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SMP001

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# Overview

## Essential Standards and Clarifying Objectives

Apply the four operations to solve problems involving integers.

- Use the order of operations to simplify expressions with integers.

Use properties and strategies to compute with integers.

- Use integers with all four operations to solve problems in context.
- Apply the order of operations to integers in the calculation of contextual problems.
- Use formal algorithms for all four operations for integers to develop fluency.

Apply the distributive property to area models.

- Use area models to illustrate the distributive property.
- Use area models to determine the dimensions of a rectangle, given the area.



Goal: To develop understanding of how the operations work in numerical expressions; to develop fluency with the operations both in isolation and in numerical expressions



### WORDS TO KNOW

**denominator**

the bottom number in a fraction; shows how many equal parts the item is divided into

**dividend**

the amount being divided. It is a quantity that is being divided by another quantity. It is essentially a product of two factors (the divisor and the quotient).

**division**

taking the ratio ( $x/y$  or  $x \div y$ ) of two numbers  $x$  and  $y$

**divisor**

the number of shares by which you divide the dividend

**numerator**

the top number in a fraction; shows how many parts of the whole are present

**quotient**

the value of a given ratio; the total amount of each share; the result of a division problem

**reduced fraction**

a fraction written in lowest terms, i.e., by dividing numerator and denominator through by their greatest common divisor. For

example,  $\frac{2}{3}$  is the reduced fraction of  $\frac{8}{12}$ .

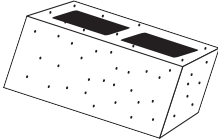

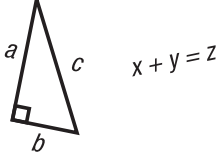
## UNIT 4 • SIMPLIFYING NUMERICAL EXPRESSIONS

### Overview

#### Instruction

- regrouping or “borrowing”** in subtraction, the procedure used to shift or “borrow” from the next higher digit column to the column being subtracted in order to obtain a positive difference in that column and enable the subtraction; used when a digit of higher value is being subtracted from a digit of lower value in an equation involving one or more numbers with multiple digits
- unit size** the lowest positive whole number or amount of a set of items involved in a calculation

#### Teacher Notes

<p><b>Concrete</b> <b>Real world</b></p> 	<p><b>Sense-making</b> <b>Conceptual understanding</b></p> 	<p><b>Communication</b> <b>Representation</b></p> 
<p>Making Change Bowling the Order of Operations Jelly Bean Party Fraction Squares Contig Egg-Cellent Fractions</p>	<p>Why does your product not become larger when you're multiplying fractions? Why is the order of operations important? What does 'division' really mean? Why is unit size important?</p>	<p>PEMDAS <math>24 - (5 \times 4) \div 2 + 15 = 29</math> The Top Dog Gets the Dog House</p>

#### Concepts

- Focus on unit size rather than number of units.
- Following the order of operations ensures consistency when solving multi-step equations.
- Using the distributive property and fractions
- Practice with operations structures
- Fractions are a form of division and can be rewritten as division problems.

## UNIT 4 • SIMPLIFYING NUMERICAL EXPRESSIONS

### Overview

#### Instruction

### Summary of Activities

#### Day 39

Marilyn Burns Fraction Kit warm-up: Combining like terms

Number Theory—Considering the Unit

Combining terms with money

#### Day 40

Marilyn Burns Fraction Kit warm-up: Combining like terms

Number Theory—More practice with units

Subtracting with Money

#### Day 41

Marilyn Burns Fraction Kit—Pick Two

Which came first—the fraction or the egg?

#### Day 42

Marilyn Burns Fraction Kit warm-up

More fractions: how much, how many and finding a common unit size

#### Day 43

Warm-up—Adding and subtracting with Fraction Squares

Multiplying with money

Multiplying Fractions: exploring the question, “Is it really true that when we multiply our answer is always bigger?”

#### Day 44

Warm-up—Adding and subtracting with Fraction Squares

Number Theory—Different forms of division

Multiplying Fractions Algorithm

Division of Fractions

## UNIT 4 • SIMPLIFYING NUMERICAL EXPRESSIONS

### Overview

#### Instruction

#### Day 45

Warm-up: Planning a Jelly Bean Party

Division Algorithm

Mixed Practice and Review

#### Day 46

Warm-up/Number Theory: Practice with the Operation Structures

Distributive Property: Can you do that with fractions?

