Unit 2, Lesson 5: Defining Equivalent Ratios

Lesson Goals

- Create diagrams that represent equivalent ratios.
- Find sets of equivalent ratios.
- Explain the meaning of equivalent ratios using words and diagrams.

Required Materials

- tools for creating a visual display

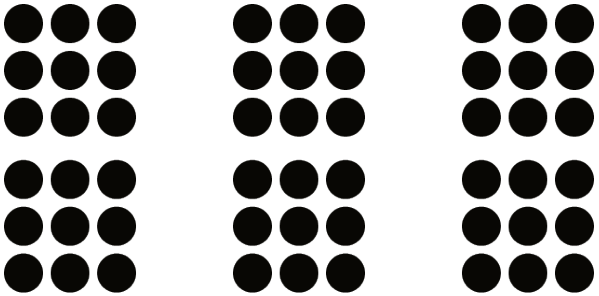
5.1: Dots and Half Dots (10 minutes)

Setup:

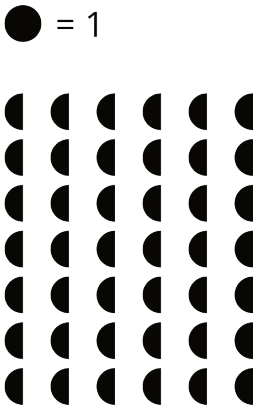
Display the image for all to see, hide it, and then reveal it once more. 1 minute of quiet think time after each image, followed by a whole-class discussion.

Student task statement

Dot Pattern 1:



Dot Pattern 2:



Possible responses

1. 54 dots

2. 21 dots

5.2: Tuna Casserole (15 minutes)

Setup:

Allow students a few minutes for individual think time to read the recipe and questions. Then have students work with a partner to complete the task.

Student task statement

Here is a recipe for tuna casserole.

Ingredients

- 3 cups cooked elbow-shaped pasta
- 6 ounce can tuna, drained
- 10 ounce can cream of chicken soup
- 1 cup shredded cheddar cheese
- $1\frac{1}{2}$ cups French fried onions

Instructions

Combine the pasta, tuna, soup, and half of the cheese. Transfer into a 9 inch by 18 inch baking dish. Put the remaining cheese on top. Bake 30 minutes at 350 degrees. During the last 5 minutes, add the French fried onions. Let sit for 10 minutes before serving.

1. What is the ratio of the ounces of soup to the cups of shredded cheese to the cups of pasta in one batch of casserole?

2. How much of each of these 3 ingredients would be needed to make:
   a. twice the amount of casserole?

   b. half the amount of casserole?

   c. five times the amount of casserole?

   d. one-fifth the amount of casserole?

Possible responses

1. $10 : 1 : 3$.

2. The ratio of these ingredients for different numbers of batches are:
   a. 20 ounces, 2 cups, 6 cups

   b. 5 ounces, $\frac{1}{2}$ cup, $1\frac{1}{2}$ cups

   c. 50 ounces, 5 cups, 15 cups

   d. 2 ounces, $\frac{1}{5}$ cup, $\frac{3}{5}$ cup.

3. $3 : 6$.

4.
   a. 3 batches

   b. 6 batches

   c. $\frac{1}{3}$ batch

Anticipated misconceptions

Students who are not yet fluent in fraction multiplication from grade 5

3. What is the ratio of cups of pasta to ounces of tuna in one batch of casserole?

4. How many batches of casserole would you make if you used the following amounts of ingredients?

   a. 9 cups of pasta and 18 ounces of tuna?

   b. 36 ounces of tuna and 18 cups of pasta?

   c. 1 cup of pasta and 2 ounces of tuna?

Are you ready for more?

The recipe says to use a 9 inch by 18 inch baking dish. Determine the length and width of a baking dish with the same height that could hold:

1. Twice the amount of casserole
2. Half the amount of casserole
3. Five times the amount of casserole
4. One-fifth the amount of casserole

may have difficulty understanding how to find half or one-fifth of the recipe ingredient amounts. Likewise, they may have difficulty identifying one-third of a batch. Suggest that they draw a picture of $\frac{1}{2}$ of 10, remind them that finding $\frac{1}{2}$ of a number is the same as dividing it by 2, or remind them that $\frac{1}{2}$ of a number means $\frac{1}{2}$ times that number.

Possible Responses

Answers vary. Sample responses:

1. 18 inch by 18 inch
2. 9 inch by 9 inch
3. 45 inch by 18 inch
4. 9 inch by $\frac{18}{5}$ inch

5.3: What Are Equivalent Ratios? (15 minutes)

Setup: Students in groups of 3–4. Provide tools for creating a visual display.

Student task statement

The ratios $5 : 3$ and $10 : 6$ are **equivalent ratios**.

1. Is the ratio $15 : 12$ equivalent to these? Explain your reasoning.
2. Is the ratio $30 : 18$ equivalent to these? Explain your reasoning.
3. Give two more examples of ratios that are equivalent to $5 : 3$.
4. How do you know when ratios are equivalent and when they are *not* equivalent?
5. Write a definition of *equivalent ratios*.

   Pause here so your teacher can review your work and assign you a ratio to use for your visual display.

6. Create a visual display that includes:
   - the title "Equivalent Ratios"
   - your best definition of *equivalent ratios*
   - the ratio your teacher assigned to you
   - at least two examples of ratios that are equivalent to your assigned ratio
   - an explanation of how you know these examples are equivalent
   - at least one example of a ratio that is *not* equivalent to your assigned ratio
   - an explanation of how you know this example is *not* equivalent

   Be prepared to share your display with the class.

Possible responses

1. No
2. Yes
3. Answers vary. Sample responses: $15 : 9$, $20 : 12$, $50 : 30$
4. Answers vary.
5. Answers vary. Sample response: A ratio is equivalent to $a : b$ when both a and b are multiplied by the same number.
6. Answers vary.

Anticipated misconceptions

Students may incorporate recipes, specific examples, or batch thinking into their definitions. These are important ways of thinking about equivalent ratios, but challenge them to come up with a definition that only talks about the numbers involved and not

what the numbers represent.

If groups struggle to get started thinking generally about a definition, give them a head start with: "A ratio is equivalent to $a : b$ when . . ."

If students include "or divide" in their definition, remind them that, for example, dividing by 5 gives the same result as multiplying by one-fifth. Therefore, we can just use "multiply" in our definition.

Lesson Synthesis (5 minutes)

How can you make multiple batches of a mixture or food recipe using equivalent ratios? What are equivalent ratios, and how are they created?

5.4: Why Are They Equivalent? (Cool-down, 5 minutes)

Setup: None.

Student task statement

1. Write another ratio that is equivalent to the ratio $4 : 6$.

2. How do you know that your new ratio is equivalent to $4 : 6$? Explain or show your reasoning.

Possible responses

1. Answers vary.

2. Answers vary.

Anticipated misconceptions

If students are not clear about the meaning of equivalent ratios, refer them to the visual displays created in the previous activity.