad \frac{2}{3} \quad 1
```

---

**Biking Trail**

Rosewood Forest is a nature preserve that is open for recreation. Most famous is a bike trail that is 30 kilometers (30 km) long. Along the trail there are rest areas and special places for wildlife viewing. Here is a list of the places along this trail.

- restrooms (R1): \(\frac{1}{3}\) of the way
- restrooms (R2): \(\frac{3}{4}\) of the way.
- bee colony (BC): \(\frac{1}{2}\) of the way.
- picnic area (P): \(\frac{2}{3}\) of the way.
- wilderness campground (W): \(\frac{5}{6}\) of the way.
- bird-viewing hut (H): \(\frac{1}{5}\) of the way
- grazing cattle (C): \(\frac{3}{5}\) of the way
Visitors can obtain a leaflet with information about the trail and the locations of the special places along it. This line represents the trail.

```
| Start | End |
```

3. **a.** Draw your own line representing the trail.

   **b.** Correctly position each special place along this trail. To save space, write only the corresponding letter of each special place.

Sam and Nicole take a rest at the bird-viewing hut (H).

4. **What part of the trail do they still have to bike?**

An additional picnic area is being built closer to the start of the trail. It will be located between the bird-viewing hut (H) and the first restrooms (R1).

5. **Correctly position the new picnic area (P2) on your trail line. Describe the location using a fraction.**

### Signposts

Sam and Nicole are biking the Henson Creek Trail in Maryland. They are not sure where they are right now. When they see a signpost, they stop and look at their map of the trail.

Using the information on the signpost and the map, they start to figure out where they are. A map of the Henson Creek Trail is on **Student Activity Sheet 8.**

6. **a.** Why are there two arrows on the signpost pointing in two different directions?

   **b.** According to the signpost, how far are Sam and Nicole from Oxon Hill Road?

   **c.** Which road are they closer to—Tucker Road or Bock Road?

7. **Use Student Activity Sheet 8** to estimate where Sam and Nicole are now. Mark that spot on the map.
The distances on this type of signpost are written with one decimal, so tenths of a mile are used.

You can use the **bar model** to make a number line.

Each mile is divided into ten parts, so each part is one-tenth of a mile.

8. **a.** Explain why 0.3 is placed correctly on this number line.

   **b.** On **Student Activity Sheet 8**, fill in each of the empty circles with an appropriate decimal number.

   **c.** Place the following decimal numbers on this number line: 0.7, 2.1, and 3.4.

The signpost from problem 6 shows the distance to Tucker Road and the distance to Bock Road.

9. What is the distance from Tucker Road to Bock Road?
Sam and Nicole continue their bike trip along the trail. After a while, they see this signpost.

10. How do you know that this signpost is where Brinkley Road crosses the trail? Indicate the location of this signpost on the map of Student Activity Sheet 8.

The bike trail crosses Bock Road, Tucker Road, and Oxon Hill Road. To get a better picture of all of the distances, you can use a number line representing the trail. The signpost from problem 10 is placed at zero (0) location.

Use Student Activity Sheet 9 to answer problems 11–13.

11. Locate where the trail crosses each of the following roads: Bock Road, Tucker Road, and Oxon Hill Road. To save space, use arrows to connect each road to its location on the number line.

12. How many miles did Sam and Nicole bike from the first signpost to the signpost at Brinkley Road?

13. On the number line in problem 11, indicate where the bike trail crosses Temple Hill Road.
A new signpost will be placed where the bike trail crosses Tucker Road. What distances will this signpost show? You can use the number line on page 30 to help you calculate the distances.

14. Copy the drawing and write the distances on the signpost.

The Jump Jump Game

Objective of the game: Use a number line to “jump” from one number to another in as few jumps as possible.

How to play: To get to a number, players can make jumps of three different lengths: 0.1, 1, and 10. Players can jump forward or backward.

Example: Jump from 0 to 0.9

If you make jumps of 0.1, then you need nine jumps to go from 0 to 0.9.

However, you can go from 0 to 0.9 in two jumps.

15. Use Student Activity Sheet 9 to show how you can jump from 0 to 0.9 in two jumps.

If you don’t have a picture of a numbered number line, you can draw your own empty number line. You can show your jumps by drawing curves of different lengths—a small curve for a jump length of 0.1, a medium curve for a jump length of 1, and a large curve for a jump length of 10.

Here is one example: Jump from 1.6 to 2.5.

16. Describe the moves shown above. How many total jumps were made?
Here is the beginning of another round: Jump from 0 to 22.9.
You can make two jumps of 10, then one jump of 1, another jump of
1, and then…?

17. Describe the different ways you can jump to the final destination
of 22.9.

18. Use Student Activity Sheet 10 to complete the ten rounds as
described on the next pages.

Complete Rounds 1 and 2 individually. After each round, write the
total number of jumps you made in the box at the right.

Round 1: Go from 0 to 5.3 in the fewest jumps.

Round 2: Go from 0 to 6.9 in the fewest jumps.

Compare your results with a classmate. Score two points for a win
and one point for a tie.

Do the following problems individually.

Round 3: Go from 0 to 29.8 in the fewest jumps.

Round 4: Go from 0 to 28.1 in the fewest jumps.

Round 5: Go from 0 to 51.6 in the fewest jumps.

Compare your results with a classmate. Score two points for a win
and one point for a tie. Keep track of your total score.
The next few problems are a little different. Do the problems individually.

**Round 6:** Go from 5.0 to 26.8 in the fewest jumps.

![Number line from 5.0 to 26.8]

**Round 7:** Go from 32.4 to 54.6 in the fewest jumps.

![Number line from 32.4 to 54.6]

Compare your results with a classmate. Score two points for a win and one point for a tie. Keep track of your total score.