#### Day 47

Warm-up/Number Theory: Practice with the Operation Structures

Order of Operations

#### Day 48

Warm-up: Play “Contig”

Order of Operations

#### Day 49

Warm-up: Play “Contig”

Practice and Review

#### Day 50

Warm-up: Play “Contig”

Unit Assessment: Showing what you know!

#### Materials List



- Marilyn Burns Fraction Kit
- play money: 1s, 10s, and 100s, pennies, dimes, and quarters—at least 10 ones, 1 ten, 1 100, 20 pennies, 5 dimes, and 4 quarters per student
- egg cartons (1 per student or group)
- 6 pieces of string and fillers for carton (beans, marshmallows, colored discs, etc.)

## UNIT 4 • SIMPLIFYING NUMERICAL EXPRESSIONS

### Overview

#### Instruction

- graph paper
- large-faced clock (analog, not digital) for discussion of fractions
- 6 cups of jelly beans (you may wish to double this amount since the activity is carried out on two separate days)
- 18 measuring cups or other containers that each hold 1 cup
- Contig game materials: Contig game board (created from master in unit), three 6-sided dice, pencil and scratch paper for keeping score, and bingo chips or wide-tip markers to mark game squares
- six-sided dice; 3 per group
- transparencies you create from masters included in unit (noted in applicable lessons)
- “Century Hi/Low” game
- fraction strips created during Unit 3
- unit cubes (optional)
- fraction kit magnets
- scissors (class set)
- Square paper (chop  $8.5 \times 11$  paper into  $8.5 \times 8.5$ )
- Cuisenaire rods
- calculators (class set; preferably not programmed with order of operations)

### Career Connections

Fractions and unit size are critical concepts in accounting, bookkeeping, retail, and banking. Unit size also comes into play with converting from one unit of measurement to another, as in making change for a customer or in cooking.

### Unit Project(s)

Teacher-designed projects (optional)

## Day 41

## Summary

- Review part-to-whole concept of fractions with modeling
- Introduce terms: “numerator,” “denominator,” “part,” “whole”
- Explore equivalent fractions

## Teacher background

Read article (Teaching about the meaning of FRACTIONS: a conceptual and constructivist approach. <http://literacynow.info/page.aspx?hid=167>)

## Learner Objective

As a result of learning, students will understand the functions of the numerator and denominator in a fraction, and model various fractions as parts of the whole.

## Materials List

- egg cartons (1 per student if working individually, or 1 per group)
- 6 pieces of string per group and fillers for carton (beans, marshmallows, colored discs, etc.)
- graph paper
- play money: a dollar’s worth of various coins
- large-faced clock (analog, not digital) for discussion of fractions

## Warm-Up Activity

- Marilyn Burns Fraction Kit Day 41
- worksheet on page 29
- See directions on page 9 and Teaching Directions, pages 9–11, numbers 1–5.
- Model for students and then have students play Pick Two.
- Let students include 3rds and 6ths if they can.
- Have students record and follow directions as on the worksheet on page 29.

## Formative Assessment

**Journal Prompt:** Why is  $\frac{1}{2} + \frac{1}{2}$  equal to 1 whole but  $\frac{1}{2} \cdot \frac{1}{2}$  is equal to  $\frac{1}{4}$ ? Explain in words and pictures.

