MSTAR INTERVENTION

L10

Lesson 10: Multiply by 1 to Compute Equivalent Fractions

Lesson Objectives

- Students will generate fractions equal to 1 to make a statement of equivalent fractions true.
- Students will calculate the missing numerator, given a pair of equivalent fractions.

Instructional Materials

Material	Quantity	Description
Fraction strips from Lesson 1: Model Equivalent Fractions with Area Models	1 each	
Timer	1 (optional)	
How Am I Doing? graph	1 per student	
Colored pencils	1 per student	
Display Masters	1 each	• Demonstrate: Key Ideas: Multiply by 1 to Compute Equivalent Fractions • Demonstrate: Blank Multiplication Table (if needed)
Handouts	1 per student	• Cumulative Review • Timed Multiplication Test • Blank Multiplication Table (optional, if needed) • Practice 1 • Practice 2 • Independent Practice
Answer Keys	1 each	• Cumulative Review • Timed Multiplication Test • Practice 1 • Practice 2 • Independent Practice

Cumulative Review

Have students answer the questions on the Cumulative Review handout. Go over the answers. Correct misconceptions. Have students use a colored pencil to make corrections as needed. Collect student papers to determine who needs additional instruction.

Preview

This lesson will build on students' knowledge of the multiplicative identity property. Students will apply the multiplicative identity property to generate equivalent fractions by multiplying. Students will use the mathematical ideas taught in this lesson when they compare and order fractions and when they add and subtract fractions.

Display and introduce through a brief explanation the key ideas for this lesson:

- Multiplying by 1 (applying the identity property of multiplication) requires that the same operation be performed on the numerator and the denominator.
- A tool to find equivalent fractions is the multiplication table.

Use the Key Ideas: Multiply by 1 to Compute Equivalent Fractions DM display master as needed.

Engage Prior/Informal Knowledge

Distribute the Timed Multiplication Test handout to activate students' background knowledge.

Tell students you will time the test and that they should complete the test as quickly as possible. You may want to set a timer.

Say: *How did you finish so quickly?*

Many of the students will explain that when they multiply a number by 1, they get the same number. Explain that multiplying by 1 does not change the value of a

number, including when the number is a fraction. If students answer incorrectly on the test, tell them the correct answer or come back to the activity after demonstrating how to multiply fractions by 1.

Ask students questions such as:

- How many copies of the unit fraction $\frac{1}{3}$ make 1 whole? 2 wholes? 3 wholes? (3, 6, 9)
- Find the missing numerator or denominator so that each fraction equals 1 whole.

$\frac{?}{4}$ $\frac{7}{?}$ $\frac{12}{?}$ $\frac{2}{?}$ $\frac{?}{5}$

$(\frac{4}{4}$ $\frac{7}{7}$ $\frac{12}{12}$ $\frac{2}{2}$ $\frac{5}{5})$

If students cannot correctly answer these questions, stop and provide explicit instruction and practice before continuing with the lesson.

Demonstrate

The multiplicative identity property, also called the identity property of 1 or identity property of multiplication, states that the product of any number and 1 is the number itself.

Provide several examples, such as those below, to demonstrate to students that the multiplicative identity property applies when the original number is a fraction and when 1 is written in fractional form.

1. Generate equivalent fractions by multiplying by a fractional form of 1.

TEACHER NOTE

Depending on the students involved, you may want to give the formal name and definition of the multiplicative identity property.

TEACHER NOTE

Students may benefit from writing the 1 and the fraction used as 1 in a different color from the problem to draw attention to the 1.

Display $\frac{1}{2} \times 1 = \frac{1}{2}$

Say: *I am multiplying by 1. $\frac{1}{2}$ times 1 is equal to $\frac{1}{2}$.*

Say: *I am going to rewrite this 1 as a fraction.*

Display $\frac{1}{2} \times \frac{2}{2} = \frac{2}{4}$

TEACHER NOTE

If students struggle with multiplying fractions, explicitly teach the skill before continuing.

Be sure to draw attention to the 1, shown as $\frac{2}{2}$.

Say: *I am multiplying by 1. $\frac{2}{2}$ is equal to 1. When I multiply $\frac{1}{2}$ by $\frac{2}{2}$, I know that I need to multiply the numerator and the denominator each by 2 so I get $\frac{2}{4}$. $\frac{2}{4}$ and $\frac{1}{2}$ have the same value because I multiplied by 1. Remember that we call fractions with the same value equivalent fractions.*

Repeat with additional examples and multipliers as needed.

When using one fraction to generate many different equivalent fractions, it may be helpful to relate to the multiplication table. For example, you can show students that for the fraction $\frac{2}{5}$, the rows that contain 2 and 5 show equivalent fractions.

	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144

2. Generate equivalent fractions by identifying the fraction that makes the equation true.

Display $\frac{10}{100} \times 1 = \frac{10}{100}$ $\frac{10}{100} \times \frac{\ldots}{\ldots} = \frac{60}{600}$

Think aloud as you ask and answer the following question: What fraction equal to 1 makes the equation true?

