

TEACHER EDITION

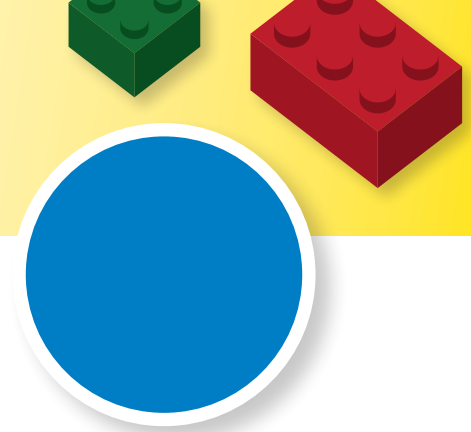


DECIMALS

USING LEGO® BRICKS

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INTRODUCING DECIMALS

Students will learn/discover:

- The definition of a decimal
- How to model decimals using bricks in a decimal grid
- How to model the place values of decimals
- How to write decimals in expanded form
- The similarities between whole number place values and decimal place values
- How to identify decimal numbers as fractions of 100

Why is this important?

Understanding how to read and write decimals is an important skill used in counting money, measuring distance, and statistical analysis. Understanding decimal place value is necessary for reading and writing decimals and using them in real-world situations. In order to grasp how decimal place values work, students must first have a firm foundation in whole number place value.

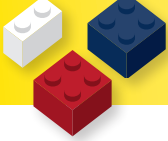
Vocabulary:

- **Decimal number:** A number with a fractional part represented by figures to the right of a decimal point; these figures are the numerator of the equivalent fraction, whose denominator is a power of ten (e.g., the decimal .2 is equivalent to $\frac{2}{10}$ or $\frac{20}{100}$)
- **Mixed decimal:** A number that includes a whole and a fractional part; the whole number is represented by figures to the left of the decimal point, while the fractional part is represented by figures to the right of the decimal point (e.g., 1.25)

SUGGESTED BRICKS

Size	Number
1x1	24
1x2	25
1x3	12
1x4	10
1x6	4
1x8	4
1x10	2
1x12	2
2x2	6
2x3	6
2x4	6

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



- **Decimal notation:** A representation of a fraction or other real number using the base ten system, with any of the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, and a decimal point
- **Tenth:** One of 10 equal parts of a whole (10^{-1} or $\frac{1}{10}$ or .10); in decimal notation, the tenths place is the first place value position to the right of the decimal point
- **Hundredth:** One of 100 equal parts of a whole (10^{-2} or $\frac{1}{100}$ or .01); in decimal notation, the hundredths place is the second place value position to the right of the decimal point
- **Thousandth:** One of 1000 equal parts of a whole (10^{-3} or $\frac{1}{1000}$ or .001); in decimal notation, the thousandths place is the third place value position to the right of the decimal point
- **Expanded form:** A math sentence for a decimal number that shows all place value positions within the number (e.g., $1.25 = 1 + .20 + .05$)

How to use the companion student book, *Decimals 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.

Part 1: Show Them How

Ask students to define a decimal and what it represents (*answer:* like a fraction, a decimal is a form of notation used to represent a part of a whole). *Note:* It is important that students make the connection between decimal and fractional representations of parts of a whole.

Explain to students that they will be learning two ways to model decimal numbers using bricks: the place value model and the decimal grid model.



The Place Value Model:

Remind students how to model decimal place value using bricks. *Note:* See *Basic Measurement Using LEGO Bricks—Teacher Edition* (Chapter 6) to review decimal place value models.