**Student Worksheets**

Day 41 Practice: Egg-cellent Fractions

Day 41 Practice: Showing the Fractions I

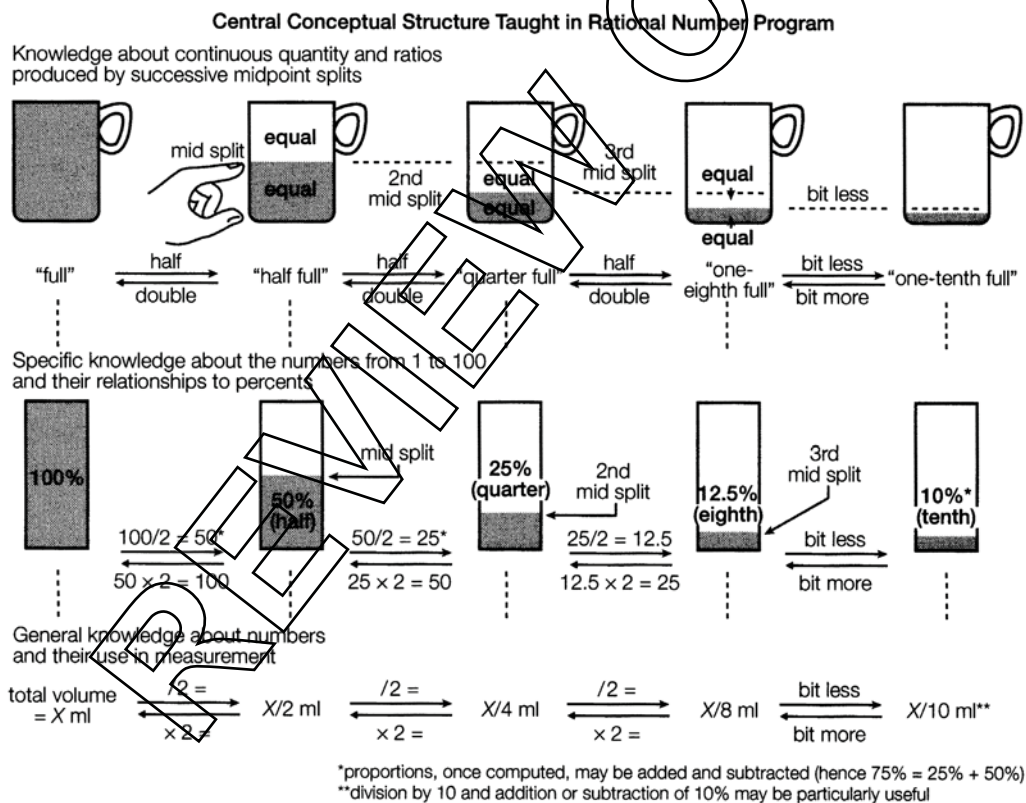
Day 41 Homework: Showing the Fractions II

**Direct Instruction**

**Classroom discussion (10 minutes)**

Remind students about the fraction work that they did with measuring cups/beakers. See “Developing Children’s Understanding of Rational Numbers: (Moss and Case)—measuring cup structure. [www.gismoite.org/ems512/articles/MossCase1999.pdf](http://www.gismoite.org/ems512/articles/MossCase1999.pdf) from Unit 1 and the ongoing work that they’re doing with the Fraction Kits.

Explain that now they’ll be looking at another way to model and think about fractions.



**Figure 1.** Central conceptual structure taught in the rational number program.

From: Developing Children’s Understanding of the Rational Numbers: A New Model and Experimental Case  
 Joan Moss; Robbie Case  
 Journal for Research in Mathematics Education, Vol. 30, No. 2. (March, 1999), pp. 122–147

# UNIT 4 • SIMPLIFYING NUMERICAL EXPRESSIONS

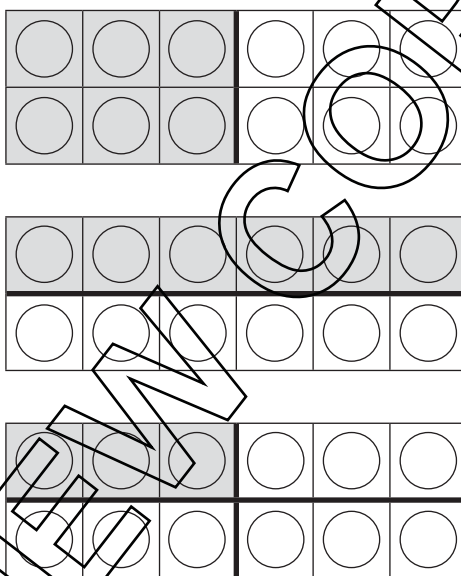
## DAY 41

### Instruction

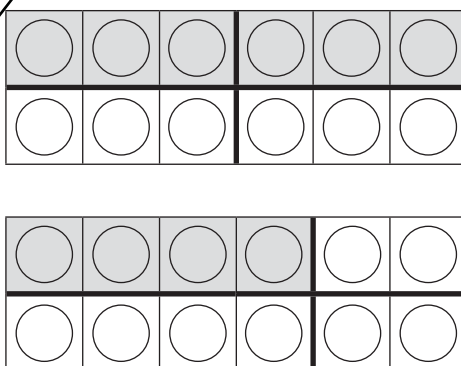
#### Instruction (30 minutes)

Distribute egg cartons, 6 pieces of string and fillers for carton (beans, marshmallows, colored disc, etc), egg carton worksheets, and graph paper.

