Rocket Strips

1

Dividing a Whole into Fractional Parts

MATERIALS

Strip Diagrams
(at end of lesson)
Scissors

Lesson Overview

Students create strip diagrams for unit fractions $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{6}$, $\frac{1}{8}$, $\frac{1}{12}$, and $\frac{1}{16}$. They identify equivalent fractions by aligning the strip diagrams on the fold lines, and then complete a graphic organizer to represent all the equivalent fractions represented by the strip diagrams. Students conclude that the numerator and denominator of equivalent fractions are multiples of the original unit fractions.

Grade 6
Proportionality

(4) The student applies mathematical process standards to develop an understanding of proportional relationships in problem situations. The student is expected to:

(F) represent benchmark fractions and percents such as 1%, 10%, 25%, $33\frac{1}{3}$%, and multiples of these values using 10 × 10 grids, strip diagrams, number lines, and numbers.

(5) The student applies mathematical process standards to solve problems involving proportional relationships. The student is expected to:

(C) use equivalent fractions, decimals, and percents to show equal parts of the same whole.

ELPS

1.A, 1.C, 1.F, 2.C, 2.D, 2.E, 3.E, 4.F, 5.F

Essential Ideas

- Strip diagrams are used to compare fractions with different denominators.
- A unit fraction is a fraction that has a numerator of 1 and a denominator that is a positive integer.
- Equivalent fractions are fractions that represent the same part-to-whole relationship.
- Equivalent fractions are fractions generated by multiplying both the numerator and denominator by the same factor.

Lesson Structure and Pacing: 1 Day

Engage

Getting Started: Newspaper Column Preparation

Students are introduced to a situation involving newspaper columns. They use this context to make sense of strip diagrams. Students cut out eight strip diagrams and label the first one as "one whole." They will be guided how to fold the remaining strip diagrams in the next activity.

Develop

Activity 1.1: Building and Comparing Strip Diagrams

Students are instructed how to fold each strip to create different unit fractions. They identify equivalent fractions by aligning the strip diagrams on the fold lines then complete a graphic organizer to represent all the equivalent fractions represented by the strip diagrams.

Demonstrate

Talk the Talk: Numerate the Denomination

Students summarize the meaning of equivalent fractions and how to write equivalent fractions.

Getting Started: Newspaper Column Preparation

ENGAGE

Facilitation Notes

In this activity, students are introduced to a situation involving newspaper columns. They use this context to makes sense of strip diagrams. Students cut out eight strip diagrams and label the first one as "one whole." They will be shown how to fold the remaining strip diagrams in the next activity.

Ask a student to read the situation aloud. Have students complete Questions 1 and 2 individually. Share responses as a class.

Questions to ask

- What is meant by the "layout" of the column?
- What content is Matthew planning to put in the columns?
- How should Matthew change the layout so that more students can be recognized for their kindness?

Summary

A strip diagram can be used to represent one whole.

Activity 1.1

Building and Comparing Strip Diagrams

DEVELOP

Facilitation Notes

In this activity, students are instructed how to fold each strip to create different unit fractions. They identify equivalent fractions by aligning the strip diagrams on the fold lines, and then complete a graphic organizer to represent all the equivalent fractions represented by the strip diagrams.

Ask a student to read the introduction. Complete Question 1 as a class.

Questions to ask

- What does the denominator of the fraction represent?
- What does the numerator of the fraction represent?
- How many halves make a whole?

Have students complete Questions 2 through 4 with their partner or group. Share responses as a class.

Questions to ask

- How did you determine what fraction to use to label each part of the strip diagram?
- How do the denominators of the fractions compare to each other?
- How many parts does it take to make a half in this strip diagram?

Differentiation strategy

To extend the activity, have students compare their strip diagrams to the markings between 0 and 1 inch on a ruler with customary units.

Have students complete Questions 5 through 7 with their partner or group. Share responses as a class.

