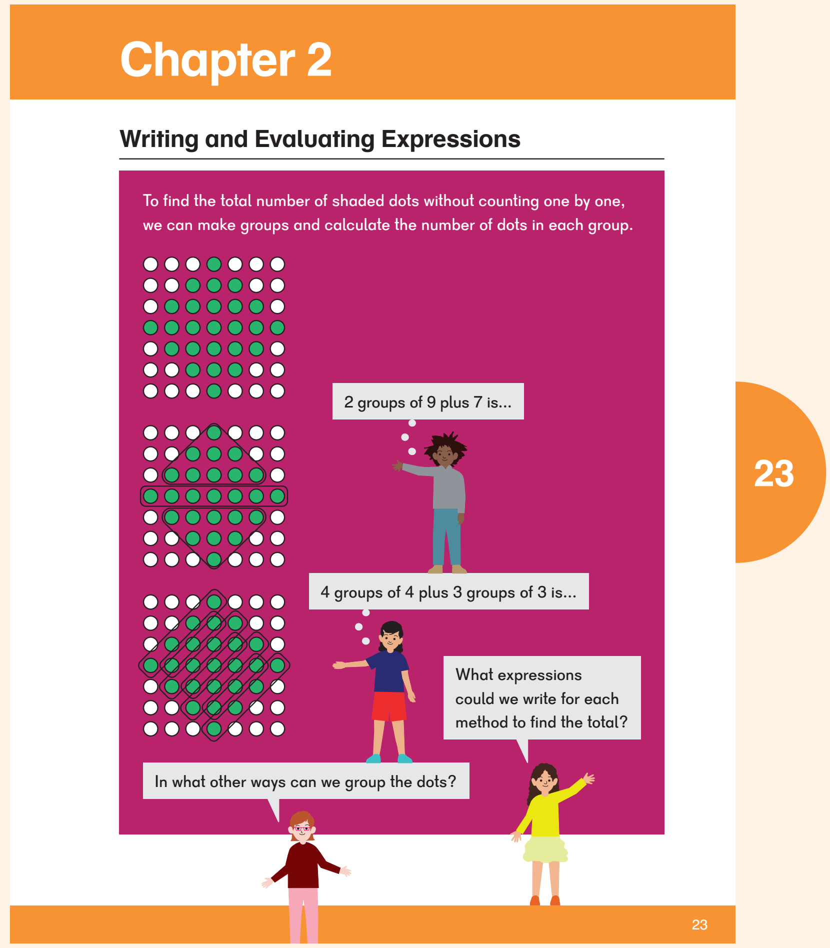
Objective

- Investigate writing expressions.

Lesson Materials

- Shaded Dots (BLM)



Provide students with Shaded Dots (BLM) and have them discuss the Chapter Opener.

Review the terms “expressions” and “equations” with students.

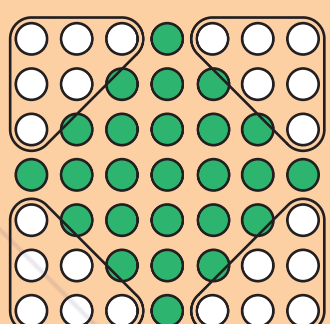
Discuss Dion’s and Mei’s thoughts.

Students should see that Dion groups the dots as 2 groups of 9 with a middle row of 7. Point out that Dion did not say, “I found 2 groups of 9 first, then added 7.”

Mei calculates the number of green dots differently. Point out that she did not say, “I found 4 groups of 4 equals 16, then found 3 groups of 3 equals 9. Then I added 16 and 9 together to get 25.”

Have students try to find other ways to group the dots.

For example, they may see:



Challenge students to explain their solutions. For example, they may say, “I saw 7 groups of 7 in all and I subtracted 4 groups of 6 white dots on the corners.”

Learn

Have students compare their expressions from **Think** with the ones shown in the textbook. Discuss each friend's comment.

Method 1

We begin with the whole and then subtract each of the parts. Written as one expression, the whole comes first, and we calculate from left to right.

The two steps can be shown with a single expression: 1,000 – 450 – 150, starting with the amount of money the Astronomy Club had at first and subtracting each amount spent, one amount at a time.

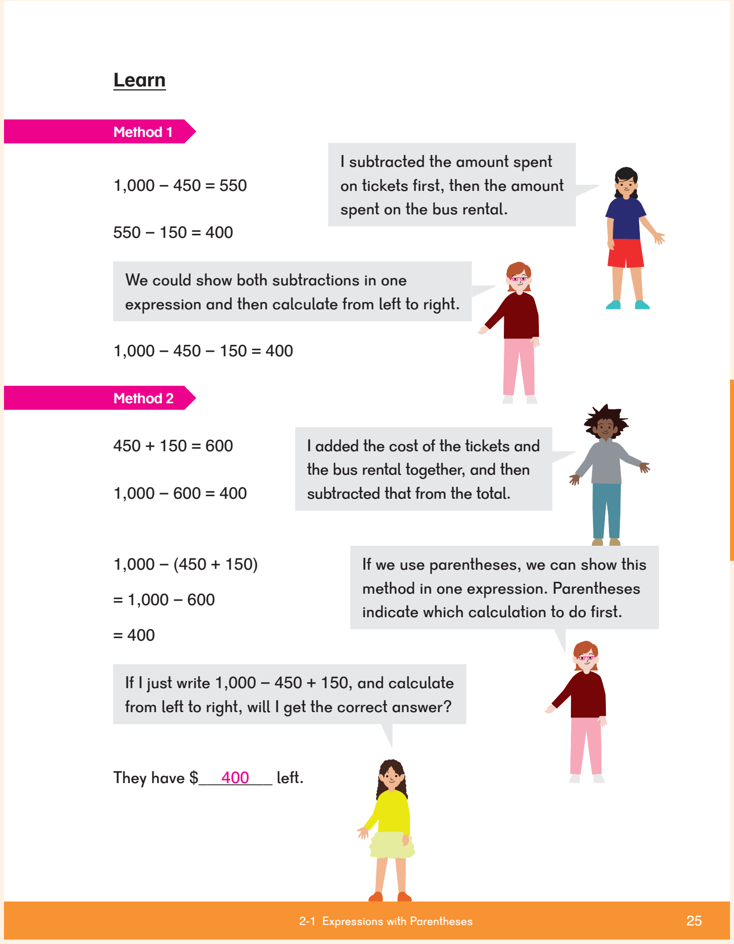
1,000 – 150 – 450 is also correct.

