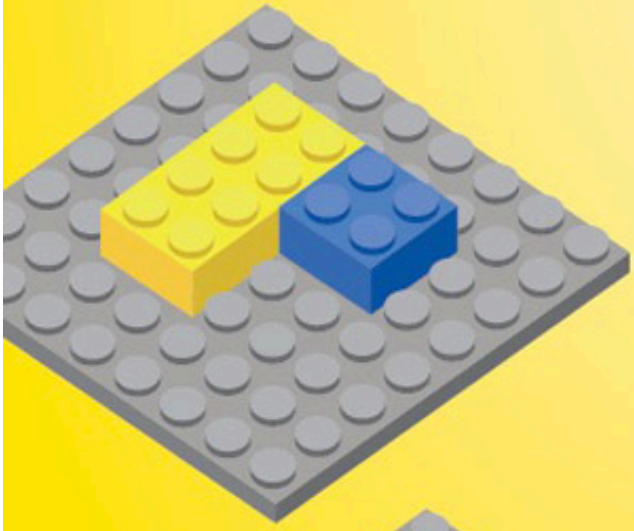
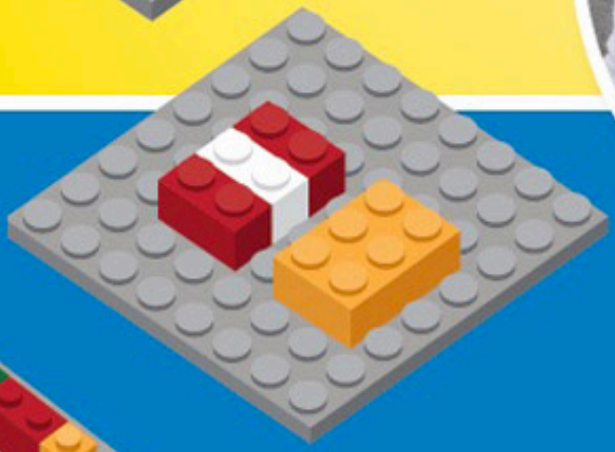
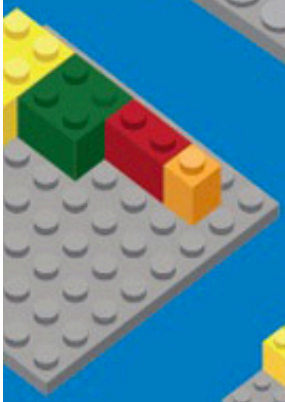
TEACHER EDITION

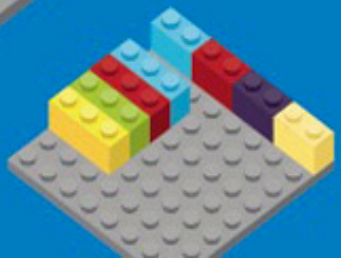
BASIC FRACTIONS

USING LEGO® BRICKS









Dr. Shirley Disseler

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BRIGANTINE MEDIA

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Second Edition

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CONTENTS

PARTS OF A FRACTION

Students will learn/discover:

- The term *numerator*
- The term *denominator*
- The term *whole* and how it is represented in a fraction

Why is this important?

Students need to see a fraction as one number, not as two separate numbers.

They also need to understand the relationship between the numerator and denominator as they proceed toward ratios in later content.

Vocabulary:

- **Numerator:** The digit of the fraction that shows the amount of the whole being used; the numerator is on the top of the fraction
- **Denominator:** The digit of the fraction that shows the whole; the denominator is on the bottom of the fraction

How to use the companion student book, *Basic Fractions Using LEGO® Bricks–Student Edition*:

- After students build their models, have them draw the models and explain their thinking in the Student Edition. Recording the models on paper after building them with bricks helps reinforce the concepts being taught.
- Discuss the vocabulary for each lesson with students as they work through the Student Edition.
- Use the chapter assessments in the Student Edition to gauge student understanding of the content.