Differentiation strategy

To scaffold support, demonstrate how to fold the strip into three equal sections.

Questions to ask

- How did you determine what fraction to use to label each part of the strip diagram?
- Why are the fractions labeled $\frac{1}{6}$ and $\frac{1}{12}$?
- How many parts does it take to make $\frac{1}{3}$ in the two other strip diagrams?

Have students complete Questions 8 through 10 with their partner or group. Share responses as a class.

Questions to ask

- How is a unit fraction different than all other fractions?
- What is an example of a fraction that is not a unit fraction?
- Why does the least fraction have the greatest denominator?

Have students complete Questions 11 through 13 with their partner or group. Share responses as a class.

Questions to ask

- What pattern do you see in all the equivalent fractions?
- How can you tell if two fractions are equivalent without using strip diagrams?
- What would be an equivalent fraction to $\frac{1}{2}$ that has a denominator of 10?

Summary

Fractions that represent the same part-to-whole relationship are equivalent fractions.

Talk the Talk: Numerate the Denomination

DEMONSTRATE

Facilitation Notes

In this activity, students summarize the meaning of equivalent fractions and how to write equivalent fractions.

Ask students to work with a partner or in groups to complete Questions 1 and 2. Share responses as a class.

Questions to ask

- What operations can you use to write equivalent fractions?
- Why can you use divison by the same number, as well as multiplication, to write an equivalent fraction?
- Provide an example for the directions you provided in Question 2.

Summary

To write a fraction that is equivalent to a given fraction, multiply or divide the numerator and denominator by the same number.

NOTES

1 Rocket Strips

Dividing a Whole into Fractional Parts

WARM UP

1. If two people equally split one donut, how much of the donut does each person receive?
2. If three people equally split one donut, how much of the donut does each person receive?
3. If *n* people equally split one donut, how much of the donut does each person receive?

LEARNING GOALS

- Create equal parts of a whole.
- Determine whether fractions are equal.

KEY TERMS

- unit fraction
- equivalent fractions

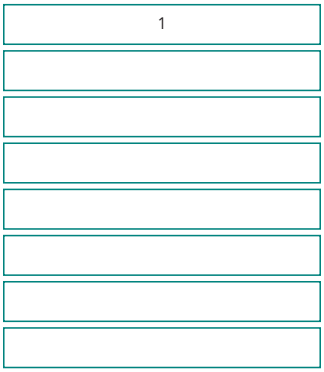
You have used concrete models to determine factors and multiples. How can you use strip diagrams to represent and compare fractions with different denominators?

Warm Up Answers

1. Each person gets $\frac{1}{2}$ of a donut.
2. Each person gets $\frac{1}{3}$ of a donut.
3. Each person gets $\frac{1}{n}$ of a donut.

Answers

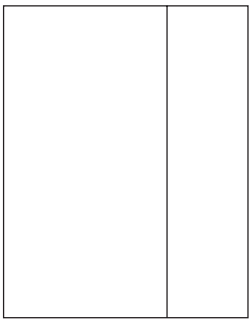
1.



2. One student can be recognized on a whole strip.

Getting Started

Newspaper Column Preparation



You signed up to participate in the school newspaper club. During the first meeting, faculty advisors Ms. Foster and Ms. Shu showed everyone copies of last year's publication of the *Rocket*. The teachers have already planned out the sections for this year's *Rocket*.

Matthew volunteered to create the "Random Acts of Kindness" section of the school newspaper, the *Rocket*. The section will appear along the right side of the paper's back page. The newspaper is printed on $8\frac{1}{2}$-inch by 11-inch paper.

Matthew plans to put a box in each homeroom and ask students to nominate classmates for the monthly recognition of random acts of kindness. Students must tell what nice act their nominee performed on a nomination slip.

In preparation for completing his section, help Matthew plan the layout of the column; do not worry about the top or bottom margin of the page.