Ask students to show how they might use these materials to demonstrate how they think of the meaning of “one half.” Explain that there’s no one right way (see the illustrations)—it’s all open. Everyone (including you) does this. Discuss and share your models. Then continue with  $1/4$ , discussion to follow. (How is this like the big measuring cup? How is this like the fraction kit? What are you noticing about  $1/2$  no matter how we model it? What about  $1/4$ ?, etc.)



Move the modeling and discussion into fractions that are different forms of the same value— $2/4$ ,  $6/12$  etc.  $1/3$ ,  $2/6$ ,  $4/12$ ).



Make a model of  $2/3$ , carefully using the yarn to split the carton into 3 equal parts and filling two of them. Write the number “ $1/3$ ” and ask the students how they think they would model  $1/3$  and how the symbol “ $1/3$ ” relates to the model. Ask: “How big do you think  $1/3$  is? Is it larger than  $1/2$  or smaller?” Have students find their own ways to subdivide the carton to show  $1/3$  of a carton. If needed, do another example such as  $2/6$  to help students relate the model to the symbol.

## UNIT 4 • SIMPLIFYING NUMERICAL EXPRESSIONS

### DAY 41

#### Instruction

Ask students what they think the bottom and top numbers of the fraction represent. You want the students to get to the point where they see for themselves that the bottom number tells how many equal parts the whole carton has been subdivided into and the top number is the number of those parts under consideration. (This is the part-to-whole concept of fractions.) Incorporate the terms “numerator” and “denominator” along with “part” and “whole.”

#### Class Activity (20 minutes)

Ask students to find ways to subdivide the carton to show  $\frac{3}{4}$  and  $\frac{5}{6}$  and  $\frac{5}{12}$ —each time using the string to clearly show the subdivisions and filling the appropriate number of sections. Ask students to explain their thinking—it will help them learn, and it will help you get a better understanding of what they do and do not understand. Include a few extra fractions to be modeled to gauge students’ understanding.

Distribute the Egg-cellent Fractions Worksheet and ask students to draw as many models of fractions of a dozen they can come up with. You should do this activity with students. Remind students to be sure and draw the string lines/subdivisions on each model, fill the appropriate number of subsections, and write the fraction symbol that the model represents—so that each model is SUPER clear—everyone should be able to clearly see the denominator and the numerator in each model. You could come up with at least 30. (You may make multiple copies of the worksheet for each student if you wish.)

*Note:* For this activity, equivalent fractions count as separate models (so, for example,  $\frac{1}{2}$  and  $\frac{6}{12}$  and  $\frac{2}{4}$  and  $\frac{3}{6}$  would count as four separate models).

Ask students what they notice about the following: What happens to the size of the individual parts as the bottom number (denominator) gets bigger?

Have the students fill in 8 slots in the egg carton on their desk. Then ask the students to use the yarn to find different names for this fraction. Share the fractions created, then discuss that these are equivalent fractions—all the fractions are equal in that they represent exactly the same quantity. Repeat this process with a different number of slots filled.

Additional key concepts to pull out of this:

- The larger the denominator, the smaller the size of the individual subsections.
- If you have the same numerator and denominator, you have one whole.
- The “reduced fraction” is the one that uses the fewest number of parts to name the fraction.
- Continue to connect student understanding to fraction kit and money models.
- Continue to draw on student understanding of the measuring cup model and adding and subtracting using that model. For instance:  $\frac{7}{12}$  is  $\frac{6}{12} + \frac{1}{12}$  (half of the measuring cup plus a little bit more).

From here, bring in other ways to explore the meaning of fractions: Use a couple of dollars in change, with a variety of coins. Ask the students to take out a dollar and to make a model of  $\frac{1}{5}$  of a dollar,  $\frac{4}{5}$  of a dollar,  $\frac{1}{20}$  of a dollar,  $\frac{7}{20}$  of a dollar, etc.