**Round 8:** Go from 4.5 to 8.4 in the fewest jumps.

![Number line from 4.5 to 8.4]

**Round 9:** Go from 5.6 to 17.3 in the fewest jumps.

![Number line from 5.6 to 17.3]

**Round 10:** Go from 44.4 to 51.6 in the fewest jumps.

![Number line from 44.4 to 51.6]

Compare your results with a classmate. Score two points for a win and one point for a tie. Write your total score in the star on **Student Activity Sheet 10** or draw your own star.

19. Make up three additional Jump Jump Game problems.
The home viewers see this number line.

\[
\begin{array}{c}
\hline \\
\$11.95 \\
\hline
\end{array}
\]

Nathalie guesses $11.50. The number line now shows:

\[
\begin{array}{c}
\hline \\
\$11.50 & $11.95 \\
\hline
\end{array}
\]

The guesses of the three other contestants are:

Maria: $12.00  
Leo: $12.50  
Ben: $11.75

20. a. Create the number line for this scenario. Who won the DVD?
   b. Whose guess is the farthest from the actual price? How far is it?
The next scenario involves a pair of jogging shoes.

The actual price is $98.75. The line shows:

$98.75

Here are the contestants’ guesses.

Nathalie: $100   Maria: $96.20   Leo: $91.99   Ben: $99.25

21. **a.** Create the number line for this scenario.
   **b.** Whose guess is the closest to the actual price? Whose is the farthest from it?

The next scenario involves a DVD player whose actual price is $165.30.

Here are the contestants’ guesses.

Nathalie: $150.80   Maria: $170   Leo: $160.99   Ben: $171.25

22. **a.** Create the number line for this scenario.
   **b.** Whose guess is the closest to the actual price? Whose is the farthest from it?
In this section, you ordered fractions and decimals on a **number line**.

To position fractions on a number line, you can use what you know about fraction bars and the order of fractions.

### Fraction Bar
One-third is less than one-half.

\[
\begin{array}{c|c|c}
\hline
\text{1/3} & \text{1/2} \\
\hline
\end{array}
\]

### Number Line
On a number line, one-third is located to the left of one-half.

\[
0 \quad \frac{1}{3} \quad \frac{1}{2} \quad \frac{2}{3} \quad 1
\]

You can use a number line to find how far apart two decimal numbers are positioned. This can help you if you need to add or subtract decimal numbers.

#### Example 1
Calculate 2.7 – 1.8.
On the number line, 1.8 and 2.7 are 0.9 apart, so 2.7 – 1.8 = 0.9.

#### Example 2
You can draw your own empty number line.
Find 2.8 – 1.6. Or how far apart are 1.6 and 2.8?
A jump of 1 and two jumps of 0.1 total 1.2.
So 1.6 and 2.8 are 1.2 units away from each other.
2.8 – 1.6 = 1.2
The line below represents the beltway. Two locations are indicated: the location of the sign and a distance of one mile down the road from the sign.

1. a. Copy the drawing above. Use the information on the sign to correctly position each of the three exits onto the line.
   b. Which of these two pairs of exits are farther apart?
      i. The South Street exit and the Main Street exit
      ii. The Main Street exit and the Harbor exit

Show how you found your answer.

The next sign along the beltway is posted at the Main Street exit. Some information is missing in the sign on the right.

2. The distance from the harbor to the beach is twice as far as the distance from Main Street to the harbor.
   a. Copy this sign and fill in the missing distances.
   b. How far is the beach from the first sign?
   c. Place the Beach exit on the line in your drawing from problem 1a.
Here is another signpost on the Henson Creek Trail. The mileage information on the signpost is missing. The signpost is located where the bike trail crosses Bock Road.

3. How far away is this signpost from all the other roads that cross the bike trail? Add the missing mileage information to the signpost on Student Activity Sheet 9. (Hint: Use the number line from problem 10 or Student Activity Sheet 8 to help you).

Play the Jump Jump Game using your own paper. Remember that players can make jumps of three different lengths: 0.1, 1, and 10. Players can jump forward and backward. Write down your best score.

4. Go from 0 to 48.1 in the fewest jumps possible.

5. Go from 6.8 to 10.7 in the fewest jumps possible.

In this scenario of the Price Guessing Game, contestants guess the price of a baseball cap whose actual price is $6.89. The line shows the price.

These are the contestants’ guesses.

<table>
<thead>
<tr>
<th>Nathalie: $9.99</th>
<th>Maria: $8.50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leo: $5.00</td>
<td>Ben: $7.75</td>
</tr>
</tbody>
</table>
6. a. Show the actual price and the guesses on the number line.
   
   b. Whose guess is the closest to the actual price? Whose guess is the farthest from it?
   
   c. What are the differences between each guess and the actual price?

   **For Further Reflection**

   Complete each number sentence so that the distance between the pair of decimal numbers on the left side is the same as the distance between the pair on the right side. Try to reason about the numbers before you calculate distances. You might not need to do any distance calculations to make these number sentences true.
   
   a. $9.3 - 4.1 = 8.3 - \ldots$
   
   b. $6.8 - 2.5 = \ldots - 3.5$
   
   c. $7.5 - \ldots = 9.5 - 2.7$
   
   d. $\ldots - 1.4 = \ldots - 5.8$
   
   e. make up your own problem
   
   $\ldots - \ldots = \ldots - \ldots$

   Which problems were the easiest for you to do? Why? Write about anything new you may have discovered about subtraction problems.
In many countries, distances are expressed in kilometers. In the United States, distances are represented in miles. Today, many maps use a **double scale line**, using both kilometers and miles. This map of Toronto, Canada, has a double scale line.

1. **a.** Describe how you might use the double scale line.

   **b.** Use the double scale line to find three relationships between miles and kilometers. Write your relationships like this.