SUGGESTED BRICKS

Size	Number
1x1	10
1x2	10
1x3	4
1x4	4
1x6	6 (two colors)
1x8	4
1x12	2
1x16	2
2x2	6
2x4	8

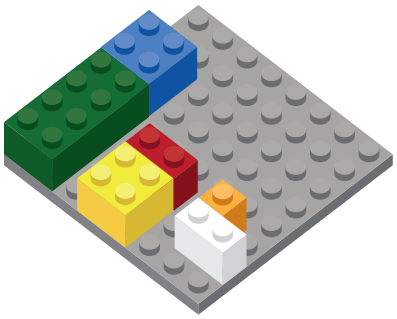
Note: Using a baseplate will help keep the bricks in place. One baseplate is suggested for these activities.

Part 1: Show Them How

Discuss with students the following:

A fraction represents part of a whole.

A fraction has two parts: the *numerator* and the *denominator*. The denominator is the digit that tells the size of the whole. For example, if the denominator is 8, then we know that the whole is made up of 8 pieces. The denominator is shown on the bottom of the fraction. The numerator is the digit that tells the amount being used out of the whole. For example, if the numerator is 6 and the denominator is 8, then we know that we are using 6 of the 8 pieces or $^6/_8$. The numerator is shown on the top of the fraction.



1. Use bricks to make several models of $^1/_2$, as illustrated. Ask students to think about what the term "half" means.

When using bricks to model fractions, count the studs. The studs represent the digits of the denominator and numerator of the fraction. One-half can be modeled in many ways.

Ask students which bricks in your models represent numerators.

(*Answers for the example illustrated:* blue 2x2, red 1x2, and orange 1x1)

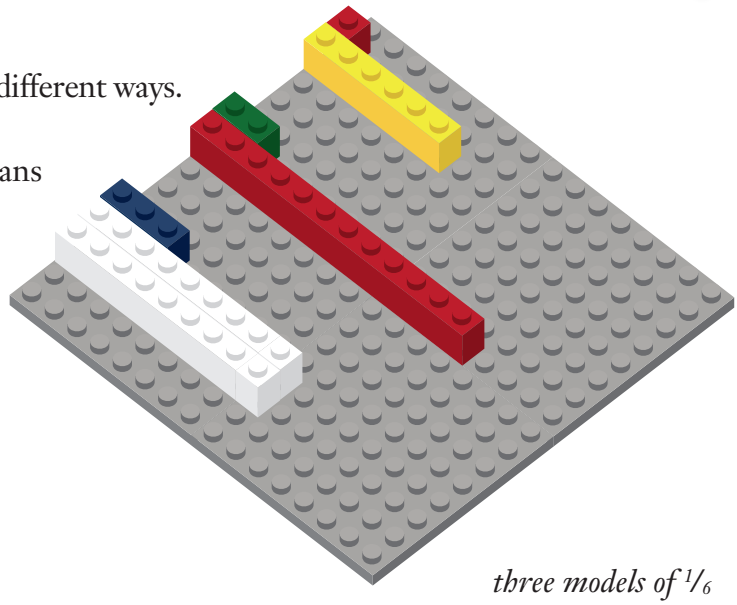
Ask students which bricks represent denominators.

(*Answers for the example illustrated:* green 2x4, yellow 2x2, and white 1x2)

Ask students to model two more ways to make $^1/_2$.