Method 2

We add the two expenses first, and then subtract the sum from the total. The two steps can be shown with a single expression if we use parentheses: 1,000 – (450 + 150). The parentheses indicate that the addition should be done first.

The answer to Sofia's question is "no," because the value of the expression would be 700, not 400. Sofia's expression shows that she is subtracting 450 from the total, and then adding 150.

Ask students to think of a story for Sofia's expression. For example, "The Astronomy Club spent $450 on telescopes, and then received $150 from a donation."



Learn

Method 1

1,000 – 450 = 550

550 – 150 = 400

I subtracted the amount spent on tickets first, then the amount spent on the bus rental.

We could show both subtractions in one expression and then calculate from left to right.

1,000 – 450 – 150 = 400

Method 2

450 + 150 = 600

1,000 – 600 = 400

I added the cost of the tickets and the bus rental together, and then subtracted that from the total.

1,000 – (450 + 150)

= 1,000 – 600

= 400

If we use parentheses, we can show this method in one expression. Parentheses indicate which calculation to do first.

If I just write 1,000 – 450 + 150, and calculate from left to right, will I get the correct answer?

They have $ 400 left.

2-1 Expressions with Parentheses 25

25

Objective

- Evaluate expressions with multiple types of operations using the order of operations.

Lesson Materials

- Shaded Dots (BLM)
- Stars (BLM)

Think

Pose the **Think** problem. Discuss Emma's solution and ask students why she used the expressions 5 × 5, 4 × 3, and 25 − 12. Have them try to combine Emma's steps into a single expression to show the number of yellow stars on the poster.

Learn

Have students compare their expression for Emma's method from **Think** with the ones shown in the textbook.

Mei reminds students that they can use parentheses to clarify which expression is calculated first.

Dion sees that the answer is the same, regardless of whether or not parentheses are used.

Introduce the term "order of operations." Explain that mathematicians have developed rules, just like rules in a board game, to ensure that everyone gets the same answer when finding the value of an expression.

When we apply order of operations to evaluate this expression, we subtract the product of 4 × 3 from the product of 5 × 5, to get 13 as the answer.

Have students relate Sofia's equation with the stars she has circled on her poster.

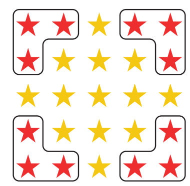
Provide students with Stars (BLM) and have them circle other groups that they see and write a single expression.

28

Lesson 2
Order of Operations — Part 1 (2)

Think

Emma saw a poster with stars on it and thought of a way to find the total number of yellow stars without counting them one by one.



I found the total stars using multiplication and then subtracted 4 groups of 3 red stars.
5 × 5 = 25
4 × 3 = 12
25 − 12 = 13

Write one math expression that shows all the steps in her solution.

28 2-2 Order of Operations — Part 1

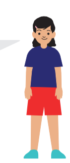
29

Learn

(5 × 5) − (4 × 3)

= 25 − 12

= 13



We learned that we can use parentheses to show which calculation to do first.

We can also write the expression without parentheses if we know that we should multiply 5 × 5 and 4 × 3 first before subtracting.

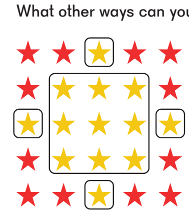
5 × 5 − 4 × 3

= 25 − 12

= 13

Order of operations
Do multiplication and/or division from left to right, then addition and/or subtraction from left to right.

What other ways can you find? Combine your steps in a single expression.



I saw 4 stars on the edges and then 3 groups of 3 stars in the middle.

4 + **3 × 3**
= 4 + 9
= 13

2-2 Order of Operations — Part 1 29

Do

❶—❹ Discuss the problems with students.

❶ Students should see a connection between this method and the use of number bonds to explain calculation strategies:

$$3 \times 46 = 3 \times 40 + 3 \times 6 = 120 + 18$$

46 → 40 and 6

The number bond is now shown as an expression:

$3 \times (40 + 6)$

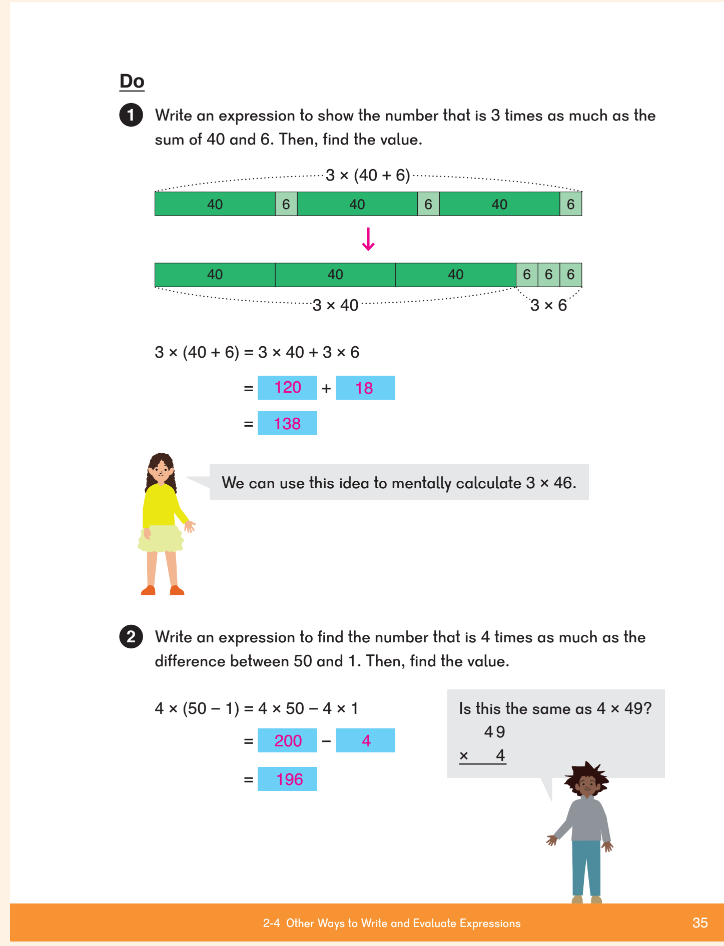
❷ Ask students:

- "What expression can be used to represent the difference between 50 and 1?"
- "What is 4 times that amount?"

Students have encountered problems like this when using mental math methods for multiplying numbers close to a multiple of 10.

For example:

49 × 4 = 50 groups of 4 – 1 group of 4



35

Do

❶ Write an expression to show the number that is 3 times as much as the sum of 40 and 6. Then, find the value.

$3 \times (40 + 6) = 3 \times 40 + 3 \times 6$

$= 120 + 18$

$= 138$

We can use this idea to mentally calculate 3 × 46.

❷ Write an expression to find the number that is 4 times as much as the difference between 50 and 1. Then, find the value.

$4 \times (50 - 1) = 4 \times 50 - 4 \times 1$

$= 200 - 4$

$= 196$

Is this the same as 4 × 49?

49×4

2-4 Other Ways to Write and Evaluate Expressions 35

Objective

- Divide a two-digit number by a two-digit divisor.

Lesson Materials

- Place-value discs: ones and tens

Think

Provide students with place-value discs and pose the **Think** problem. Have students estimate the quotient first.

Ask students:

- "Are we sharing into 21 groups or grouping by 21?" (Grouping by 21.)
- "How is this problem similar to or different from the ones we did in the previous lesson?" (The divisor is not a multiple of ten, but we can still use the same procedure to divide.)
- "How can we show how to solve the problem with the discs?"

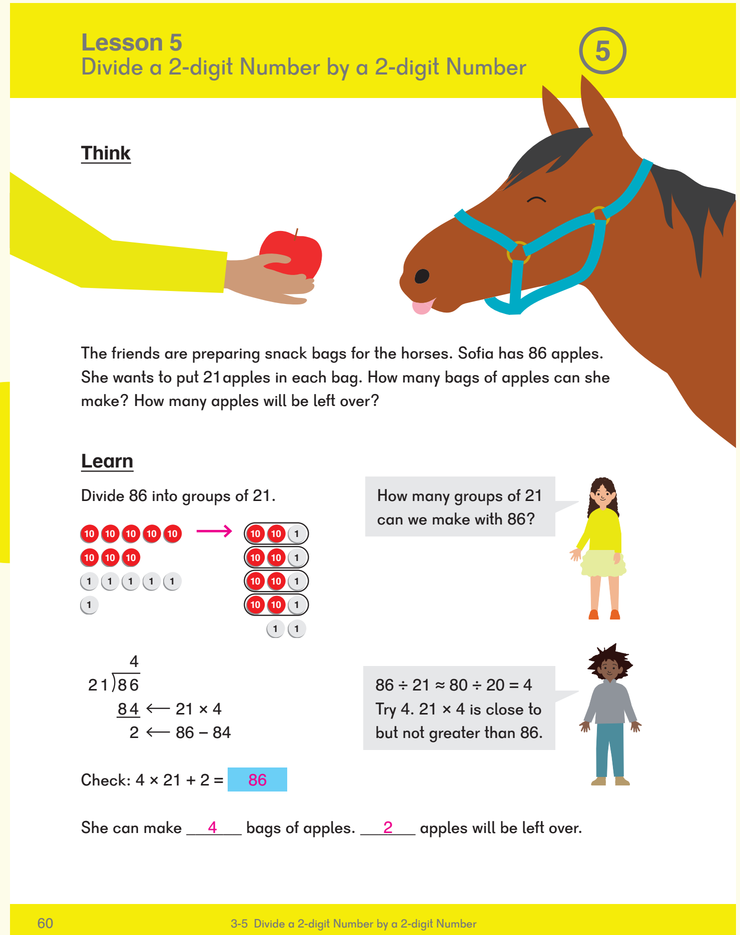
Learn

Work through the **Think** problem with students as demonstrated in **Learn**.

Discuss Dion's comments. Ask students why his comments are important. (It is useful to use estimates to find the first digit in the quotient. In this case, his estimate happens to be the exact quotient.)

When Dion calculates using his estimated quotient, 4 × 21, the remainder, 2, is less than the divisor, 21, so he knows he is done.

60



Lesson 5
Divide a 2-digit Number by a 2-digit Number (5)

Think

The friends are preparing snack bags for the horses. Sofia has 86 apples. She wants to put 21 apples in each bag. How many bags of apples can she make? How many apples will be left over?

Learn

Divide 86 into groups of 21.


```
     4
21 ) 86
     84  ← 21 × 4
      2  ← 86 − 84
```


Check: 4 × 21 + 2 = 86

She can make __4__ bags of apples. __2__ apples will be left over.

60 3-5 Divide a 2-digit Number by a 2-digit Number

Method 1

The fractional parts of the mixed number are converted to equivalent fractions with a denominator of 6.