   .... miles equal about .... kilometers

   .... kilometers equal about .... miles
The Toronto City Centre Airport is located on an island close to the coast. The distance from downtown Toronto to the airport is about 4 km.

2. a. Estimate this distance using miles.
   
   b. About how many kilometers equals 5 mi? Show how you found your answer.

You can measure distance two different ways: as the crow flies (in a straight line) or as Taxi Cab distance (along the ground from place to place). The distance as the crow flies is shorter (except for cases in which the two distances are the same).

The distance from downtown Toronto to Vaughan as the crow flies is about 15 mi.

3. About how many kilometers is this distance? Show how you found your answer.

This is part of a distance table. You can read the distances between Toronto and other large cities. Distances are given in both kilometers and miles. Some information is missing.

4. How far is the distance between Toronto and Chicago in kilometers? What is this distance in miles? How can you be sure which is which?

5. Find the missing information. You do not have to be precise.
Gary lives $\frac{1}{2}$ mi from school. He walks to school every morning.

6. How many city blocks does Gary walk to school? How did you figure this out?

Sharon lives $1\frac{1}{4}$ mi from school. She bikes to school every morning.

7. How many city blocks does she bike to school? How did you figure this out?

8. Use the city map on Student Activity Sheet 11 to locate where Gary and Sharon could live.
Rene travels 11 blocks from home to school.

9.  a. How many miles is this? How did you find out?
   b. Would you advise Rene to use her bike or to walk to school? Give reasons to support your answer.

Marcus wants to find out how far Ms. Anderson lives from school. He knows she travels 19 city blocks to school. He draws a double number line like this.

![Double Number Line Diagram]

This double number line is drawn to scale, with numbers on top as well as on the bottom. Learning how to use a double number line will help you make precise calculations effortlessly.

10.  a. On Student Activity Sheet 11, use this double number line to find out how far Ms. Anderson lives from school.
   b. Use the double number line to find out how many city blocks there are in \(1\frac{3}{4}\) mi.

Every morning, Gary takes about 10 minutes to walk \(\frac{1}{2}\) mi to school. Sharon’s bike is broken, so she is making plans to walk \(1\frac{1}{4}\) mi to school. She asks Gary how long this might take her.

11.  a. Copy the double number line below in your notebook. Using a grid helps to partition the spaces evenly.
   b. Use the double number line to calculate how long it will take Sharon to walk to school. State any assumptions you are making in finding your answer.
Gary and Sharon like to hike. This weekend they plan to walk a $4\frac{3}{4}$-mi lake trail. They estimate how long they will hike. Gary uses a double number line like the one on page 43.

12. Draw a double number line and use it to find the time needed for the hike.

Sharon uses a ratio table to make the same calculation.

<table>
<thead>
<tr>
<th>Minutes</th>
<th>10</th>
<th>20</th>
<th>80</th>
<th>5</th>
<th>15</th>
<th>.....</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miles</td>
<td>$\frac{1}{2}$</td>
<td>1</td>
<td>$\frac{3}{4}$</td>
<td>$\frac{1}{4}$</td>
<td>$\frac{3}{4}$</td>
<td>$\frac{43}{4}$</td>
</tr>
</tbody>
</table>

13. a. Explain how Sharon decided on the numbers in each new column in the table.

b. Which model do you prefer, the double number line or the ratio table? Explain your preference.

**Weights and Prices**

Jack's Delicatessen sells many different kinds of food. Jack is the shop owner. He imports fresh deli meats and more than 80 kinds of cheese. Workers slice the food items, weigh them, and calculate the prices.

Susan weighs a piece of pepper salami at 0.2 kilograms (kg).

14. Explain how Susan will calculate the price for this piece. What information does she need?
Ahmed is shopping for some brie, a kind of French cheese. He wants the piece to weigh about \( \frac{1}{4} \) kg. Susan cuts off a piece and puts it on the scale. The scale shows:

15. a. Does Ahmed have the amount of brie he wants?
   b. Calculate how much Ahmed has to pay for this piece of brie.

Ahmed often buys brie at Jack’s Delicatessen. Lately he has been thinking about a clever way to estimate the price. The scale reminds him of a double number line. He creates the following double number line including both weight and price on it.

16. Show how Ahmed can use this double number line to estimate the price for 0.7 kg of brie.

This week, brie is on sale for $9.00 per kilogram.

17. What is the sale price of 0.7 kg of brie? Show how you found your answer.

18. a. Select three different pieces of brie to purchase and write down the weight of each piece.
   b. Draw a scale pointer to mark each weight on a different number line. (You may want to exchange your notebook with a classmate after both of you have drawn your pointers.)
   c. Estimate the regular price and the sale price of the three pieces of brie.
Jack’s Delicatessen also sells fruit. This week, California grapes are on sale for $1.89 per kilogram.

Madeleine places her grapes on the scale. This is what she sees.

19. a. How much do Madeleine’s grapes weigh?

b. Estimate how much Madeleine has to pay for the grapes. You may want to use a double number line for your estimation and explanation.

Ahmed decides to use the money he has left to buy some grapes. He counts his money and realizes he has $1.25.

20. Estimate what weight of grapes Ahmed can buy for $1.25. Show how you found your answer.

Susan weighed fruit for 5 customers. She wrote the prices on small price tags, but, unfortunately, the tags got mixed up.

21. Match the information written below to the corresponding price tags. Find out which note belongs to each customer. Show your work.

Mounim 0.5 kg grapes for $1.50/kg
Claire 1.8 kg apples for $1.25/kg
Frank 2.5 kg oranges for $1.90/kg
Nadine 1.1 kg bananas for $2.50/kg
Gail 0.9 kg kiwis for $2.40/kg

$4.75 $0.75 $2.75 $2.25 $2.16
Math History

Edmund Gunter (1581-1626), an English mathematician, invented a measurement tool for surveying. It came into common usage around 1700 and was the standard unit for measuring distances for more than 150 years.