Place value model:

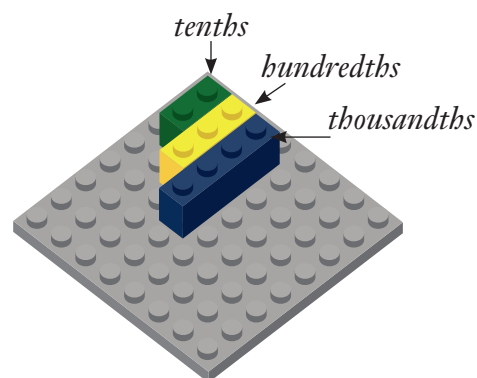
1x2 brick = tenths place = $\frac{1}{10} = 0.1$

1x3 brick = hundredths place = $\frac{1}{100} = 0.01$

1x4 brick = thousandths place = $\frac{1}{1000} = 0.001$

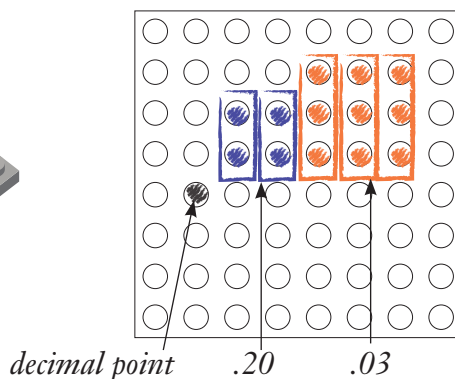
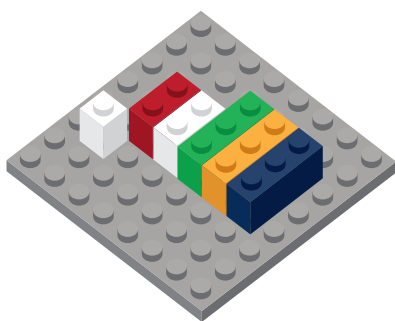
Note: Students should use a 1x1 brick to represent the decimal point. It is helpful to use the same brick color to represent the decimal point every time, especially when building mixed decimals (which also use 1x1 bricks to represent the place value for ones).

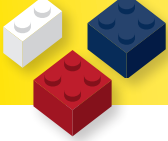
Discuss the relationship between a fractional part and a decimal part. *Note:* It is helpful for students to think about money as an example (e.g., fifty cents as a fractional part is $\frac{1}{2}$ of a dollar, while the same amount as a decimal part is 0.50 of a dollar).



Problem #1: Model this decimal: 0.23

1. Ask students to identify the bricks needed to show the tenths (*answer:* two 1x2 bricks) and the hundredths (*answer:* three 1x3 bricks).
2. Build a place value model for the decimal 0.23 using those bricks. Have students draw the model and label the place values in the decimal.

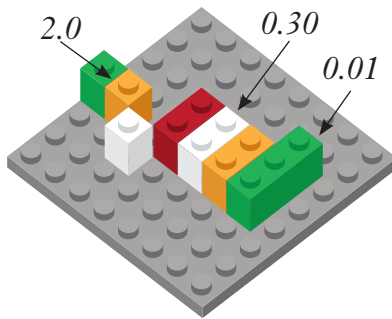




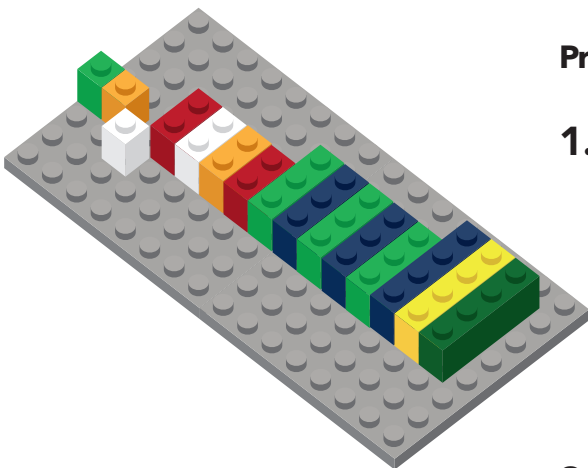
3. Show students how to write the math sentence for the decimal in expanded form (*answer*: $0.20 + 0.03 = 0.23$).