Method 2

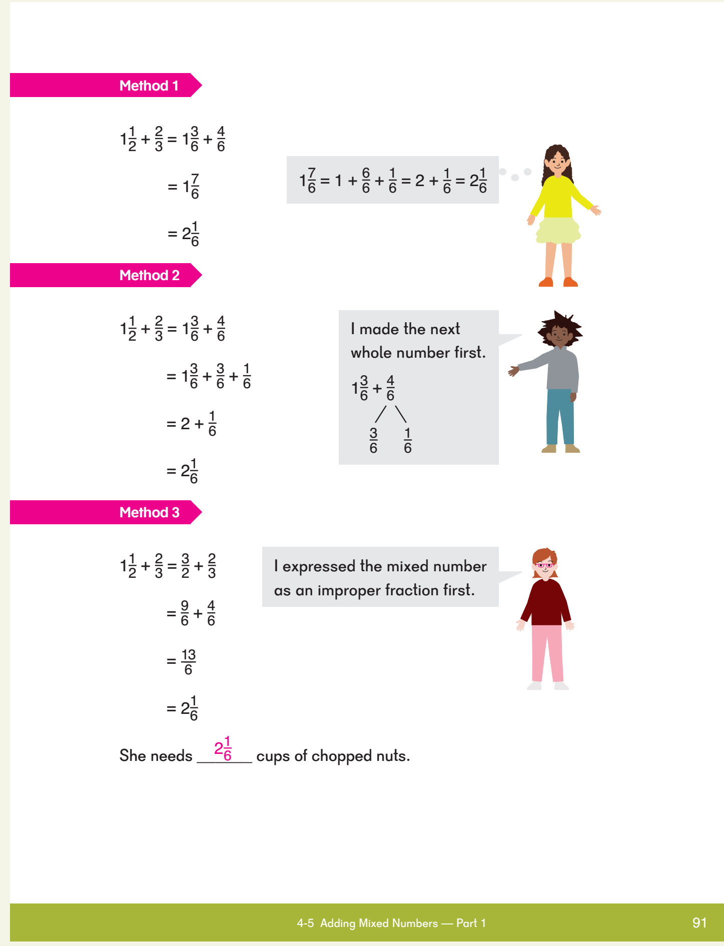
Dion makes a whole with part of the $\frac{4}{6}$ and has $\frac{1}{6}$ remaining. Students can recall adding to make the next ten, hundred, tenths, etc. Here, they make the next whole.

This method does not require the regrouping of the whole number of $1\frac{7}{6}$ in Method 1.

Method 3

The mixed number can be converted to an improper fraction first, and then both fractions can be expressed as equivalent fractions with a denominator of 6. The answer is then simplified.

Discuss the three methods with students. Ask them which method they prefer and why.


Method 1

$1\frac{1}{2}+\frac{2}{3}=1\frac{3}{6}+\frac{4}{6}$

$=1\frac{7}{6}$

$=2\frac{1}{6}$

Method 2

$1\frac{1}{2}+\frac{2}{3}=1\frac{3}{6}+\frac{4}{6}$

$=1\frac{3}{6}+\frac{3}{6}+\frac{1}{6}$

$=2+\frac{1}{6}$

$=2\frac{1}{6}$

Method 3

$1\frac{1}{2}+\frac{2}{3}=\frac{3}{2}+\frac{2}{3}$

$=\frac{9}{6}+\frac{4}{6}$

$=\frac{13}{6}$

$=2\frac{1}{6}$

She needs $2\frac{1}{6}$ cups of chopped nuts.

4-5 Adding Mixed Numbers — Part 1 91

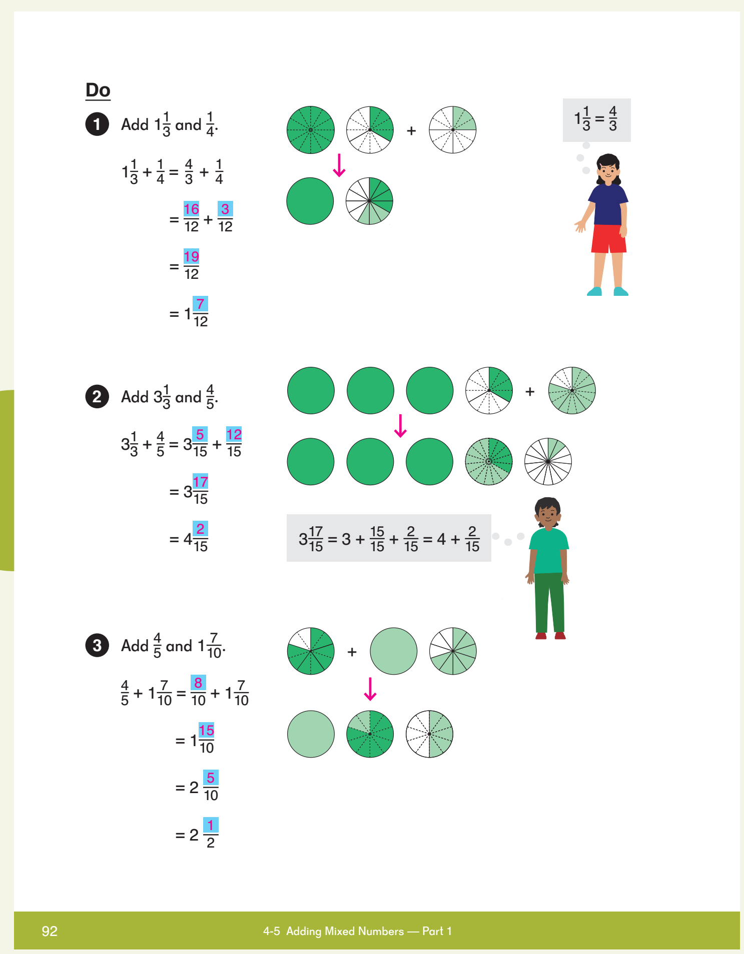
Do

❶—❹ Discuss the problems and given solutions with students. Students should give their answers in simplest form.

❶ Mei uses Method 3 from **Learn**. She converts $1\frac{1}{3}$ into an improper fraction first, and then finds a common denominator. This method is more likely to be used when the whole number part is 1.