Say: *First, I am going to find the number that I would multiply the numerator, 10, by to get 60.*

Display 6 above the fraction bar.

Say: *Second, I am going to write the fraction equal to 1.*

Display 6 below the fraction bar.

Remind students that $\frac{6}{6}$ equals 1. 4

Repeat with additional examples, such as: Change $\frac{7}{5}$ into an equivalent fraction with a denominator of 30.

3. Help students create and solve their own examples for the types of problems shown in step 1.

Be prepared to have examples for students who are not ready to create their own examples.

Select a few students to share their examples and explain their reasoning and thought process. 5

Then, think aloud as you write examples for all strips that you folded.

Example: Display the strip with $\frac{1}{2}$ shaded.

4 TEACHER NOTE

If students struggle, have them write the multiples of $\frac{10}{100}$ until they find the correct equivalent fraction. It may be helpful to relate to the multiplication table when students are using values between 1 and 12.

5 TEACHER NOTE

Students who struggle to understand the mathematical concept may benefit from using the strips they shaded and folded in the previous lessons.

To do so, say: When I multiply by 1, even when 1 is a fraction such as $\frac{2}{2}$, I change the size of the parts. The fractional amount does not change.

Display $\frac{1 \text{ shaded} \times 2}{2 \text{ total} \times 2} = \frac{2 \text{ shaded}}{4 \text{ total}}$

Say: *I am multiplying by 1. 1 is the same as* $\frac{2}{2}$.

Display $\frac{1 \times 2}{2 \times 2} = \frac{2}{4}$

Repeat, using other multipliers.

TEACHER NOTE
It may be helpful to write the number by which the numerator and denominator are multiplied in a different color to help students identify the pattern and devise a rule.

4. Help students to devise a rule for creating equivalent fractions, using multiplication.

Say: *To find an equivalent fraction, multiply both the numerator and denominator by the same number.*

Practice

For each practice activity, provide detailed feedback to students, highlighting what was done correctly and what needs improvement. Provide opportunities for students to correct their errors. Collect student work to review and monitor student progress.

WATCH FOR Some students believe that performing an operation always changes the original value, even when multiplying by 1. Teach students that multiplying by 1 does not change the value of the original number or its position on the number line, including when the operation is performed on a fraction. Use manipulatives and relate to the 1s multiplication facts as needed.

WATCH FOR Some students use additive instead of multiplicative reasoning to identify or generate equivalent fractions. For example, given $\frac{3}{8}$, these students add 8 to both the numerator and denominator to get $\frac{11}{16}$, rather than multiplying both the numerator and denominator by 2 (multiplying the whole fraction by $\frac{2}{2}$, or 1) to get $\frac{6}{16}$. To correct this error, teach students to contrast the effects of adding and multiplying. Relate addition/multiplication to subtraction/division. Teach students that adding changes the number of parts and that dividing changes the size of the parts. Use manipulatives as appropriate.

WATCH FOR Some students perform an operation only on the numerator. For example: $\frac{2}{3} \times 2 = \frac{4}{3}$. Students may assume that multiplying a fraction by 2 and multiplying a fraction by $\frac{2}{2}$ are the same process. Teach students that performing an operation only on the numerator is not the same as multiplying by 1 (applying the multiplicative identity property) and changes the fraction's value. Use manipulatives as necessary.

Activity 1: Help students complete the activity on the Practice 1 handout. Select a few students to share their answers and verbalize their reasoning and each step in the process. Listen for the development of any misconceptions within the reasoning.

Activity 2: Have students work in pairs or small groups to complete the activity on the Practice 2 handout. Have students verbalize their reasoning for each step in the process to their partners. Listen the development of any misconceptions within the reasoning.

Example: To create an equivalent fraction for $\frac{3}{7}$, highlight the rows 3 and 7 to see several equivalent fractions.

	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
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12	12	24	36	48	60	72	84	96	108	120	132	144

TEACHER NOTE

For students who need practice, a multiplication table may help in creating equivalent fractions. Students color the 2 rows on the multiplication table that contain the numerator and denominator of the fraction for which they are creating an equivalent fraction.

Independent Practice

1. Have students work independently to complete the activity on the Independent Practice handout.

2. Go over the answers (students self-check and correct, using a colored pencil).

3. Have students record the number correct in the box and complete their How Am I Doing? graph.

4. Collect the papers to review and monitor student progress.

Closure

Review the key ideas. Have students provide examples from the lesson. Ask questions such as:

- How do you create an equivalent fraction?
- How many equivalent fractions does each fraction have?

Clear up any misconceptions. Students who believe that multiplying a fraction by 1, written as a fraction, changes the value of the original fraction, do not multiply both the numerator and denominator by the same number, or use additive instead of multiplicative reasoning need additional instruction.

Ensure that students are comfortable generating equivalent fractions with multiplication before continuing.