Gunter's Chain is 66 ft long. Its usefulness comes from its connection to decimals; it is divided into 100 links.

22. How many chains make one mile?

Because Gunter's chain was used to measure America, the United States did not use the metric system (developed in France in 1790).
Double Number Line

A double number line is a number line with a scale on top and a different scale on the bottom so that you can organize and compare items that change regularly according to a rule or pattern.

Example 1
The price changes $12 for every kilogram purchased.

Example 2
The time changes by 10 minutes for every half-mile walked.

You can use a double number line to solve problems with fractions, decimals, and ratios.

Ratio Table Model
You can use a ratio table to solve these same problems.

Example 3
The time changes by 10 minutes for every half-mile walked.

<table>
<thead>
<tr>
<th>Minutes</th>
<th>10</th>
<th>20</th>
<th>80</th>
<th>5</th>
<th>15</th>
<th>....</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miles</td>
<td>$\frac{1}{2}$</td>
<td>1</td>
<td>4</td>
<td>$\frac{1}{4}$</td>
<td>$\frac{3}{4}$</td>
<td>$\frac{3}{4}$</td>
</tr>
</tbody>
</table>

On a double number line, as on a single number line, the numbers always appear in order.
Many American cities have a street plan that looks like a grid. Philip read the following on the Internet.

A lot of American cities are laid out with grids of \( \frac{1}{16} \text{ mi} \) by \( \frac{1}{8} \text{ mi} \) (metric equivalents: 100 m by 200 m). Major streets are usually at \( \frac{1}{4} \)-, \( \frac{1}{2} \)-, or 1-mi intervals.

Philip uses this information to set up the following relationships between miles and meters.

1. Help Philip use the double number line to find the distance between major U.S. streets. Write your answers using the metric system.

Near the end of the week, Jack sells a basket of mixed fruit for $1.25 per kilogram.

2. a. How much mixed fruit can you purchase for $5.00?
   b. The scale indicates 3.2 kg. What is the price for this fruit?

Sharon’s bike is fixed so she and Gary plan a \( \frac{7}{2} \)-mi bike ride. They want to estimate how long they will bike.

Sharon knows that it takes \( \frac{7}{2} \) minutes to bike the \( \frac{1}{4} \) mi to school.

3. Use a double number line or a ratio table to find the amount of time they will bike.

For Further Reflection

How are double number lines and ratio tables alike? How are they different? Which do you find easier to use?
In Sections A through D, you used different models. These models help you to solve problems involving ratios, fractions, decimals, and percents, and they often make calculations easier.

These are the models you used.

- ratio table
- percent bar
- double number line
- fraction bar
- number line

In this section, you can choose the model you like best to represent and solve each problem. Sometimes you will need only a simple calculation instead of a model.

**School Camp**

Around April of every year, all seventh- and eighth-grade students at Springfield Middle School go on an overnight camping trip. To make preparations, Mrs. Ferrero prepares the following list for this year’s trip.

<table>
<thead>
<tr>
<th>Class</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 7A</td>
<td>27 students</td>
</tr>
<tr>
<td>Class 7B</td>
<td>31 students</td>
</tr>
<tr>
<td>Class 8A</td>
<td>23 students</td>
</tr>
<tr>
<td>Class 8B</td>
<td>24 students</td>
</tr>
</tbody>
</table>

1. Students travel to the camp in small buses. Each bus can hold 15 students. How many buses are needed to send all of the students to camp?
The campsite is located at Rosewood Forest, which is 150 mi from school. Jared wonders how long it will take to travel to the campsite. He estimates that the buses will drive about 45 mi per hour on average.

2. Choose a model to estimate the time needed to travel to the campsite.

During the trip, a canoe trip is organized. The canoes can be rented at the campsite’s office. There are canoes available for rent for 2, 3, 4, or 5 people each.

3. Mrs. Ferrero prefers to rent all the same size canoes. How many canoes of what size should Mrs. Ferrero rent for the students? Explain how you found your answer.

Many team-building activities are planned for the campers. On Tuesday, an Olympic competition is held. Campers compete in a 200-m run and the long jump.
Faiza and Pablo wonder what the long jump Olympic record is. They found the following information.

In 1996, at the Olympic Games in Atlanta, Carl Lewis (USA) jumped a distance of 8.5 m in the long jump.

Faiza and Pablo looked for a meter stick and a yardstick.

4. a. Which one is longer—a meter stick or a yardstick?
   b. About how many yards are there in 8.5 m?
   c. About how many feet are there in 8.5 m?

---

**Activity**

**Meter Spotting**

For this activity, you will need a meter stick or a measuring tape at least one meter long.

First, estimate a distance by pacing off a distance of about one meter. Measure your distance after each attempt to monitor your progress.

- Using one-meter steps, pace off the distance of Carl Lewis’s 1996 Olympic winning long jump.
- Use a meter stick or a measuring tape to measure (as precisely as possible) the distance that Carl Lewis jumped.
- Compare the distance you estimated and the distance you measured. Was your estimation too short? Too long? How much is the difference?

A meter can be divided into 10 smaller units, called **decimeters** (dm).

- Use your meter stick to measure the length of 1 dm.

In the distance of Carl Lewis’s jump, fit eight whole meters. The part that remains is smaller than one meter.

- How many decimeters fit in the remaining part?
Here is a part of a meter stick in its actual size. The meter stick is divided into decimeters.

5. a. How many jumps of 1 dm do you have to make if you jump from 0 to 0.5 m?
   b. How many jumps of 1 dm do you have to make if you jump from 0.6 m to 1 m?

6. Copy the following sentences and fill the blanks.
   a. One meter is _____ decimeters
   b. Two meters is _____ decimeters.
   c. One decimeter is _____ meter.
   d. Five decimeters is _____ meter.