> *The paper strips are provided for you at the end of this lesson.*

1. To begin, cut eight strips of paper the length of a newspaper page. Remember, the *Rocket* is printed on $8\frac{1}{2}$-inch × 11-inch paper. Each strip of paper should be 1 inch wide. The strip represents one whole column. Do not fold the first strip, and label it as "1," to represent one whole.

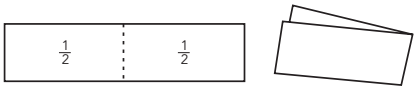
2. How many students can be recognized on a whole strip?

ACTIVITY
1.1

Building and Comparing Strip Diagrams

Let's consider the number of students that can be recognized in different columns.

1. **Take one of your paper strips and fold it carefully in half to divide the strip into two equal parts like the one shown. Label each folded part of the paper strip with the appropriate fraction, and draw a line to mark your fold. How many students can be recognized in this column?**



2. **Take another paper strip and fold it carefully in half two times. Unfold and draw lines to mark your folds. Then, label each folded part of the paper strip with the appropriate fraction. How many students can be recognized in this column?**

3. **Take another paper strip and fold it in half three times. Be very careful to fold accurately. Unfold and draw lines to mark your folds. Then, label each folded part of the paper strip with the appropriate fraction. How many students can be recognized in this column?**

Answers

1. Two students can be recognized in this column.
2. Four students can be recognized in this column.
3. Eight students can be recognized in this column.

Answers

4. Sixteen students can be recognized in this column.
5. Three students can be recognized in this column.
6. Six students can be recognized in this column.

4. Take another paper strip and fold it very carefully in half, four times. Unfold and draw lines to mark your folds. Then, label each folded part of the paper strip with the appropriate fraction. How many students can be recognized in this column?

5. Take another paper strip and fold it carefully into three equal sections. Unfold and draw lines to mark your folds. Then, label each folded part of the paper strip with the appropriate fraction. How many students can be recognized in this column?

6. Take the next paper strip and fold it into thirds, and then fold the strip in half. Unfold and draw lines to mark your folds. Then, label each folded part of the paper strip with the appropriate fraction. How many students can be recognized in this column?

7. Finally, take your last paper strip and fold it into thirds. Then, fold in half, and then fold in half once more. Unfold and draw lines to mark your folds. Then, label each folded part of the paper strip with the appropriate fraction. How many students can be recognized in this column?

Arrange your paper strips in a column so that all of the left edges are lined up and the strips are ordered from the strip with the smallest parts to the strip with the largest parts.

8. As the number of students who can be recognized in the column increases, describe what happens to the space for each student.

> *To list a set in ascending order means to list the set from least to greatest. To list a set in descending order means to list the set from greatest to least.*

A **unit fraction** is a fraction that has a numerator of 1 and a denominator that is a positive integer.

9. List the unit fractions for each strip diagram you created in ascending order.

Answers

7. Twelve students can be recognized in this column.
8. As the number of students increases, the space for each student decreases.
9. $\frac{1}{16}, \frac{1}{12}, \frac{1}{8}, \frac{1}{6}, \frac{1}{4}, \frac{1}{3}, \frac{1}{2}$

Answers

10. The denominator of the unit fraction tells me how many parts the whole is divided into.
11. See below.
12. See answers on the next page.

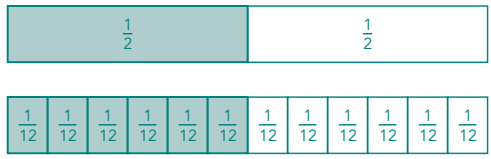
10. Explain how understanding the size of a unit fraction helps you determine the size of the whole.