2. Ask students to model $^1/_6$ with bricks in two different ways.

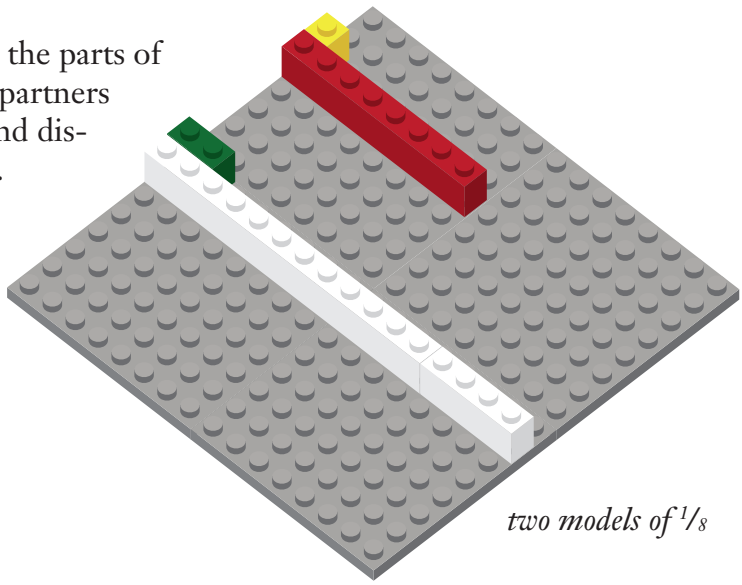
Ask students what the 6 in the fraction means (*answer*: the whole, which has 6 parts). Ask students what the 1 in the fraction means (*answer*: the number of parts used of that whole).



three models of $^1/_6$

3. Ask students to model $^1/_8$ with bricks.

Have students discuss with a partner what the parts of the fraction (the 1 and the 8) mean. Have partners show each other more ways to model $^1/_8$ and discuss how they know their models show $^1/_8$.