A meter can be divided into 100 smaller units, called centimeters (cm).

Here is the same part of the meter stick from problem 5, but now the meter stick is divided into centimeters.

7. a. How many jumps of 1 cm do you have to make if you jump from 0 to 0.50 m?
   b. How many jumps of 1 cm do you have to make if you jump from 0.60 m to 1 m?

8. Write four statements similar to the ones in problem 6, but now use meters and centimeters.
9. Copy and complete each sentence.
   a. 8.50 meters is 8 meters and _____ decimeters.
   b. 8.50 meters is 8 meters and _____ centimeters.

Carl Lewis won his fourth Olympic medal in 1996. At that time, the world record holder was Mike Powell (USA). He made a jump of 8.95 m in 1991.

10. How much longer was Mike Powell’s World Record jump compared to Carl Lewis’s Olympic jump?

11. How many centimeters is the record of Mike Powell away from the magic barrier of 9 m?

Faiza, Juanita, Zinzi, and Margie are competing in the long jump. The results before Margie jumped are:
   Faiza  3.03 m   Juanita  3.10 m   Zinzi  2.95 m
Margie jumped a little under 3 m, but she did better than Zinzi.

12. a. Name 3 possible jump lengths for Margie.
   b. Order this group’s results.
   c. Place all possible results on a number line and find out the differences in centimeters among the jumps of the 4 girls.

Here are the times for the six boys running the 200-m event.
   Peter  27.05 seconds   Mustafa  27.93 seconds
   Pablo  28.01 seconds   Jesse  27.15 seconds
   Sam  26.84 seconds   Igor  28.60 seconds
13. a. Which two boys finished the closest to each other? What was the time difference?

b. What was the time difference between the finish of the first and the last-place finishers?

Every day, six groups prepare dinner for 20 people. Each small group consists of five campers. Each group does all of the shopping and the cooking.

One group makes muffins for breakfast. This is the recipe they use.

**Honey Make My Morning Muffins**

(10 to 12 muffins)

**Ingredients:**
- $\frac{1}{2}$ cup milk
- $\frac{1}{4}$ cup honey
- 1 egg, beaten
- $2\frac{1}{2}$ cups buttermilk baking mix (sometimes called biscuit mix)

**Directions:** In a medium bowl, combine milk, honey, and beaten egg; mix well. Add baking mix and stir until moistened. Spoon into greased muffin tins. Bake at 400°F for 18–20 minutes.

14. This group decides to make 30 muffins. Calculate how much of each ingredient the group needs.

15. What would you put on your shopping list for this group?
Another group decides to make pancakes. This is their recipe.

Buttermilk Pancakes
(about 14 pancakes)

**Ingredients:**
- 2 cups all-purpose flour
- 2 tablespoons sugar
- 2 teaspoons baking powder
- \( \frac{3}{4} \) teaspoon baking soda
- \( \frac{1}{2} \) teaspoon salt
- 2 cups buttermilk
- \( \frac{1}{3} \) cup milk
- 2 large eggs
- \( \frac{1}{4} \) cup butter or margarine, melted
- 3–4 tablespoons butter, vegetable oil, or shortening, for frying
- \( \frac{1}{2} - \frac{3}{4} \) cups pure maple syrup and additional butter (optional)

**Directions:**

2. Heat a large nonstick griddle. When griddle is hot, add buttermilk mixture to dry ingredients; mix batter with a wooden spoon just until blended. Lumps are okay.

3. Reduce heat to medium and grease griddle with butter, oil or shortening. Using a ladle or a \( \frac{1}{3} \)-cup dry measure, pour spoonfuls of batter a few inches apart onto the hot greased griddle. Cook until small bubbles begin to form on the top and some pop, 2 to 3 minutes. Carefully turn pancakes with a flexible spatula, then cook 1 to 2 minutes more, until golden brown. Serve immediately with maple syrup and additional butter, if desired, or keep pancakes warm in oven. Repeat process with remaining batter.
16. How many pancakes and how much of each ingredient do they need to prepare breakfast for 20 people?

While three students of this group prepare the pancakes, the two others make spaghetti sauce for dinner tonight.

When the sauce is ready, they have 2 liters (L) of sauce. They want to put the sauce in the refrigerator. They find three plastic containers; each can hold \( \frac{3}{4} \) L.

17. Will they be able to store all of the sauce in these three containers? Show your work.

On the last night, students perform a talent show. Some students sing, some do a short skit, and others form a band. Isabel, Larry, and Warda organize the evening program. Mr. De Felko is willing to go to the next town to have copies made. At Plinko’s, the cost of 10 copies is $1.15. Xelox charges $1.70 for 15 copies.

18. a. Where would you recommend that Isabel, Larry, and Warda send Mr. De Felko? Show how you found your answer.

b. If tax in the local area is 4%, calculate the total bill for your recommendation.
Deci- and centi-
The prefix \textit{deci-} is used with the metric system. It stands for 0.1, or \( \frac{1}{10} \).

So if you divide 1 m into 10 equal parts, the size of each part is 1 decimeter (dm); 1 dm is \( \frac{1}{10} \) of a meter.

The prefix \textit{centi-} is used with the metric system. It stands for 0.01, or \( \frac{1}{100} \).

So if you divide 1 m into 100 equal parts, the size of each part is 1 centimeter (cm); 1 cm is \( \frac{1}{100} \) of a meter.

A distance of 3.25 m can mean:
- \( 3 \frac{1}{4} \) m
- 3 m and 25 cm
- 3 m 2 \( \frac{1}{2} \) dm
- 3 m 2 dm and 5 cm

Models
These are the models that you have used in this unit.

- ratio table
- number line
- fraction bar
- empty number line
- percent bar
- double number line

For examples of these models, look at the summaries of the previous sections in this unit.