Problem #2: Model this decimal: 2.31

1. Have students identify what type of decimal 2.31 is (*answer*: a mixed decimal). Discuss the definition of a mixed decimal and its similarity to a mixed fraction.
2. Ask students to identify the bricks needed to model the decimal (*answer*: two 1x1 bricks for the whole number, three 1x2 bricks for the tenths, and one 1x3 brick for the hundredths).



3. Show students how to use bricks to build a place value model for the decimal. *Note*: Model the decimal point with a 1x1 brick one row below the model of the decimal, so the brick that models the decimal point is clearly understood.
4. Have students draw the model and label the place values in the decimal. Have students write a math sentence for the decimal in expanded form (*answer*: $2.0 + 0.30 + 0.01 = 2.31$).



Problem #3: Have students model this decimal: 2.453

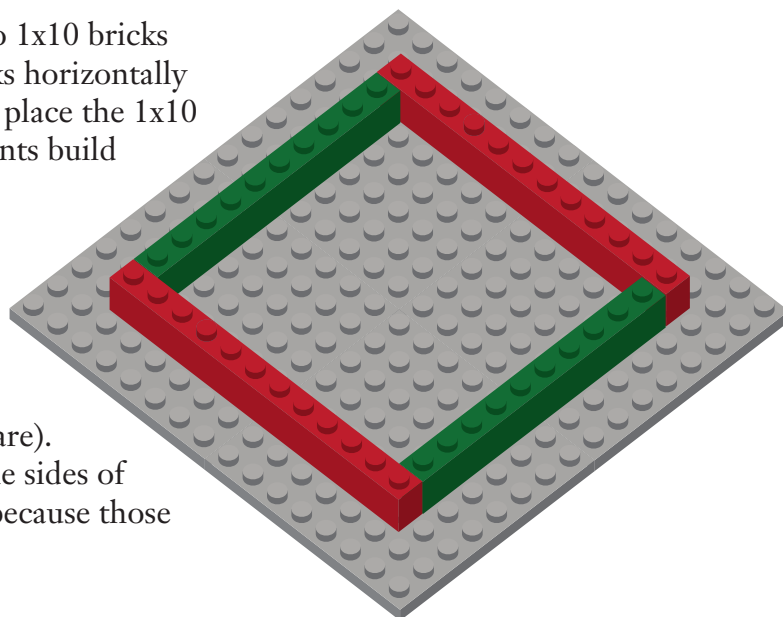
1. Ask students to select the bricks needed to build a place value model for 2.453. Have students discuss their selections with a partner, and then build the model.
2. Have students draw the model, and write a math sentence for the decimal in expanded form (*answer*: $2.0 + 0.4 + 0.05 + 0.003 = 2.453$).
3. Ask students to discuss how decimal place values are similar to whole number place values (*answer*: in both cases, moving between place values requires multiplication or division by 10).



Decimal Grid Model:

Explain to students that you are going to build a Brick Math decimal grid, a 10 x 10 grid with 100 studs inside, which is used to model decimal numbers.

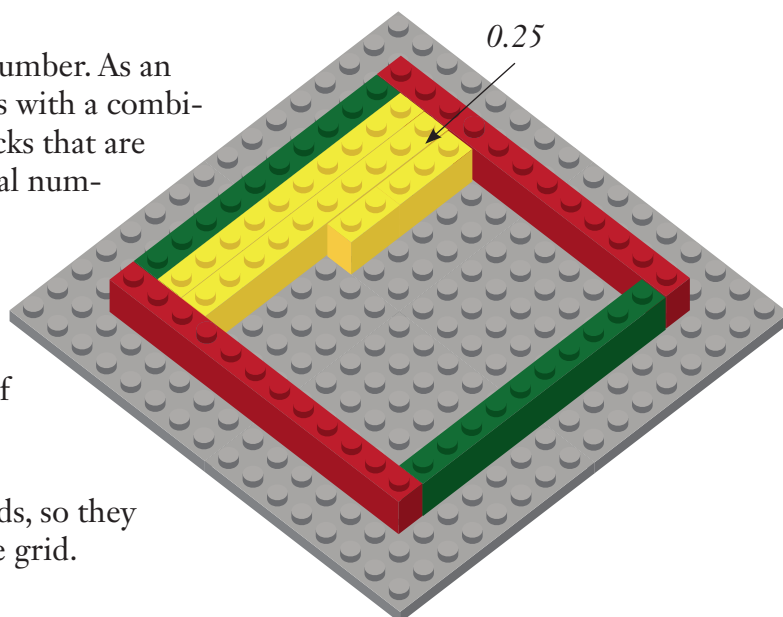
1. Build a rectangle on a baseplate using two 1x10 bricks and two 1x12 bricks. Place the 1x12 bricks horizontally on the top and bottom of the model, and place the 1x10 bricks vertically on each side. Have students build the same model along with you.