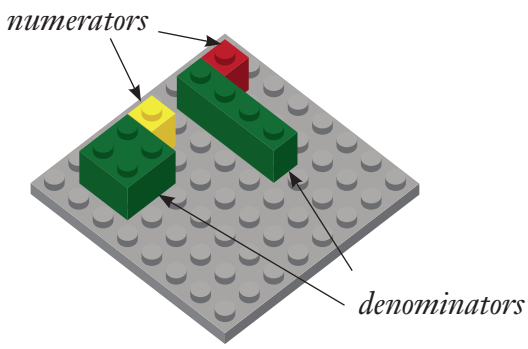


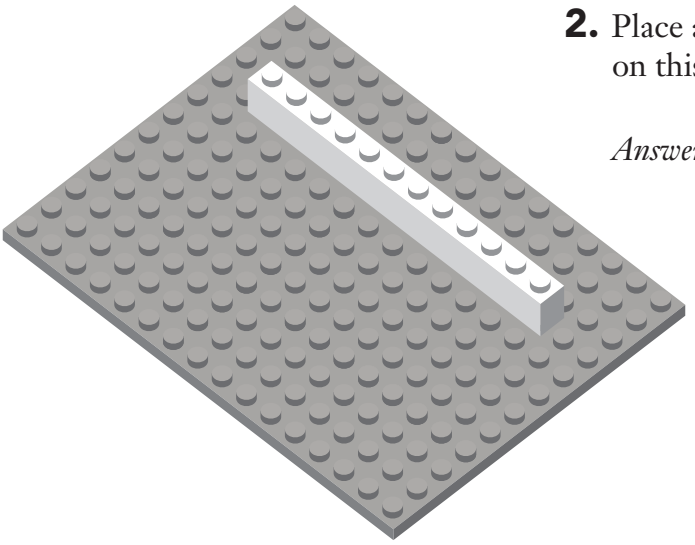
two models of $^1/_8$

Part 2: Show What You Know

1. Can you design a model that shows $^1/_4$? Draw your model and label the numerator and denominator.

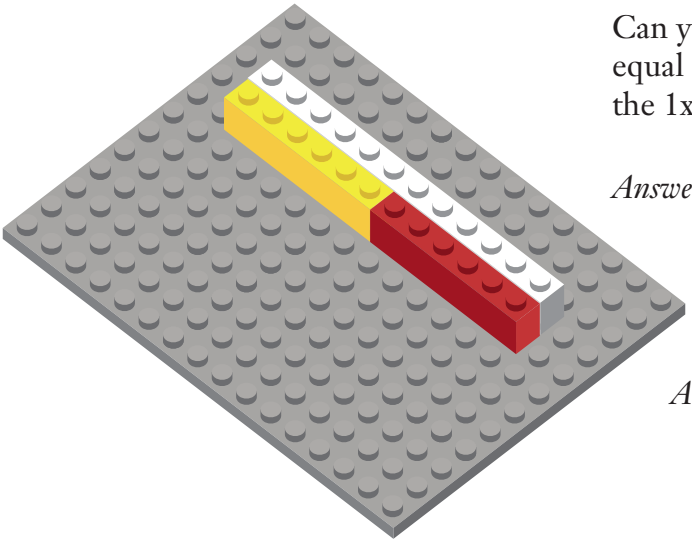
Possible solutions:





2. Place a 1x12 brick on a baseplate. How many studs are on this brick?

Answer: 12 studs

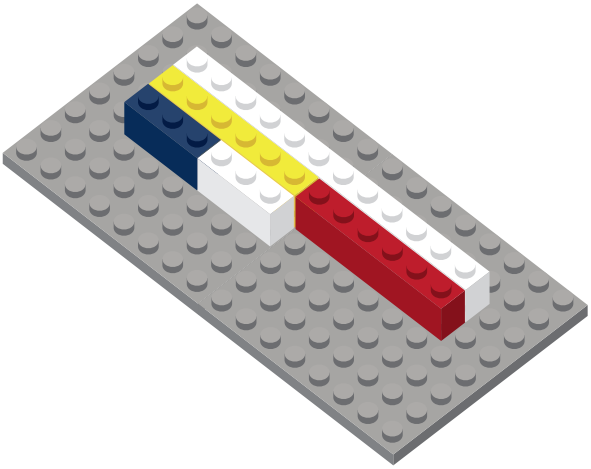


Can you find two bricks of the same length that together equal the length of the 1x12 brick? Place them next to the 1x12 brick. Which size brick did you choose?

Answer: 1x6 brick

What fraction shows how much of the whole each of these bricks represents?

Answer: each 1x6 brick represents $1/2$ of the whole

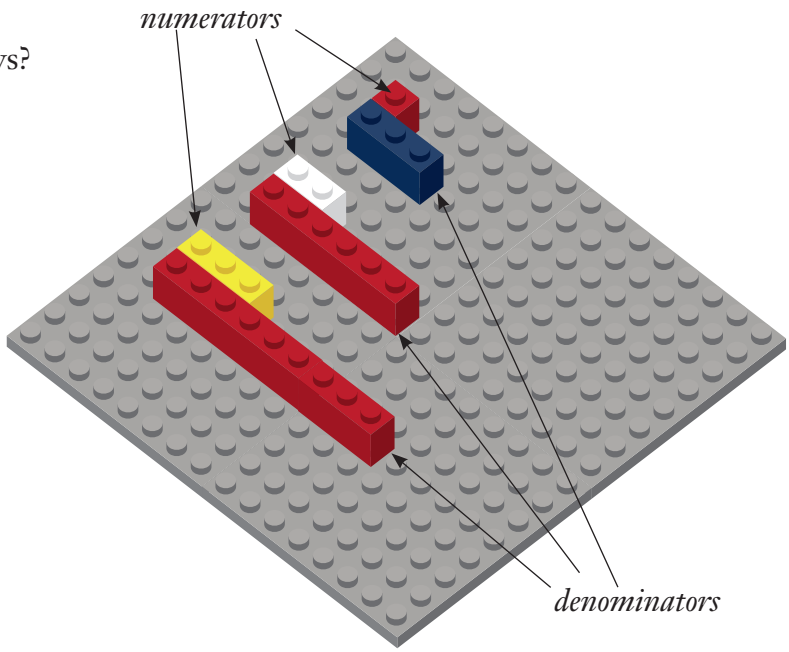


Can you show another way to model $1/2$ of the 1x12 brick?

