Lesson 5: Solving Problems by Finding Equivalent Ratios

Student Outcomes

- Students use tape diagrams to find an equivalent ratio when given the part-to-part ratio and the total of those two quantities. Students use tape diagrams to find an equivalent ratio when given the part-to-part ratio and the difference between those two quantities.
- Students make the connection between the constant, c, in the definition of equivalent ratios and the value of the unit in the tape diagram used to solve ratio problems.

Classwork

Example 1 (10 minutes)

Provide students time to think about each question, and then elicit a class discussion for each question. Provide students opportunities to participate and ask questions.


Example 1

A County Superintendent of Highways is interested in the numbers of different types of vehicles that regularly travel within his county. In the month of August, a total of 192 registrations were purchased for passenger cars and pickup trucks at the local Department of Motor Vehicles (DMV). The DMV reported that in the month of August, for every 5 passenger cars registered, there were 7 pickup trucks registered. How many of each type of vehicle were registered in the county in the month of August?

a. Using the information in the problem, write four different ratios and describe the meaning of each.

   The ratio of cars to trucks is $5 : 7$ and is a part-to-part ratio. The ratio of trucks to cars is $7 : 5$ and that is a part-to-part ratio. The ratio of cars to total vehicles is 5 to 12 and that is a part-to-whole ratio. The ratio of trucks to total vehicles is 7 to 12 and that is a part-to-whole ratio.

b. Make a tape diagram that represents the quantities in the part-to-part ratios that you wrote.

   Passenger Cars

   Pickup Trucks
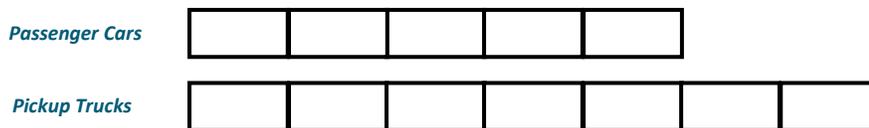
c. How many equal-sized parts does the tape diagram consist of?

   12

d. What total quantity does the tape diagram represent?

   192 *vehicles*

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e. **What value does each individual part of the tape diagram represent?**

Divide the total quantity into **12** *equal-sized parts:*

$$\frac{192}{12} = 16$$

f. **How many of each type of vehicle were registered in August?**

$5 \cdot 16 = 80$ *passenger cars*

$7 \cdot 16 = 112$ *pickup trucks*

Example 2 (10 minutes)

Find the values of the partial quantities in Example 2.

Example 2

The Superintendent of Highways is further interested in the numbers of commercial vehicles that frequently use the county's highways. He obtains information from the Department of Motor Vehicles for the month of September and finds that for every 14 non-commercial vehicles, there were 5 commercial vehicles. If there were 108 more non-commercial vehicles than commercial vehicles, how many of each type of vehicle frequently use the county's highways during the month of September?

Non-Commercial Vehicles

Commercial Vehicles

These **9** *sections represent the "more than commercial vehicles," which is* **108**.

To determine how many cars each section represents, divide **108** *by* **9** *to get* **12**. *Therefore, each section of the tape diagram represents* **12** *vehicles.*

Since every section of the tape diagram represents 12 vehicles, demonstrate how to calculate the number of each type of vehicle.

168 non-commercial vehicles and 60 commercial vehicles.

Exercises (16 minutes)

In pairs or small groups, students complete the following problems. After students are given time to work, have groups explain their answers.

Exercises

1. **The ratio of the number of people who own a smartphone to the number of people who own a flip phone is $4:3$. If 500 more people own a smartphone than a flip phone, how many people own each type of phone?**

   $2,000$ *people own a smartphone, and* $1,500$ *people own a flip phone.*

2. Sammy and David were selling water bottles to raise money for new football uniforms. Sammy sold 5 water bottles for every 3 water bottles David sold. Together they sold 160 water bottles. How many did each boy sell?

   Sammy sold 100 *water bottles, and David sold* 60 *water bottles.*

3. Ms. Johnson and Ms. Siple were folding report cards to send home to parents. The ratio of the number of report cards Ms. Johnson folded to the number of report cards Ms. Siple folded is 2 : 3. At the end of the day, Ms. Johnson and Ms. Siple folded a total of 300 report cards. How many did each person fold?

   Ms. Johnson folded 120 *report cards, and Ms. Siple folded* 180 *report cards.*

4. At a country concert, the ratio of the number of boys to the number of girls is 2 : 7. If there are 250 more girls than boys, how many boys are at the concert?

   There are 100 *boys at the country concert.*

Closing (4 minutes)

- Explain how tape diagrams can be helpful in solving ratio word problems.

Exit Ticket (5 minutes)

Name _____   Date_____

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Exit Ticket

When Carla looked out at the school parking lot, she noticed that for every 2 minivans, there were 5 other types of vehicles. If there are 161 vehicles in the parking lot, how many of them are not minivans?

Exit Ticket Sample Solution

> When Carla looked out at the school parking lot, she noticed that for every 2 minivans, there were 5 other types of vehicles. If there are 161 vehicles in the parking lot, how many of them are not minivans?
>
> *5 out of 7 vehicles are not minivans.* $7 \times 23 = 161$. *So,* $5 \times 23 = 115$. *115 of the vehicles are not minivans.*

Problem Set Sample Solutions

1. Last summer, at *Camp Okey-Fun-Okey*, the ratio of the number of boy campers to the number of girl campers was $8:7$. If there were a total of 195 campers, how many boy campers were there? How many girl campers?

    104 boys and 91 girls are at Camp Okey-Fun-Okey.

2. The student-to-faculty ratio at a small college is $17:3$. The total of students and faculty is 740. How many faculty members are there at the college? How many students?

    111 faculty members and 629 students are at the college.

3. The Speedy Fast Ski Resort has started to keep track of the number of skiers and snowboarders who bought season passes. The ratio of the number of skiers who bought season passes to the number of snowboarders who bought season passes is $1:2$. If $1,250$ more snowboarders bought season passes than skiers, how many snowboarders and how many skiers bought season passes?

    $1,250$ skiers bought season passes, and $2,500$ snowboarders bought season passes.

4. The ratio of the number of adults to the number of students at the prom has to be $1:10$. Last year there were 477 more students than adults at the prom. If the school is expecting the same attendance this year, how many adults have to attend the prom?

    53 adults have to be at the prom to keep the $1:10$ ratio.