1. Tamara jumped 4.37 m and Janet jumped 4.49 m. Explain how much farther Janet jumped.

2. Karen received a photo from her pen pal in Europe. The photo has dimensions of 15 cm by 10 cm. Karen looks on the Internet for photo frames. There are different-sized frames available. Which of the following frames can she use without cutting the photo?
   a. 5 by 3.5 inches
   b. 6 by 4 inches
   c. 8 by 6 inches

3. A piece of pepperoni weighs 2,400 grams.
   Where would you make a cut to make one of the pieces weigh about 1,800 grams?

4. What will this dinner cost you in Iowa, where the sales tax is 5%? Remember to calculate the sales tax and the tip separately on the cost of the dinner.

   Check
   Dinner $7.99
   Includes Buffet & Sundae Bar

   Thank You
Honey Chicken Pizza
(6 servings)

**Ingredients:**
- \(\frac{3}{4}\) cup + 2 tablespoons prepared tomato-based pizza sauce
- \(\frac{1}{4}\) cup honey
- \(\frac{1}{2}\) teaspoon hot pepper sauce, or to taste
- 1 cup diced or shredded, cooked chicken breast
- 1 tube (10 oz.) refrigerated pizza dough
- 1 tablespoon olive oil
- 3 oz. blue cheese, finely crumbled (\(\frac{3}{4}\) cup)
- \(\frac{1}{2}\) cup finely diced celery

**Directions:**
Heat pizza sauce and honey; remove from heat. Stir in hot pepper sauce. Mix 2 tablespoons sauce with chicken; reserve. Shape pizza dough according to package directions for thin-crust pizza. Brush pizza shell with 1 tablespoon olive oil. Spread remaining \(\frac{3}{4}\) cup sauce over dough. Scatter reserved chicken over sauce. Bake at 500°F until lightly browned, about 10 minutes. Remove from oven. Sprinkle pizza with cheese, then celery. Cut pizza into 6 wedges.

Pick a number of slices they will make. Calculate how much they need of each ingredient. Finally, make a shopping list. You may need to look up some information about the packaging of certain products.

**For Further Reflection**
In this unit, you have used several different tools (ratio tables, percent bars, fraction bars, number lines, and double number lines). Explain how each is different and how they are similar to one another. Choose your favorite and tell why it is your favorite.
1. a. Marty takes six steps for every 4 m. How many steps does Marty take for 100 m? One kilometer?

b. For every three steps Marty takes, his father takes only two. How many steps does Marty’s father take for 100 m?

2. At the school store at Springfield Middle School, Jason ordered erasers. A package containing 25 erasers costs $3. What is the price of a single eraser? Show your work.

Here is a recipe for Scottish Pancakes.

Scottish Pancakes (makes about 16 pancakes)

**Ingredients:**
- 1 cup all-purpose flour
- 3/4 cup milk
- 2 tablespoons sugar
- 1 egg, lightly beaten
- 1 teaspoon baking powder
- 2 tablespoons butter, melted
- 1/2 teaspoon baking soda
- extra melted butter
- 1/2 teaspoon lemon juice or vinegar

**Directions:**
Sift flour, sugar, baking powder, and soda into a medium-size mixing bowl. Add juice or vinegar to the milk to sour it; allow to stand for 5 minutes.

Make a well in the center of the dry ingredients and add the egg, 3/4 cup milk, and the butter; mix to form a smooth batter. If the batter is too thick to pour from the spoon, add remaining milk.

Brush base of frying pan lightly with melted butter. Drop 1-2 tablespoons of mixture onto base of pan, about 3/4 inch apart. Cook over medium heat for 1 minute, or until underside is golden. Turn pancakes over and cook the other side. Remove from pan; repeat with remaining mixture.

Ms. Anderson wants to try out the recipe in her family. However, she thinks eight pancakes will be enough.

3. a. How much of each ingredient does she need?

b. Ms. Anderson wants to use the recipe to make pancakes at a school fair. How much of each ingredient does she need for 80 pancakes?
1. Which fraction best describes the shaded part of each measuring strip?

2. Susan and Hielko had solar collectors installed for their hot water system. The tank can hold 450 L of water. On the left is a model of the gauge that is fixed to the tank.

Last week, $\frac{2}{5}$ of the water tank was filled with water.

   a. Copy the gauge in your notebook and color the part of the gauge that represents $\frac{2}{5}$.

   b. What percentage of the tank was filled?

   c. How many liters were in the tank when it was $\frac{2}{5}$ full?

   d. It is best to keep the water tank filled up to at least 80%. In your drawing for part a, write this percentage next to the gauge in its proper place.

   e. Write 80% as a fraction and simplify.

3. For his birthday party, Paul took his friends to a hamburger restaurant. The total bill was $24.78. Paul wants to add about 15% to the bill as a tip. Make an accurate estimate of the amount Paul will pay.

4. Copy the table below and fill in the blanks.

<table>
<thead>
<tr>
<th>Fraction</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\frac{1}{2}$</td>
<td>50</td>
</tr>
<tr>
<td>$\frac{1}{4}$</td>
<td>10</td>
</tr>
<tr>
<td>$\frac{15}{100}$</td>
<td>15</td>
</tr>
<tr>
<td>$\frac{3}{5}$</td>
<td>60</td>
</tr>
<tr>
<td>1</td>
<td>100</td>
</tr>
</tbody>
</table>
1. The distance of 1 mi is represented on this number line.
   a. What fraction can replace the question mark?
   b. Use arrows to indicate a distance of \( \frac{1}{2} \) mi, \( \frac{1}{4} \) mi, and \( \frac{2}{3} \) mi.

2. This part of a number line is exactly 12 cm.
   a. Copy this picture in your notebook. Use a ruler.
   b. Use arrows to indicate the following fractions as accurately as possible: \( \frac{1}{6} \), \( \frac{5}{6} \), \( \frac{9}{12} \), \( \frac{3}{4} \), and \( 1\frac{2}{3} \).