Possible solution: two 1x3 bricks together model $1/2$ of the 1x12 brick

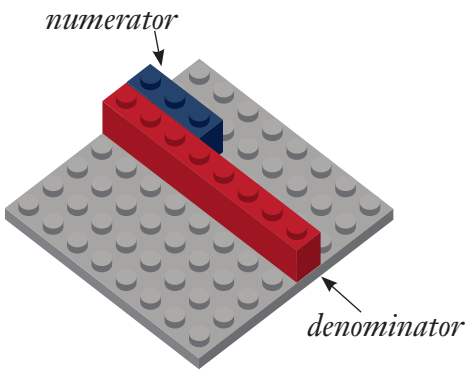
3. Can you model $1/3$ in three different ways? Draw and label your model to show the numerators and the denominators.

Possible solution:



4. Challenge Problem: Model $3/8$. Draw your model. Label the numerator and the denominator.

Possible solution:



2

SUGGESTED BRICKS

Size	Number
1x1	40
1x2	16
1x3	6
1x4	8
1x6	4
1x8	4
2x2	6
2x3	2
2x4	8
2x6	2
2x8	2

Note: Using a baseplate will help keep the bricks in place. One baseplate is suggested for these activities.

BENCHMARK FRACTIONS

Students will learn/discover:

- Values of the benchmark fractions: $1/4$, $1/2$, and $3/4$
- Fractions can be made with different wholes

Why is this important?

Students start by understanding the meaning of the benchmark fractions that they will see over and over again. Benchmark fractions better prepare students to make estimates of measurements, distances, and amounts of wholes in real-life situations.

Another key to understanding fractions is the recognition that fractions can be made from many different wholes.

Envision the concept of a whole as a pizza, and recognize that a piece that is $1/8$th of a 14-inch large pizza is not the same-sized piece as one that is $1/8$th of an 8-inch small pizza. The fractional amount of the whole is the same, but if the size of the two whole pizzas is different, the fractions are not equal.

Vocabulary:

- **Numerator:** The digit of the fraction that shows the amount of the whole being used; the numerator is on the top of the fraction
- **Denominator:** The digit of the fraction that shows the whole; the denominator is on the bottom of the fraction
- **Benchmark fractions:** Simple fractions that are commonly used, such as $1/8$, $1/4$, $1/2$, and $3/4$

How to use the companion student book, *Basic Fractions Using LEGO® Bricks–Student Edition*:

- After students build their models, have them draw the models and explain their thinking in the Student Edition. Recording the models on paper after building them with bricks helps reinforce the concepts being taught.
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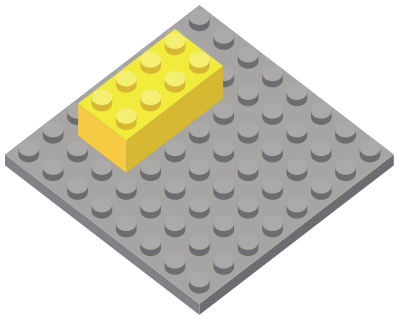
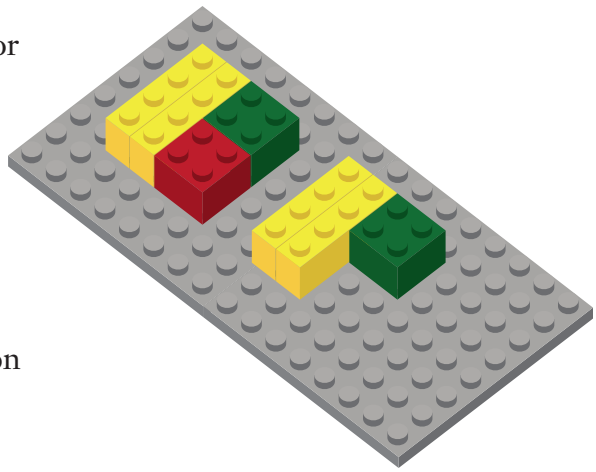
Part 1: Show Them How