❷ Alex uses Method 1 from **Learn**. He converts $\frac{1}{3}$ and $\frac{4}{5}$ to fractions with a denominator of 15: $3+\frac{5}{15}+\frac{12}{15}$ to get $3\frac{17}{15}$. Then he simplifies the sum.

❸ Ask students to identify which method is shown. They should see that it is similar to ❷ and uses Method 1 from **Learn**.


Do

1 Add $1\frac{1}{3}$ and $\frac{1}{4}$.

$1\frac{1}{3}+\frac{1}{4}=\frac{4}{3}+\frac{1}{4}$

$=\frac{16}{12}+\frac{3}{12}$

$=\frac{19}{12}$

$=1\frac{7}{12}$

2 Add $3\frac{1}{3}$ and $\frac{4}{5}$.

$3\frac{1}{3}+\frac{4}{5}=3\frac{5}{15}+\frac{12}{15}$

$=3\frac{17}{15}$

$=4\frac{2}{15}$

3 Add $\frac{4}{5}$ and $1\frac{7}{10}$.

$\frac{4}{5}+1\frac{7}{10}=\frac{8}{10}+1\frac{7}{10}$

$=1\frac{15}{10}$

$=2\frac{5}{10}$

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

92 4-5 Adding Mixed Numbers — Part 1

❸—❹ As the models are all given, students should be able to work these problems independently.

❸ Students may also find the value of 1 unit, then find the number of large-breed dogs and small-breed dogs, and then subtract from the whole:

Large-breed dogs ⟶ 4 × 23 = 92
Small-breed dogs ⟶ 7 × 23 = 161
Difference ⟶ 161 − 92 = 69

This solution requires more steps and computations than the one given in the answer overlay.

Help students see that if they find the value of 1 unit, they can simply multiply by 3 to find the 3 units of the difference.

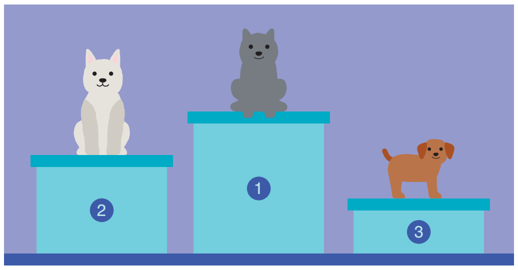
❹ If we consider the number of students in the fencing club as 1 unit, then we can represent the number of students in the chess club with 2 units.

If the number of students in the fencing club is $\frac{1}{5}$ the number in the cooking club, then the cooking club must be 5 units.

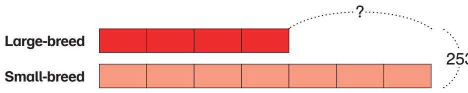
There are 42 more students or 3 units more in the cooking club than the chess club, so the value of 3 units is 42 students. Once we know the value of 3 units, we can find the value of 1 unit and then 2 units, which is the number of students in the chess club.

122

❸

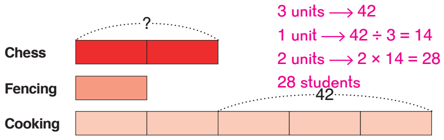


There are 253 dogs at a dog show. There are $\frac{4}{7}$ as many large-breed dogs as small-breed dogs. How many more small-breed dogs are there than large-breed dogs?



11 units ⟶ 253
1 unit ⟶ 253 ÷ 11 = 23
3 units ⟶ 3 × 23 = 69
69 more

❹ Twice as many students are in the chess club as in the fencing club. The number of students in the fencing club is $\frac{1}{5}$ the number of students in the cooking club. There are 42 more students in the cooking club than in the chess club. How many students are in the chess club?



3 units ⟶ 42
1 unit ⟶ 42 ÷ 3 = 14
2 units ⟶ 2 × 14 = 28
28 students

122 5-3 Word Problems — Part 1

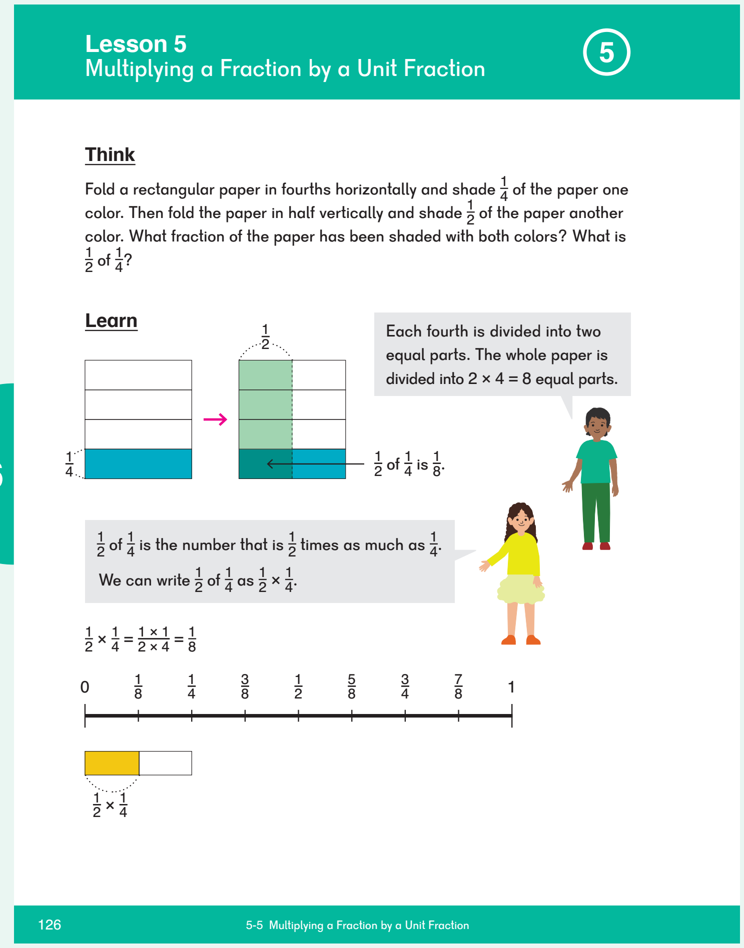
Lesson 5 Multiplying a Fraction by a Unit Fraction

Objective

- Multiply a fraction by a unit fraction.