Use a big face clock and look at fractions of an hour.

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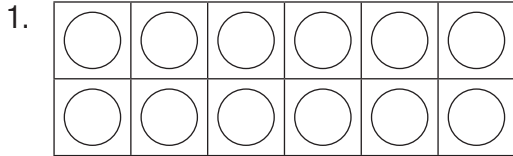
# UNIT 4 • SIMPLIFYING NUMERICAL EXPRESSIONS

## DAY 41

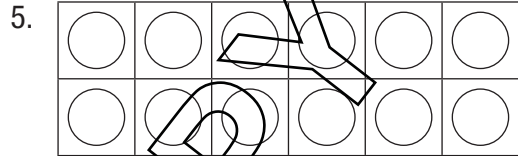
### Day 41 Practice

#### Egg-cellent Fractions

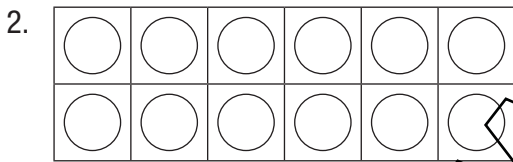
Using the empty egg carton diagrams, draw as many models of fractions of twelve (a dozen) as you can. Make sure to draw where your string will divide the carton. Shade the number of boxes representing the numerator of your fraction. Write the fraction that your drawing represents on the line.



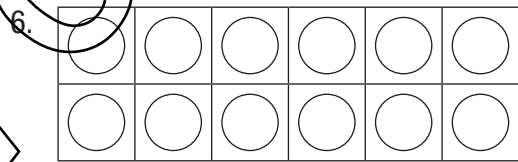
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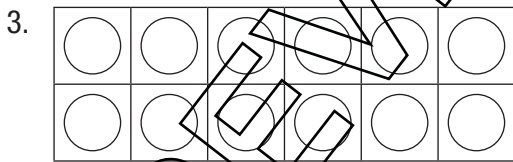
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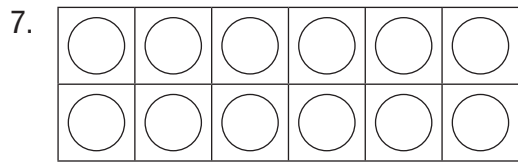
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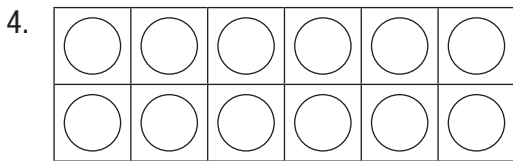
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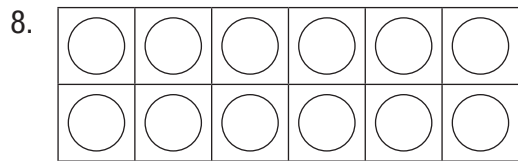
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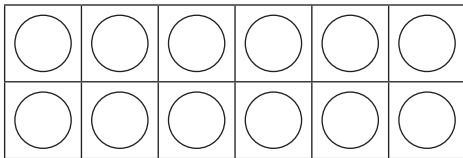
**UNIT 4 • SIMPLIFYING NUMERICAL EXPRESSIONS**  
**DAY 41**

**Day 41 Practice**

**Showing the Fractions I**

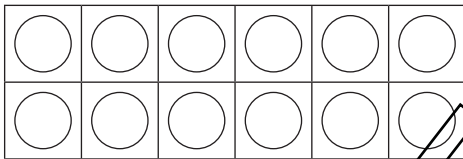
Draw a line on each illustration showing the given fraction. Shade the portion of the drawing that represents the numerator. Circle whether the fraction is close to zero, close to  $\frac{1}{2}$ , or close to 1.

