Activity Narrative

This activity introduces students to ratio language and notation through examples based on a collection of everyday objects. Students learn that a ratio is an association between quantities, and that this association can be expressed in multiple ways.

After discussing examples of ratio language and notation for one way of categorizing the objects in the collection, students write ratios to describe the quantities for another way of categorizing objects in the collection.

As students work, circulate and identify those who:

- Create different categories from the given collection.
- Create categories whose quantities can be rearranged into smaller groups (e.g. 6 A's and 4 B's can be expressed as "for every 3 A's there are 2 B's").
- Express the same ratio in opposite order or by using different words (e.g. "the ratio of A to B is 7 to 3," and "for every 7 A's there are 3 B's").

Activity

1. Think of a way to sort your teacher's collection into two or three categories. Record your categories in the top row of the table and the amounts in the second row.

category name			
category amount			

Pause here so your teacher can review your work.

2. Write at least two sentences that describe **ratios** in the collection. Remember, there are many ways to write a ratio:
   - The ratio of *one category* to *another category* is _____ to _____.
   - The ratio of *one category* to *another category* is _____ : _____.
   - There are _____ of *one category* for every _____ of *another category*.

Activity Narrative

In this activity, students continue to draw connections between a diagram and the ratios it represents. Students work in pairs to discuss different ways to use ratio language to describe discrete diagrams. They first identify statements that would correctly describe a given diagram. Then, they create both a diagram and corresponding statements to represent a new situation involving ratio.

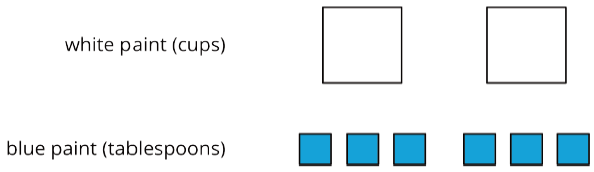
As students work, monitor for different ways in which students draw and discuss diagrams of the paste recipe. Identify a few pairs who draw different diagrams and use ratio language differently to share later. A few things to anticipate:

- Some students may draw very literal drawings of cups and pints. Encourage them to use simpler representations.
- Students may choose to draw letters (X's) or other symbols or marks instead of squares and rectangles.
- Students may use equivalent ratios to describe a situation, even though these have not been explicitly taught (e.g., they may say the ratio of cups of flour to pints of water is $4:1$ instead of $8:2$). Though this is correct, be careful here. We have previously regrouped objects and might say, for example, that with a ratio $8:2$, "for every 4 cups of flour there is 1 cup of water," but we have not asserted that this ratio can be written as $4:1$ yet. The idea of equivalent ratios is sophisticated and will be developed over the next several lessons.
- Correct descriptions may include fractions (e.g., for every tablespoon of blue paint, there is $\frac{1}{3}$ cup of white paint). Although students are not expected to work with fractions in this lesson, responses involving fractions are fine.

Activity

Elena mixed 2 cups of white paint with 6 tablespoons of blue paint.

Here is a diagram that represents this situation.



1. Discuss the statements that follow, and circle all those that correctly describe this situation. Make sure that both you and your partner agree with each circled answer.

   A. The ratio of cups of white paint to tablespoons of blue paint is $2:6$.

   B. For every cup of white paint, there are 2 tablespoons of blue paint.

   C. There is 1 cup of white paint for every 3 tablespoons of blue paint.

   D. There are 3 tablespoons of blue paint for every cup of white paint.

   E. For each tablespoon of blue paint, there are 3 cups of white paint.

   F. For every 6 tablespoons of blue paint, there are 2 cups of white paint.

   G. The ratio of tablespoons of blue paint to cups of white paint is 6 to 2.

2. Jada mixed 8 cups of flour with 2 pints of water to make paste for an art project.

   a. Draw a diagram that represents the situation.

   b. Write at least two sentences describing the ratio of flour and water.

Activity Narrative

Students continue to use diagrams to represent the ratio of ingredients in a recipe as well as mixtures that contain multiple batches. They come to understand that a change in the number of batches changes the quantities of the ingredients, but the end product tastes the same. They then use this observation to come up with a working definition for equivalent ratio.

Activity

A recipe for one batch of cookies calls for 5 cups of flour and 2 teaspoons of vanilla.

1. Draw a diagram that shows the amount of flour and vanilla needed for *two* batches of cookies.
2. How many batches can you make with 15 cups of flour and 6 teaspoons of vanilla? Indicate the additional batches by adding more ingredients to your diagram.
3. How much flour and vanilla would you need for 5 batches of cookies?
4. Whether the ratio of cups of flour to teaspoons of vanilla is $5 : 2$, $10 : 4$, or $15 : 6$, the recipes would make cookies that taste the same. We call these **equivalent ratios**.
    a. Find another ratio of cups of flour to teaspoons of vanilla that is equivalent to these ratios.
    b. How many batches can you make using this new ratio of ingredients?

Activity Narrative

In this activity, students mix different numbers of batches of a color recipe to obtain a certain shade of green. They observe how multiple batches of the same recipe produce the same shade of green as a single batch, which suggests that the ratios of blue to yellow for the two situations are equivalent. They also come up with a ratio that is not equivalent to produce a mixture that is a different shade of green.

As students make the mixtures, ensure that they measure accurately so they will get accurate outcomes. As students work, note the different diagrams students use to represent their recipes. Select a few examples that could be highlighted in discussion later.

Activity

Your teacher mixed milliliters of blue water and milliliters of yellow water in the ratio $5 : 15$.

1. Doubling the original recipe:
   a. Draw a diagram to represent the amount of each color that you will combine to double your teacher's recipe.
   b. Use a marker to label an empty cup with the ratio of blue water to yellow water in this double batch.
   c. Predict whether these amounts of blue and yellow will make the same shade of green as your teacher's mixture. Next, check your prediction by measuring those amounts and mixing them in the cup.
   d. Is the ratio in your mixture equivalent to the ratio in your teacher's mixture? Explain your reasoning.
2. Tripling the original recipe:
   a. Draw a diagram to represent triple your teacher's recipe.
   b. Label an empty cup with the ratio of blue water to yellow water.
   c. Predict whether these amounts will make the same shade of green. Next, check your prediction by mixing those amounts.
   d. Is the ratio in your new mixture equivalent to the ratio in your teacher's mixture? Explain your reasoning.
3. Next, invent your own recipe for a bluer shade of green water.
   a. Draw a diagram to represent the amount of each color you will combine.
   b. Label the final empty cup with the ratio of blue water to yellow water in this recipe.
   c. Test your recipe by mixing a batch in the cup. Does the mixture yield a bluer shade of green?
   d. Is the ratio you used in this recipe equivalent to the ratio in your teacher's mixture? Explain your reasoning.

Activity Narrative

In this activity, students identify what equivalent ratios have in common (a ratio equivalent to $a : b$ can be generated by multiplying both a and b by the same number) and generate equivalent ratios (MP8). It is at this point in the unit where students will explicitly define the term "equivalent ratios" (MP6).

Activity

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.