2. Ask students to count the number of studs *inside* the rectangle (*answer*: 100 studs). Explain that this is a decimal grid. Have students identify the shape of the grid (*answer*: the grid is a 10 x 10 square). *Note*: Make sure students do not count the sides of the grid (i.e., the 1x10 and 1x12 bricks), because those bricks are not inside the square.

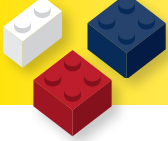
3. Explain that each stud inside the grid represents one hundredth, and each 1x10 column or row of studs represents one tenth, because it contains 10 of the 100 studs.

4. Show students how to model a decimal number. As an example, model 0.25 by covering 25 studs with a combination of bricks. *Note*: If possible, use bricks that are all the same color to represent the decimal number inside the decimal grid.

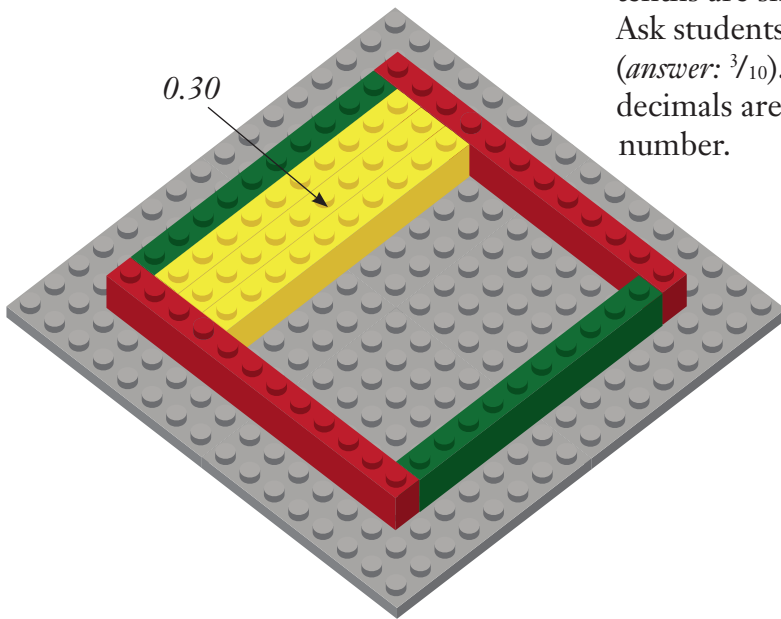


5. Ask students to model 0.30 in a decimal grid using three 1x10 bricks. *Note*: Remind students not to count the sides of the model.