Lesson Materials

- Index cards


126

Lesson 5
Multiplying a Fraction by a Unit Fraction
5

Think

Fold a rectangular paper in fourths horizontally and shade $\frac{1}{4}$ of the paper one color. Then fold the paper in half vertically and shade $\frac{1}{2}$ of the paper another color. What fraction of the paper has been shaded with both colors? What is $\frac{1}{2}$ of $\frac{1}{4}$?

Learn

<u>Think</u>

Discuss the **Think** task and have students fold and shade the index cards as directed.

Ask students the **Think** questions.

<u>Learn</u>

Have students discuss the **Learn** examples. Their folded paper should look similar to the one in the textbook.

Ask students to count the total parts and the part that is shaded with both colors. They should see that 1 part of a total of 8 parts is double shaded.

They can label that double shaded part with the fraction of the whole, $\frac{1}{8}$.

Alex points out that when students folded the paper in fourths (by 4) and then in half (by 2), they made 2 × 4 parts which relates to the denominators of $\frac{1}{2}$ and $\frac{1}{4}$.

The total number of parts in the model is therefore the product of the denominators.

The total number of double shaded parts is the product of the numerators. We can multiply the numerators together to get the number of parts, and the denominators together to get the total parts.

Ask students about the number line model. They should see that half of $\frac{1}{4}$ is $\frac{1}{8}$.

Sofia ties the area model and the number line model together to point out that $\frac{1}{2}$ of $\frac{1}{4}$ is the same as multiplying $\frac{1}{2} \times \frac{1}{4}$.

Do

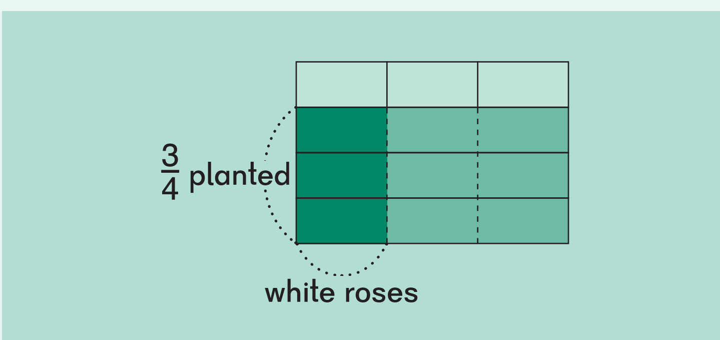
❶—❹ Discuss the problems and given models with students.

❶ Ask students how (a) and (b) are different. Students that need additional help can draw the two models and shade in $\frac{1}{3}$ and $\frac{1}{4}$ on each as they did in **Learn**.

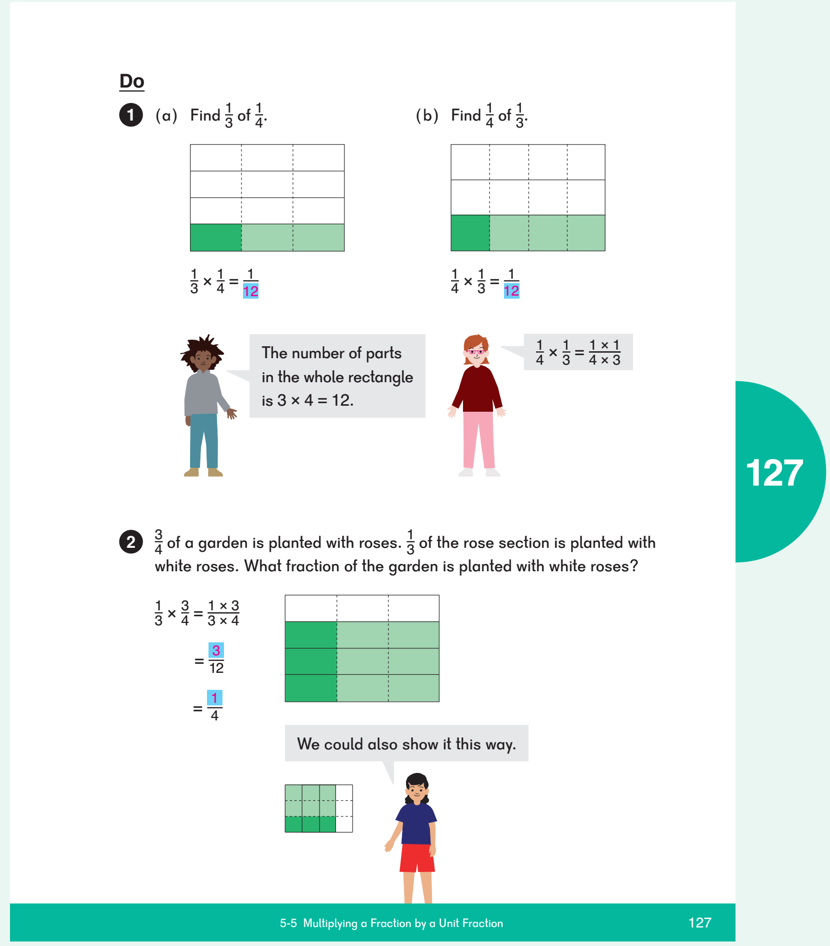
In (a), first $\frac{1}{4}$ of the whole is shaded light green. Ask students, "How do we find $\frac{1}{3}$ of $\frac{1}{4}$?" $\frac{1}{3}$ of that $\frac{1}{4}$ is shaded with the dark green.