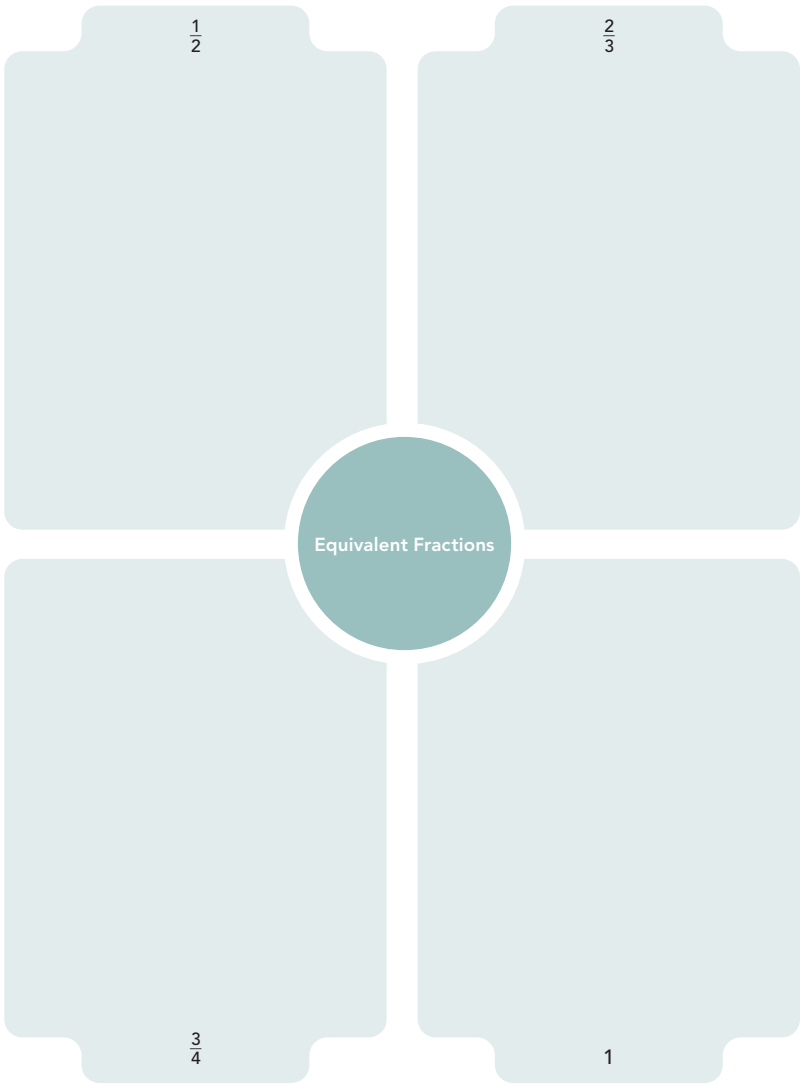
If you folded the paper strips carefully, you will notice that some of the folds line up with each other. Fractions that represent the same part-to-whole relationship are **equivalent fractions**.

11. Show that $\frac{1}{2}$ is equivalent to $\frac{6}{12}$. Draw on the strip diagrams to represent halves and twelfths. Then, shade the strip diagrams to represent $\frac{1}{2}$ and $\frac{6}{12}$.

12. Make a collection of equivalent fractions using your strip diagrams. Then, complete the graphic organizer by writing all the equivalent fractions for each.

11.





Answers

12. Fractions equivalent to $\frac{1}{2}$ are $\frac{2}{4}$, $\frac{3}{6}$, $\frac{4}{8}$, $\frac{6}{12}$, and $\frac{8}{16}$.

    Fractions equivalent to $\frac{2}{3}$ are $\frac{4}{6}$ and $\frac{8}{12}$.

    Fractions equivalent to $\frac{3}{4}$ are $\frac{6}{8}$, $\frac{9}{12}$, and $\frac{12}{16}$.

    Fractions equivalent to 1 are $\frac{2}{2}$, $\frac{3}{3}$, $\frac{4}{4}$, $\frac{6}{6}$, $\frac{8}{8}$, $\frac{12}{12}$, and $\frac{16}{16}$.