1.  $\frac{4}{8}$



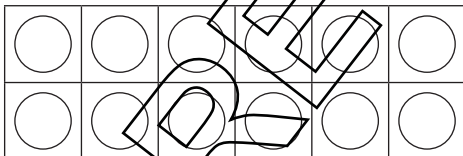
Close to: 0,  $\frac{1}{2}$ , 1

2.  $\frac{3}{6}$



Close to: 0,  $\frac{1}{2}$ , 1

3.  $\frac{4}{24}$



Close to: 0,  $\frac{1}{2}$ , 1

*continued*

NAME: \_\_\_\_\_

# UNIT 4 • SIMPLIFYING NUMERICAL EXPRESSIONS

## DAY 41

4.  $\frac{1}{8}$



Close to: 0,  $\frac{1}{2}$ , 1

5.  $\frac{1}{3}$



Close to: 0,  $\frac{1}{2}$ , 1

6.  $\frac{5}{6}$



Close to: 0,  $\frac{1}{2}$ , 1

7.  $\frac{3}{5}$



Close to: 0,  $\frac{1}{2}$ , 1

*continued*

NAME: \_\_\_\_\_

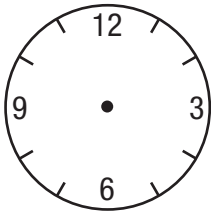
**UNIT 4 • SIMPLIFYING NUMERICAL EXPRESSIONS**  
**DAY 41**

8.  $\frac{1}{4}$



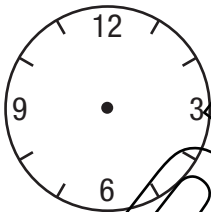
Close to: 0,  $\frac{1}{2}$ , 1

9.  $\frac{3}{4}$



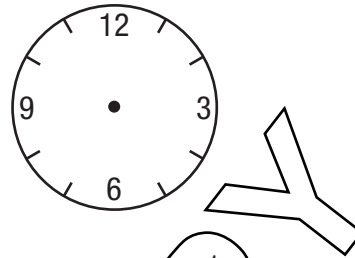
Close to: 0,  $\frac{1}{2}$ , 1

10.  $\frac{3}{12}$



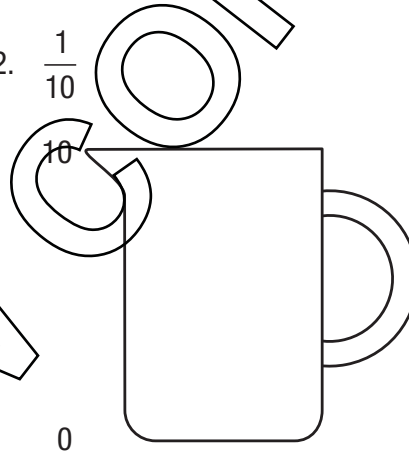
Close to: 0,  $\frac{1}{2}$ , 1

11.  $\frac{5}{6}$



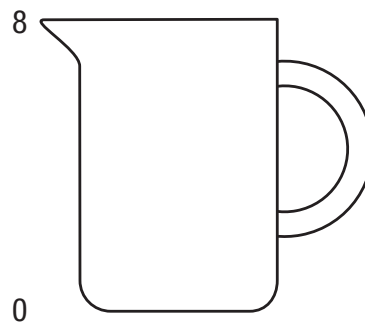
Close to: 0,  $\frac{1}{2}$ , 1

12.  $\frac{1}{10}$



Close to: 0,  $\frac{1}{2}$ , 1

13.  $\frac{5}{8}$



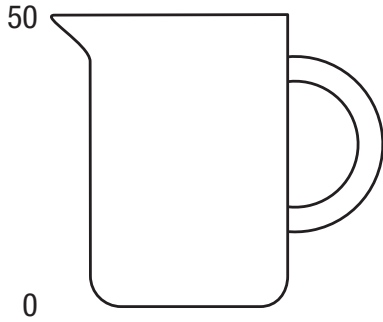
Close to: 0,  $\frac{1}{2}$ , 1

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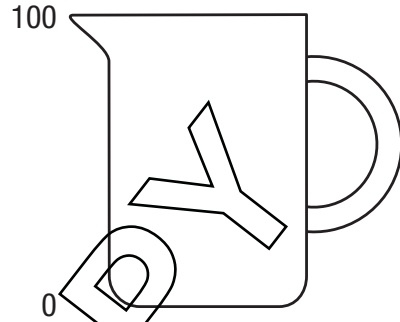
**UNIT 4 • SIMPLIFYING NUMERICAL EXPRESSIONS**  
**DAY 41**

14.  $\frac{25}{50}$



Close to: 0,  $\frac{1}{2}$ , 1

15.  $\frac{60}{100}$



Close to: 0,  $\frac{1}{2}$ , 1

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