Model benchmark fractions $^1/_2$, $^1/_4$, $^1/_8$, and $^3/_4$



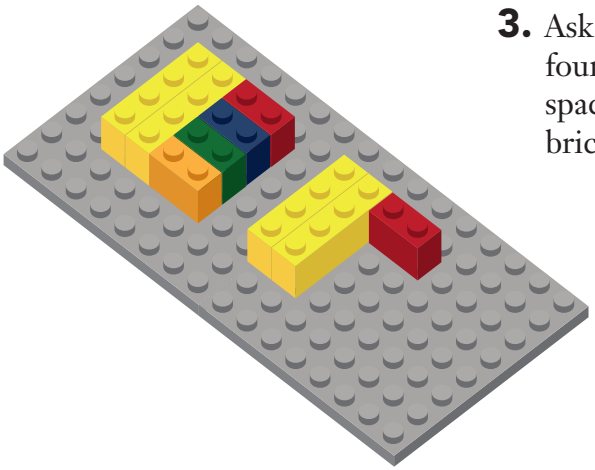
1. Place a 2x4 brick on a baseplate. This is the whole. Remind students that this represents the denominator of the fraction. The denominator is the whole that is being divided into parts. It is the bottom number in a fraction. In this case, the denominator is 8.



two 2x2 bricks divide the whole (8 studs) into halves (4 studs)

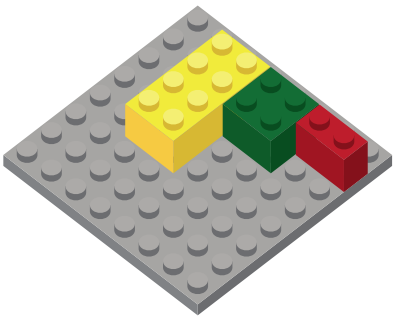
2. Ask students to find $^1/_2$ of this whole. Have them look for two bricks that are the same size and take up the same space as the whole when they are placed together. One of these bricks equals $^1/_2$ (*answer:* one 2x2 brick or one 1x4 brick).

The four-stud brick (2x2) is one-half the eight-stud brick (2x4). The 4 is the numerator in the fraction, which is the top number. Since 4 is half of 8, this fraction can be written as $^4/_8$ or $^1/_2$.

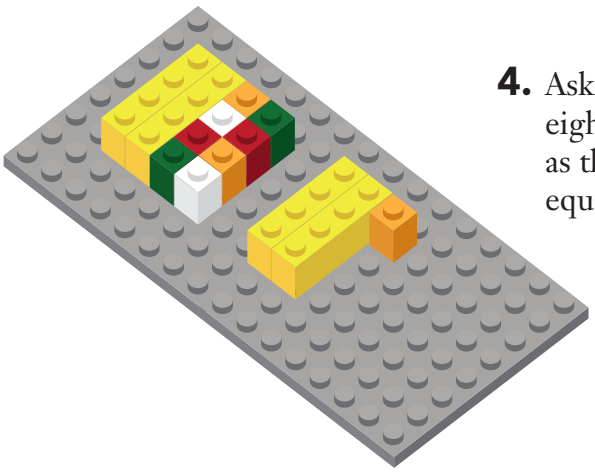


four 1x2 bricks divide the whole (8 studs) into quarters (2 studs)

3. Ask students to find $1/4$ of the whole. Have them look for four bricks that are the same size that take up the same space as the whole when placed together. One of these bricks equals $1/4$ (*answer:* one 1x2 brick).



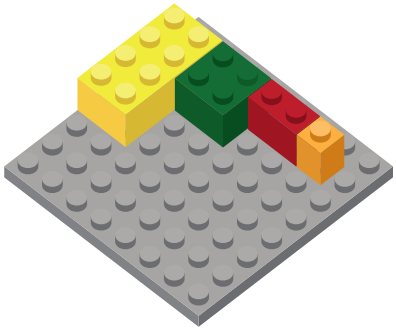
More for students to discover:
Demonstrate that $1/4$ is equivalent to $1/2$ of the half found in step 2.