In (b), first $\frac{1}{3}$ is shaded light green. Ask students, "How do we find $\frac{1}{4}$ of $\frac{1}{3}$?" $\frac{1}{4}$ of $\frac{1}{3}$ is shaded with the dark green. Students should know that they get the same answer even if the order of the factors is switched.

❷ Encourage students to label the model if needed.



Mei points out that we find the same answer whether we show fourths using horizontal lines or vertical lines.


Do

❶ (a) Find $\frac{1}{3}$ of $\frac{1}{4}$. (b) Find $\frac{1}{4}$ of $\frac{1}{3}$.

$\frac{1}{3} \times \frac{1}{4} = \frac{1}{12}$

$\frac{1}{4} \times \frac{1}{3} = \frac{1}{12}$

The number of parts in the whole rectangle is 3 × 4 = 12.

$\frac{1}{4} \times \frac{1}{3} = \frac{1 \times 1}{4 \times 3}$

❷ $\frac{3}{4}$ of a garden is planted with roses. $\frac{1}{3}$ of the rose section is planted with white roses. What fraction of the garden is planted with white roses?

$\frac{1}{3} \times \frac{3}{4} = \frac{1 \times 3}{3 \times 4}$

$= \frac{3}{12}$

$= \frac{1}{4}$

We could also show it this way.

5-5 Multiplying a Fraction by a Unit Fraction 127

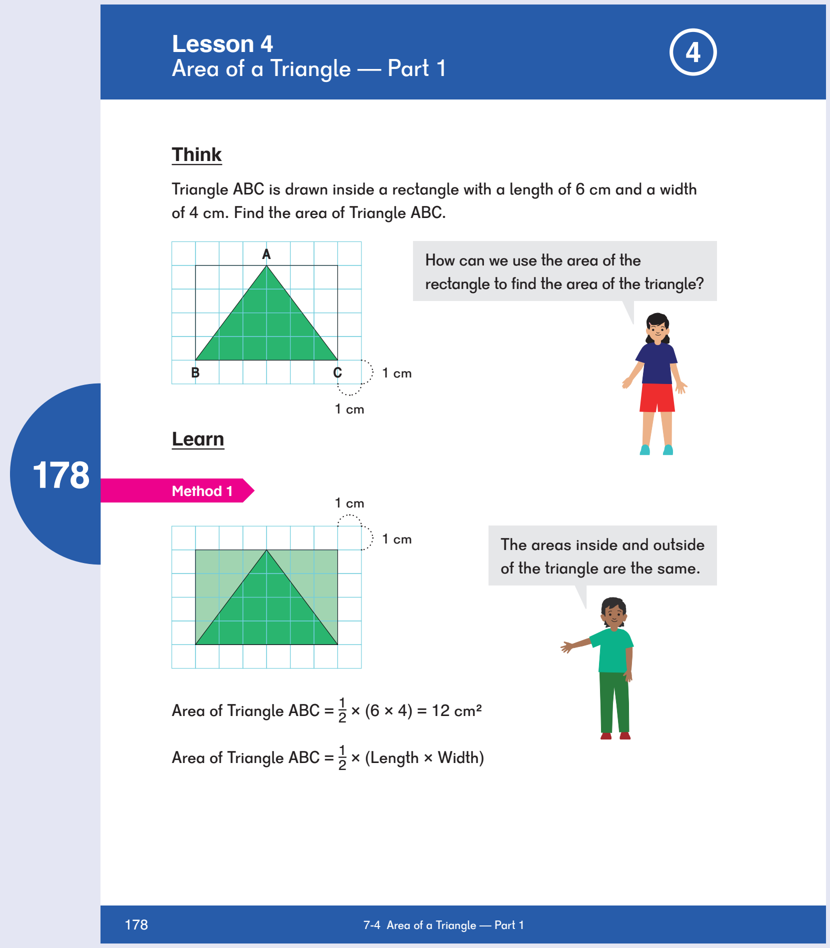
127

Objective

- Find the area of a triangle when the height is given inside of the triangle.

Lesson Materials

- Area of a Triangle 1 (BLM)


178

Lesson 4
Area of a Triangle — Part 1
4

Think

Triangle ABC is drawn inside a rectangle with a length of 6 cm and a width of 4 cm. Find the area of Triangle ABC.

Learn

Method 1

Area of Triangle ABC = $\frac{1}{2}$ × (6 × 4) = 12 cm²

Area of Triangle ABC = $\frac{1}{2}$ × (Length × Width)

178 7-4 Area of a Triangle — Part 1

Think

Provide students with Area of a Triangle 1 (BLM) and pose the **Think** problem.

Discuss Mei's question. Students can fold, shade, or cut Area of a Triangle 1 (BLM) to find their answers. Students may also try to match partial squares to make full squares and count the squares.

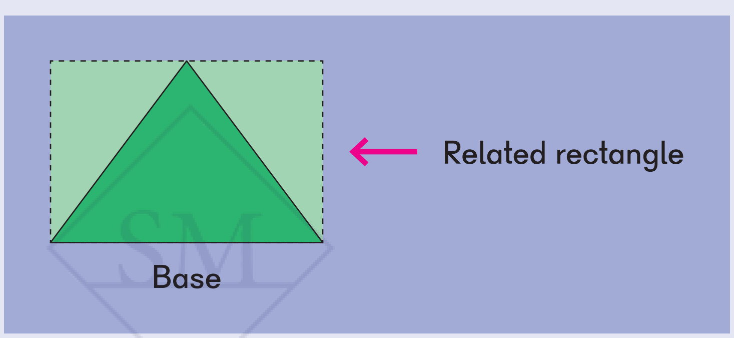
Discuss student solutions.