Answers

13. The parts of each fraction are equal. If I compare the $\frac{1}{8}$ strip diagram with the $\frac{1}{16}$ strip diagram, I see that $\frac{2}{16}$ is equivalent to $\frac{1}{8}$.

13. **What do you notice in the collection of equivalent fractions? Give an example to justify your answer.**

NOTES

TALK the TALK

Numerate the Denomination

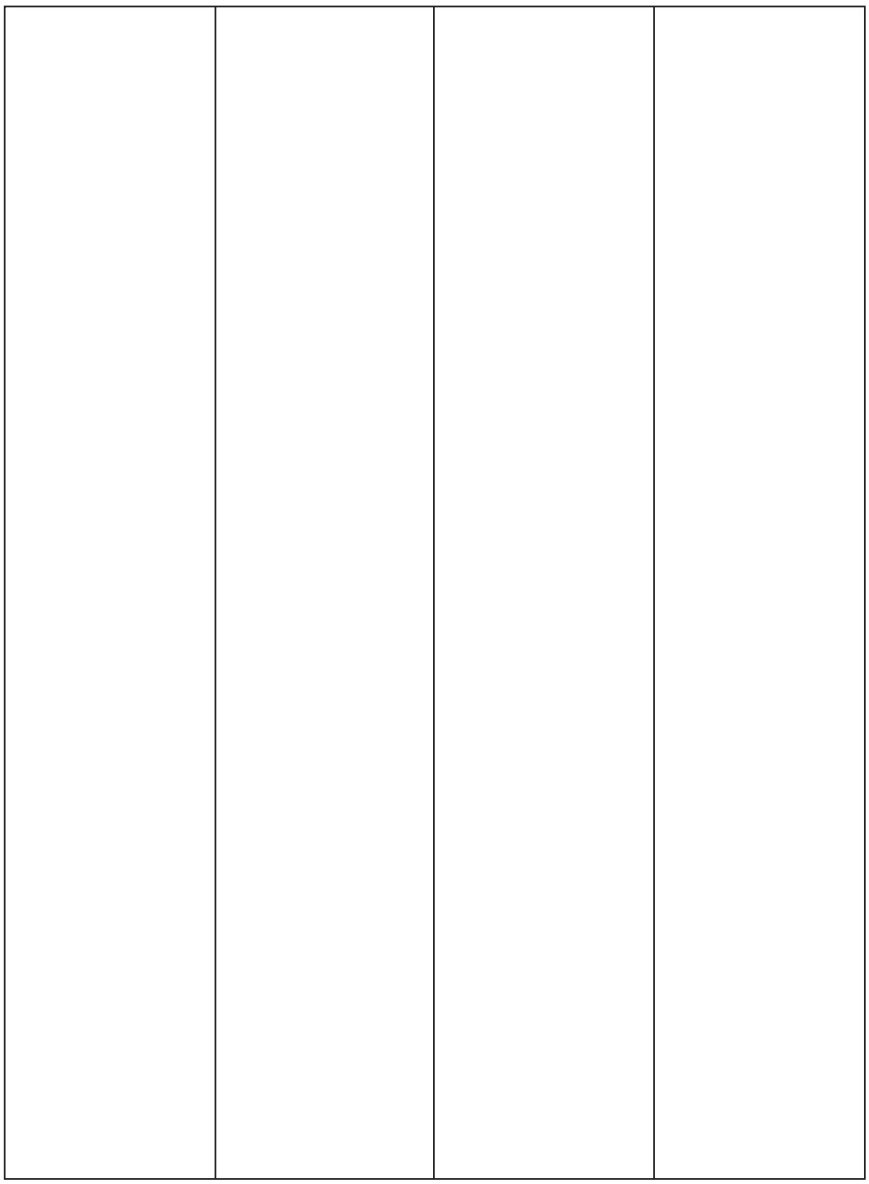
1. **What do you notice about the numerator and denominator of the equivalent fractions?**

2. **What do you need to do to both the numerator and the denominator of a fraction in order to write another equivalent fraction?**

Be prepared to share your solutions and methods.