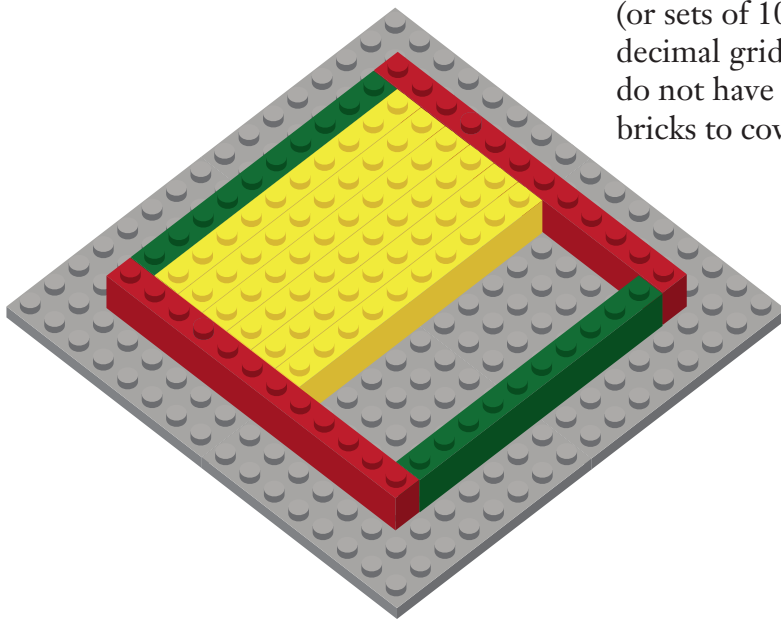
Point out that each 1x10 brick has 10 studs, so they will cover 30 of the 100 total studs in the grid.



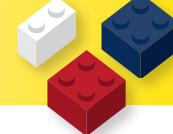
Ask students how to express this as a fractional part of the whole grid (*answer: $\frac{30}{100}$*). Ask students how many tenths are shown in the model (*answer: 3 tenths*). Ask students how 3 tenths are written as a fraction (*answer: $\frac{3}{10}$*). *Note: Make sure students understand that decimals are another way to write a fractional part of a number.*



6. Have students build 0.6 using the grid model. Have them draw their model and explain their thinking, then write a fraction for the decimal. To get students started with the process of modeling, ask how many 1x10 bricks (or sets of 10 studs) are needed to show 6 tenths in the decimal grid (*answer: six 1x10 bricks*). *Note: If students do not have six 1x10 bricks, use a combination of smaller bricks to cover 60 studs.*



*60 of 100 studs are covered
The fraction is $\frac{6}{10}$ or $\frac{60}{100}$*

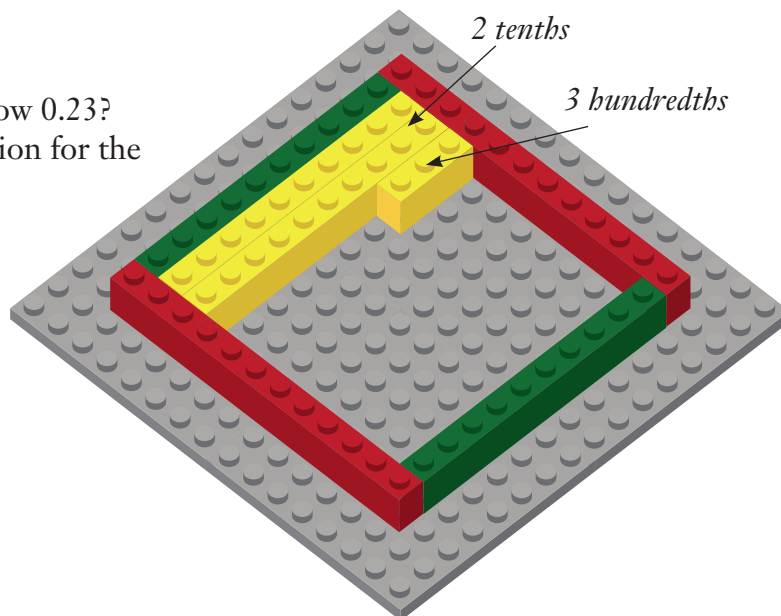


Part 2: Show What You Know

1. Can you use a decimal grid model to show 0.23? Draw and label the model. Write a fraction for the decimal.

Solution:

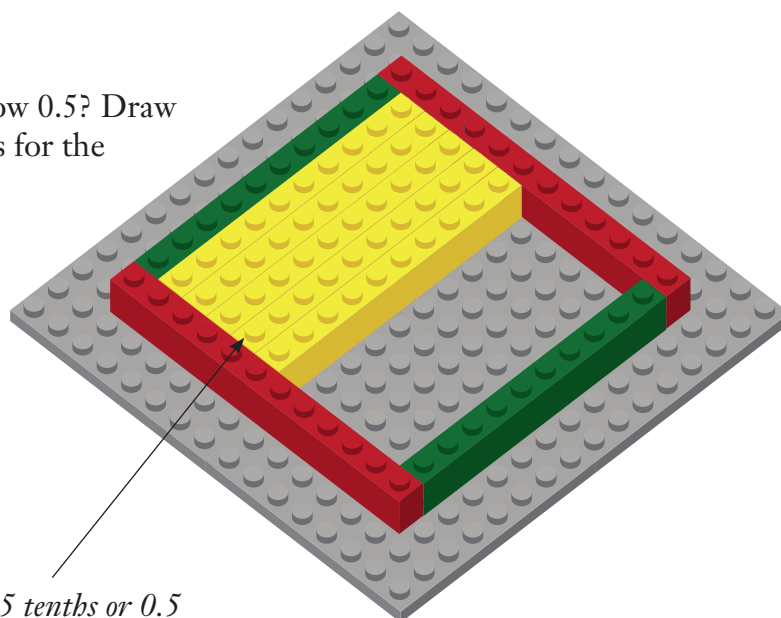
23 of 100 studs are covered
The fraction is $\frac{23}{100}$

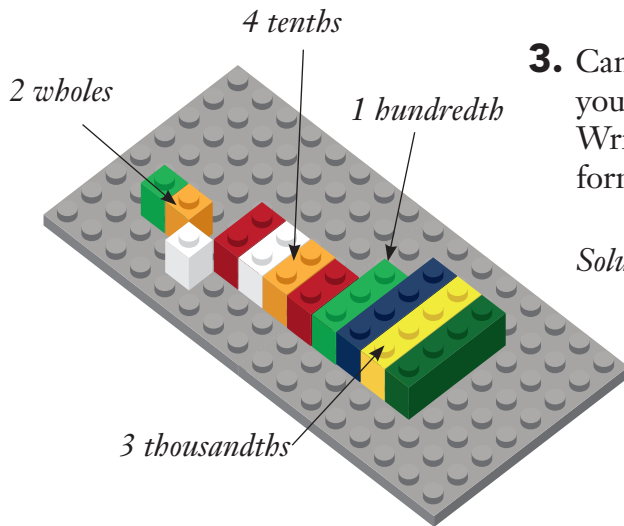
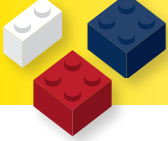


2. Can you use a decimal grid model to show 0.5? Draw and label the model. Write two fractions for the decimal.

Solution:

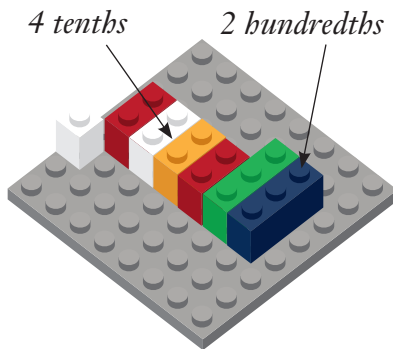
5 tenths or 50 hundredths
 $\frac{5}{10}$ or $\frac{50}{100}$





- 3.** Can you use a place value model to show 2.413? Draw your model and label the parts of the decimal number. Write a math sentence for the decimal in expanded form.

Solution: $2.0 + 0.4 + 0.01 + 0.003 = 2.413$



- 4.** Can you use a place value model to show 0.42? Draw your model and label the parts of the decimal number. Write a math sentence for the decimal in expanded form.

Solution: $0.4 + 0.02 = 0.42$

- 5.** Partner build: Using either a place value model or a decimal grid model, build a decimal number without allowing your partner to see it. Exchange models. Identify the decimal number and the place values in your partner's model. Draw and label the place values in your partner's decimal, and write a math sentence for the decimal in expanded form.

Solutions will vary.