Learn

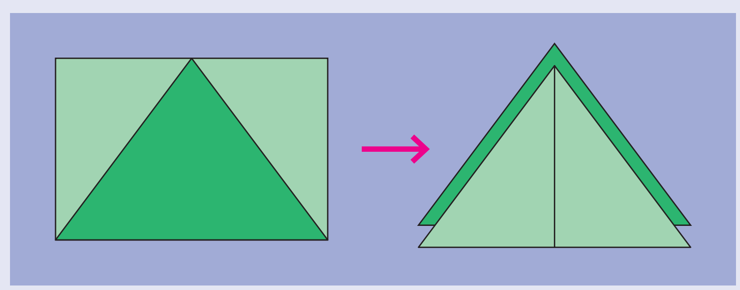
Have students compare their solutions to the three methods shown in **Learn**.

Method 1

The base of the triangle is one side of the related rectangle, which is the rectangle that has the same length base and height as the triangle.



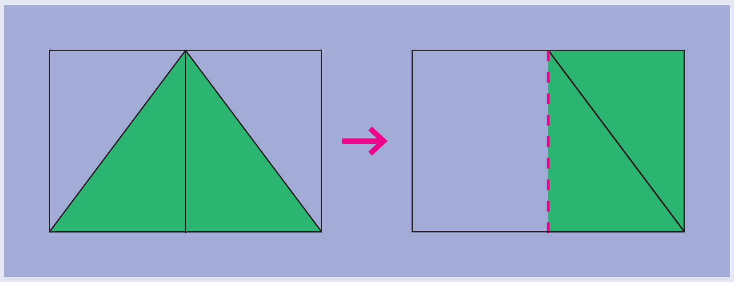
Alex cuts out the related rectangle, and then the triangle. The parts of the rectangle that are cut away will directly overlay the remaining triangle.



Since the light green and dark green triangles together make up the whole rectangle, each triangle is one half of the rectangle.

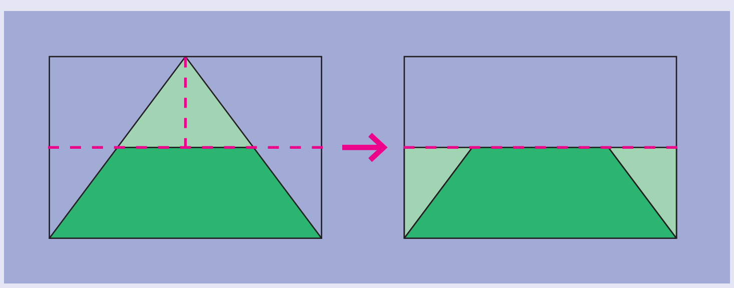
Method 2

Sofia cuts out the triangle, and then cuts the triangle in half. The parts of the triangle are put together and form one half of the original rectangle.

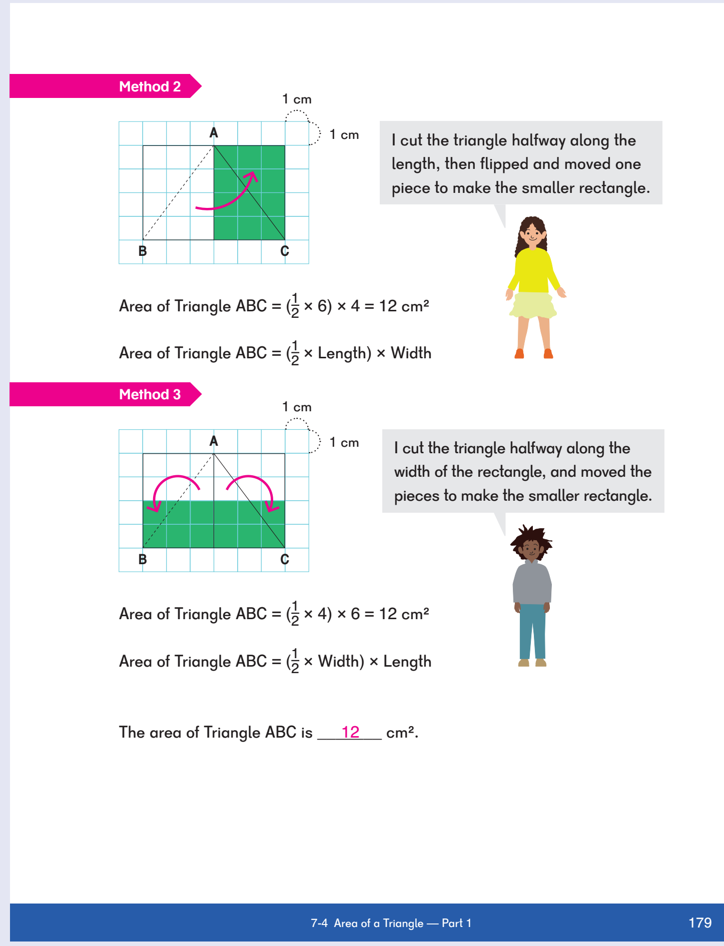


Method 3

Dion cuts the triangle in half horizontally. He can then cut the top part of the triangle in half, as in Method 2, to form one half of the rectangle in a different way.



Point out that the related rectangle has the same base and height as the triangle. We can see that the area of the triangle is half of the area of the related rectangle by cutting and moving pieces.



Method 2

1 cm

1 cm

I cut the triangle halfway along the length, then flipped and moved one piece to make the smaller rectangle.

Area of Triangle ABC = $(\frac{1}{2} \times 6) \times 4 = 12$ cm²

Area of Triangle ABC = $(\frac{1}{2} \times \text{Length}) \times \text{Width}$

Method 3

1 cm

1 cm

I cut the triangle halfway along the width of the rectangle, and moved the pieces to make the smaller rectangle.

Area of Triangle ABC = $(\frac{1}{2} \times 4) \times 6 = 12$ cm²

Area of Triangle ABC = $(\frac{1}{2} \times \text{Width}) \times \text{Length}$

The area of Triangle ABC is __12__ cm².

7-4 Area of a Triangle — Part 1 179

179