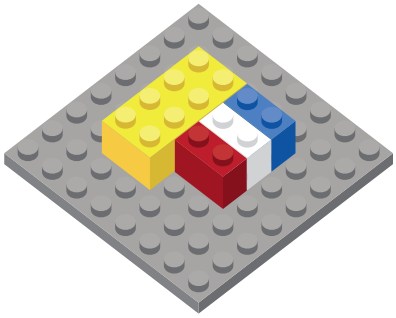
eight 1x1 bricks divide the whole (8 studs) into eighths (1 stud)

4. Ask students to find $1/8$ of the whole. Have them look for eight bricks of the same size that take up the same space as the whole when placed together. One of these bricks equals $1/8$ (*answer*: one 1x1 brick).

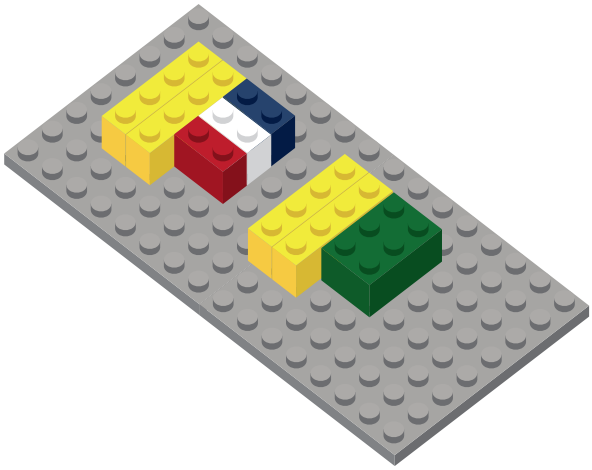
More for students to discover:
Demonstrate that this 1x1 brick is equivalent to $\frac{1}{2}$ of the $\frac{1}{4}$ in step 3.



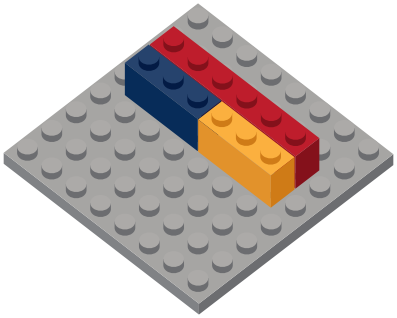
5. Ask students to find $\frac{3}{4}$ of the whole. Have them look for the brick that made $\frac{1}{4}$, then find three of them (*answer*: three 1x2 bricks).



More for students to discover:
Demonstrate that three 1x2 bricks are equivalent to one 2x3 brick.

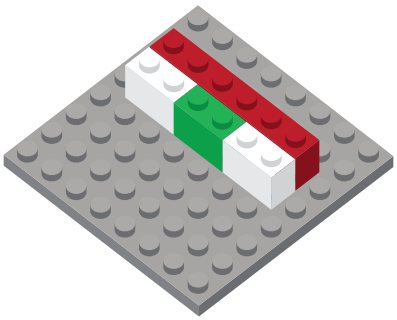


Part 2: Show What You Know



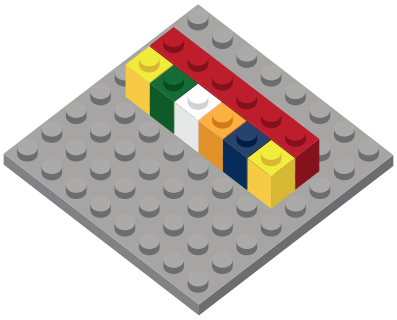
1. Place a 1x6 brick on a baseplate. Find a brick that shows $1/2$ of this whole. Build this model. Which brick did you use?