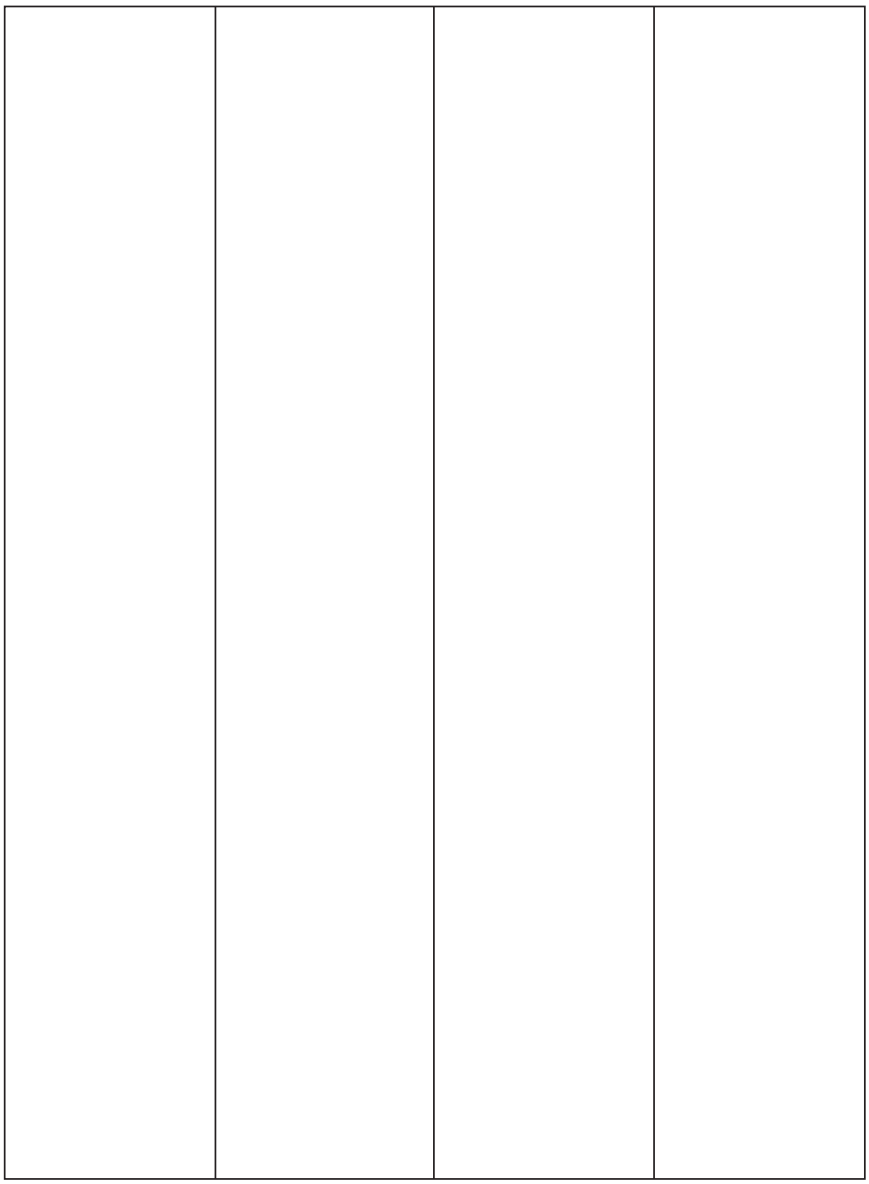
Answers

1. The numerators and denominators of the equivalent fraction are multiples of the original unit fraction.
2. I need to multiply or divide both the numerator and denominator by the same factor.



Why is this page blank?

So you can cut out the paper strips on the other side.



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