3. a. Use a number line to go from 3.9 to 5.8 in the fewest number of jumps. You may make jumps of 0.1, 1, and 10.
   b. How far apart are 3.9 and 5.8?

4. Mr. Henderson’s class is playing a game in which students have to estimate distances in meters and centimeters. The estimates are shown on a number line, and whoever is the closest to the real distance wins. Note that 10 cm is 0.1 m.

Here are the estimates from four students for the length of the classroom.

Anouk 9 meters  Ilse 8.75 meters
Barry 7.8 meters  Henry 9.2 meters

Mr. Henderson measured the length of the classroom and found it was 8 m and 90 cm.
   a. Draw a number line indicating the positions of the four estimates and the actual length.
   b. Who won this game?
5. At the world swimming championships in Barcelona, Spain, on July 25, 2003, Michael Phelps swam the finals in 1 minute 56.04 seconds. In the semifinals, he swam 1.48 seconds faster for a new world record. Calculate Michael Phelps’s time in the semifinals.

Section D  The Double Number Line

1. Five miles is the equivalent of exactly 8 km.

   ![Double Number Line Diagram]

   a. How many miles equal 12 km?

   b. In cities in The Netherlands, the speed limit for driving is 50 kilometers per hour (km/h). About how many miles per hour is that?

2. If Norman bikes to school, it takes him about a quarter of an hour to cover the 3 mi.

   a. At the same average speed, how many miles can Norman bike in 1 1/2 hours?

   b. How long would a 15-mi trip take at the same average speed?

3. Ahmed buys a piece of cheese at Jack’s Delicatessen. This is what the scale shows.

   ![Double Number Line Diagram]

   a. What is the amount in kilograms shown on the scale?

   b. Find out how much Ahmed has to pay if the price of 1 kg of the cheese is $9. You may use a double number line.

   c. The piece is too expensive for Ahmed. Jack shows him another piece and says, “This will cost you $5.40.” What is the weight of this piece of cheese?

Who is the taller of the two? You may use the general rule that there is a little less than 3 feet (ft) in 1 m and there are 12 inches (in) in 1 ft. Show your work.

Section E

Choose Your Model

1. Michelle walks about 5 km/hr. At the same average speed, how many kilometers does she walk in $2 \frac{1}{4}$ hours?

2. Order the following numbers from small to large:
   \[2 \frac{1}{3}, 2.7, 2.09, 1.98, 2 \frac{3}{4}, 0.634\]

3. Outdoor Living is selling a backpack for $27.95. How many backpacks can the school purchase with $500? (Schools are exempt from paying sales tax.)

Here is a table of the Olympic Record holders for the long jump through August 2004.

<table>
<thead>
<tr>
<th>Name</th>
<th>Country</th>
<th>Result (in meters)</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beamon</td>
<td>USA</td>
<td>8.90</td>
<td>10-18-1968</td>
</tr>
<tr>
<td>Boston</td>
<td>USA</td>
<td>8.27</td>
<td>10-17-1968</td>
</tr>
<tr>
<td>Boston</td>
<td>USA</td>
<td>8.12</td>
<td>09-02-1960</td>
</tr>
<tr>
<td>Owens</td>
<td>USA</td>
<td>8.06</td>
<td>08-04-1936</td>
</tr>
<tr>
<td>Hamm</td>
<td>USA</td>
<td>7.73</td>
<td>07-31-1928</td>
</tr>
<tr>
<td>Gutterson</td>
<td>USA</td>
<td>7.60</td>
<td>07-12-1912</td>
</tr>
<tr>
<td>Irons</td>
<td>USA</td>
<td>7.48</td>
<td>07-22-1908</td>
</tr>
<tr>
<td>Prinstein</td>
<td>USA</td>
<td>7.34</td>
<td>09-01-1904</td>
</tr>
<tr>
<td>Kraenzlein</td>
<td>USA</td>
<td>7.18</td>
<td>07-15-1900</td>
</tr>
<tr>
<td>Prinstein</td>
<td>USA</td>
<td>7.17</td>
<td>07-14-1900</td>
</tr>
<tr>
<td>Clark</td>
<td>USA</td>
<td>6.35</td>
<td>04-07-1896</td>
</tr>
</tbody>
</table>

4. a. Since 1896, how much has the Olympic long jump record increased?

b. Which person held the Olympic long jump record for the longest time period? For the shortest time period?

c. Which person increased the Olympic long jump record the most?
Answers to Check Your Work

Section A The Ratio Table

1. You may have used different operations. However, your answer should be 400 notebooks, as shown in this ratio table, where the number of packages is doubled each time.

<table>
<thead>
<tr>
<th>Number of Packages</th>
<th>1</th>
<th>2</th>
<th>4</th>
<th>8</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Notebooks</td>
<td>25</td>
<td>50</td>
<td>100</td>
<td>200</td>
<td>400</td>
</tr>
</tbody>
</table>

2. You may have used the results of problem 1 or a different strategy, but your answer should be 23 packages as shown in this ratio table.

<table>
<thead>
<tr>
<th>Number of Packages</th>
<th>16</th>
<th>4</th>
<th>2</th>
<th>1</th>
<th>23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Notebooks</td>
<td>400</td>
<td>100</td>
<td>50</td>
<td>25</td>
<td>575</td>
</tr>
</tbody>
</table>

3. a. 48 pens for $12
   12 protractors for $42
   25 rulers for $50
   b. $0.25 per pen
   $3.50 per protractor
   $2.00 per ruler
   c. $1.75 for 7 pens
   $24.50 for 7 protractors
   $14.00 for 7 rulers

4. There are different ways to find the answers.

For example, to find the number of bananas, you could have reasoned that for eight servings, you need four bananas. Thus for 16 servings, you need 8 bananas, and for 4 servings, you need 2 bananas. Thus, for 20 servings, you need 10 bananas.