Answer: 1x3 brick



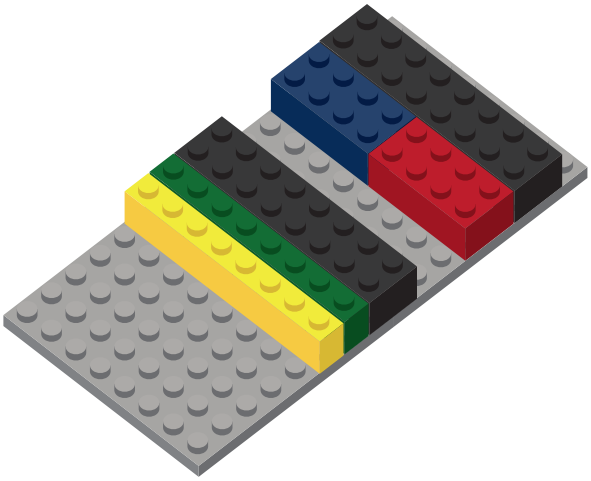
2. Use a 1x6 brick as the whole and build a model to show $1/3$ of this whole. Which brick did you use? Draw your model and explain your thinking.

Answer: 1x2 brick, because three 1x2 bricks are the same length as one 1x6 brick



3. Use a 1x6 brick as the whole and build a model to show $1/6$ of this whole. Which brick did you use? Draw your model and explain your thinking.

Answer: 1x1 brick, because six 1x1 bricks are the same length as one 1x6 brick



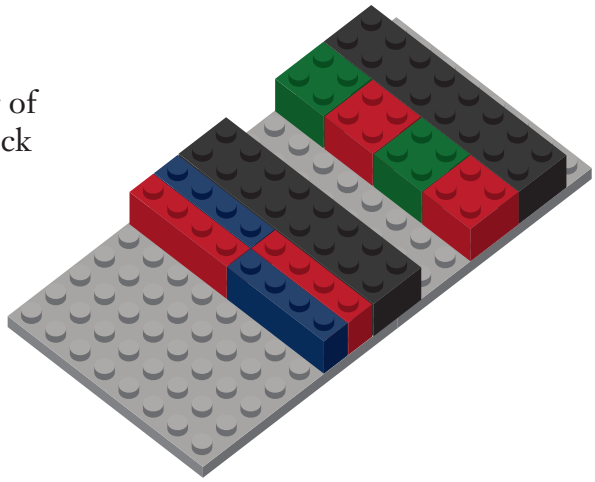
4. If one whole is equal to a 2x8 brick, what brick can be used to model each of the following? Build your model for each, draw the model, and explain your thinking.

a. $1/2$

Possible answers: 2x4 brick or 1x8 brick, because two of these bricks are the same dimensions as one 2x8 brick

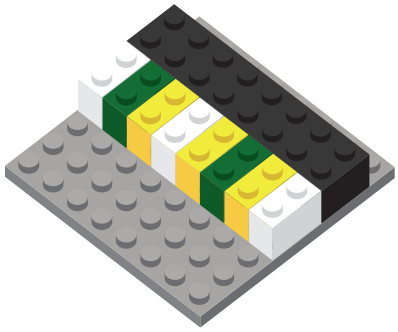
b. $1/4$

Possible answers: 2x2 brick or 1x4 brick, because four of these bricks are the same dimensions as one 2x8 brick



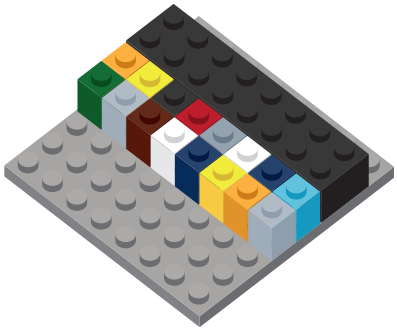
c. $1/8$

Answer: 1x2 brick, because eight of these bricks are the same dimensions as one 2x8 brick



d. $1/16$

Answer: 1x1 brick, because 16 of these bricks are the same dimensions as one 2x8 brick



e. $3/4$ of the whole

Possible answers:

Three 2x2 bricks or one 2x6 brick