The number of craft sticks is the same as the number of servings, so 20 craft sticks.

They need $2 \frac{1}{2}$ cups of topping and $1 \frac{1}{4}$ cups of honey.
1. a. b.

2. a. A (\(\frac{3}{8}\) or 37.5%), B (\(\frac{3}{10}\) or 30%), C (\(\frac{8}{10}\) or 80%), D (\(\frac{3}{4}\) or 75%)

b. A (30 cups), B (24 cups), C (64 cups), D (60 cups)
3. You may have used different strategies, but your answers should be the same as these.

a. Answer: 160 minutes

Sample strategy: Calculate 50% (times ten) and then calculate 100% (double).

b. Answer: 25 minutes

Sample strategy: Calculate 20% (divide by 3) and then calculate 100% (times 5).

c. Answer: 80 minutes

Sample strategy: Calculate 5% (divided by 3), then calculate 50% (times ten), and then calculate 100% (double).

d. Answer: $1\frac{1}{4}$ hours or 75 minutes. Different strategies are possible.

Example 1:

Calculate 40% (halving), and then calculate 20% (halving) and then 100% (times 5).
Example 2:
Using minutes:

Strategy:
Calculate 40% (halving), then calculate 20% (halving), then 10% (halving), and then 100% (times 10).

4. A percent bar using estimates $20 ($20.10) and $12 ($11.95) may support your estimations.

10% of $20.10 is about $2.00.
15% of $20.10 is about $2.00 + $1.00 = $3.00.
20% of $20.10 is about $4.00.

10% of $11.95 is about $1.20.
15% of $11.95 is about $1.20 + $0.60 = $1.80.
20% of $11.95 is about $2.40.
1. a. 

![Number Line Diagram]

b. The Main Street exit and the Harbor exit. You may divide the line in 12 equal pieces to find the differences.

2. a. Harbor $\frac{1}{2}$ mile
   Beach $1\frac{1}{2}$ mile

b. $2\frac{1}{4}$ mile (1 mile further down from Harbor).

c. 

![Number Line Diagram]

3. Your sign should contain this same mileage information.

![Number Line Diagram with Mileage]

Strategy:
The sign is located at Bock Road. You should create a number line showing Bock road at the zero location.

![Number Line Diagram with Bock Road]
4. From 0, make five jumps of 10 to the right, and then you arrive at 50.

From 50, you make two jumps of 1 to the left, and then you arrive at 48. The final jump is one of 0.1 to the right.

A total of 8 jumps

5. Four jumps of 1 and one jump of 0.1 are five jumps total.

6. a.

b. Ben’s guess was the closest. Nathalie’s guess was the farthest off.

c. Nathalie: $3.10 (too high)
Leo: $1.89 (too low)
Maria: $1.61 (too high)
Ben: $0.86 (too high)
2. a. 4 kg. Sample strategy using a double number line:

\[\begin{array}{cccccc}
0 & 1 & 2 & 3 & 4 & 5 kg \\
0 & $1.25 & $2.50 & $5.00 & $6.25 \\
\end{array}\]

b. The price for 3.2 kg of apples is $4.00.
To get 3.2 kg, you can add 0.2 to 3.
The price for 3.2 kg of apples is $3.75 + $0.25 = $4.00.

3. 45 minutes are needed.
Sample strategy using a double number line:

Calculations: First double, and then times 3.
The same calculations can be made using a ratio table.
Section E Choose Your Model

1. You can draw a number line and then use jumps to find the difference.

The answer: Janet jumped 0.12 m (or 12 cm) farther.

2. A way to solve this problem is using a ruler with centimeters and inches. The 8 in. by 6 in. frame is best.
   a. The length is 5 inches, which is about 12.5 cm; that is too small, because the length of the photo is 15 cm.
   b. Both 6 inches and 4 inches are a little larger than 15 cm and 10 cm.
   c. This frame is large enough: 8 inches is more than 16 cm, and 6 inches is more than 12 cm.

3. You can think of a double number line to find the solution.

You have to cut at $\frac{3}{4}$, because $\frac{1}{4}$ is 600 grams, and the rest is $\frac{3}{4}$, which is 1,800 grams.

4. Assuming a 15% tip, the cost of the dinner with tax and tip will be: $7.99 + $1.20 + $0.40 = $9.59

To find the tax and the tip, you can use a percent bar.
5. You can use an extended ratio table to organize your work.

<table>
<thead>
<tr>
<th>Number of Pizzas</th>
<th>1</th>
<th>2</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cups pizza sauce</td>
<td>$\frac{3}{4}$</td>
<td>$1\frac{1}{2}$</td>
<td>3</td>
</tr>
<tr>
<td>Tbsp pizza sauce</td>
<td>2</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Cups of honey</td>
<td>$\frac{1}{4}$</td>
<td>$\frac{1}{2}$</td>
<td>1</td>
</tr>
<tr>
<td>Tbsp hot pepper sauce</td>
<td>$\frac{1}{2}$</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Cups chicken breast</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Tubes pizza dough</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Tbsp olive oil</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Cups blue cheese</td>
<td>$\frac{3}{4}$</td>
<td>$1\frac{1}{2}$</td>
<td>3</td>
</tr>
<tr>
<td>Cups diced celery</td>
<td>$\frac{1}{2}$</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Here is a shopping list for making 4 pizzas.

**Possible shopping list:**
- One jar of honey (12-ounce container)
- Four cups of sauce, or 48-ounce container
- Two chicken breasts
- Four tubes of pizza dough
- A small bottle of hot pepper sauce
- One small bottle of olive oil (4 tablespoons)
- 12 ounces of blue cheese
- One head of celery