Family Support Materials

Introducing Multiplication

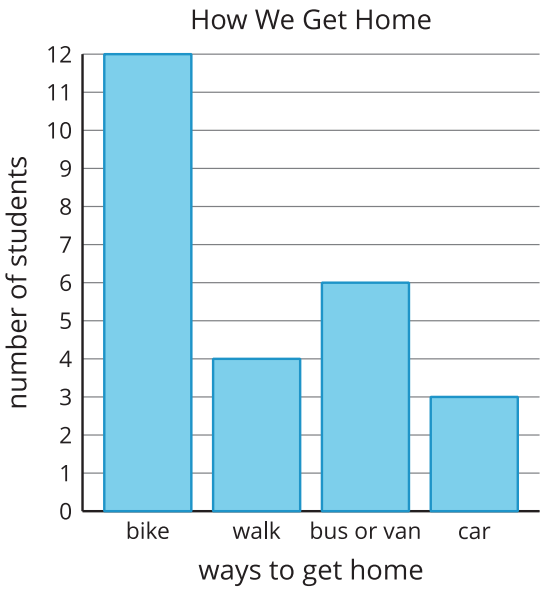
In this unit, students represent and interpret data on scaled bar graphs and picture graphs. Then, they are introduced to the concept of multiplication.

Section A: Interpret and Represent Data on Scaled Graphs

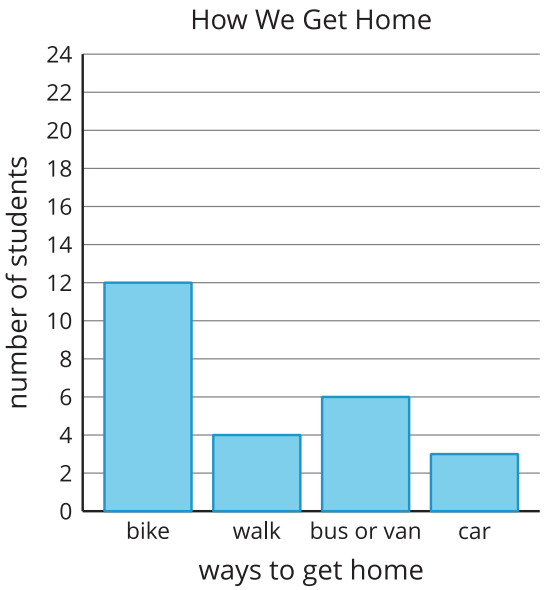
In this section, students make sense of and draw picture graphs and bar graphs. They see that each picture in a picture graph, or each step on a bar graph, can represent more than one object. They work with scales of 2, 5, and 10 (where each picture or step represents 2 objects, 5 objects, or 10 objects).

Students use the scaled bar graphs to solve “how many more” and “how many fewer” problems where the numbers are within 100.

bar graph



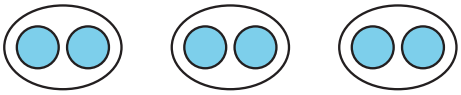
scaled bar graph



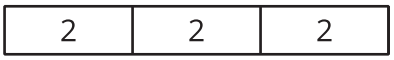
Section B: From Graphs to Multiplication

In this section, students use the idea of "each picture representing multiple objects" to think about equal-size groups and learn about multiplication. They create drawings and tape diagrams to represent situations that involve equal-size groups.

drawing of equal groups



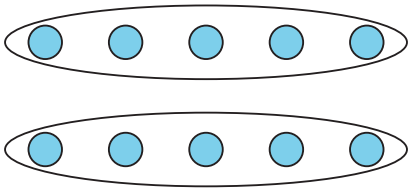
tape diagram

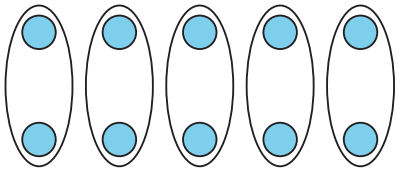


Students learn that we can write 3×2 to represent these drawings and interpret the expression to mean "3 groups of 2." Later, they write equations to represent multiplication situations. They also find unknown factors and products in equations (for example, $4 \times ? = 12$ and $5 \times 4 = ?$).

Section C: Represent Multiplication with Arrays and the Commutative Property

In this section, students connect the equal-group representations to arrays. An array is a set of objects organized in rows and columns. Students look for equal-size groups in arrays like in these diagrams:





Students write expressions to represent arrays. For example, in the shown arrays, we can write 2×5 (or 2 groups of 5) and 5×2 (or 5 groups of 2).

Try it at home!

Near the end of the unit, ask your student to find examples of equal-size groups or arrays at home, or use household objects to make such groups or arrays.

Questions that may be helpful as they work:

- How many groups are there?
- How many are in each group?
- Represent the objects with a drawing, a diagram, and an expression. How does your drawing and diagram match the expression?

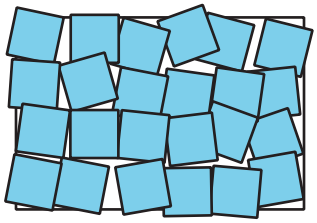
Family Support Materials

Area and Multiplication

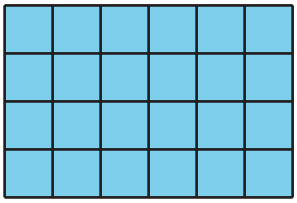
In this unit, students learn about the concept of area and relate area to multiplication and addition.

Section A: Concepts of Area Measurement

In this section, students make sense of the area of flat shapes. They learn that the area of a shape is the amount of space it covers, and it can be measured by the number of square units that cover it without gaps or overlaps. Students explore this idea by tiling shapes with squares and counting the number of squares.



We cannot measure area by the number of squares when they cover a shape with gaps and overlaps.

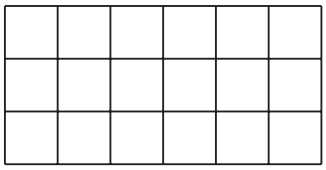


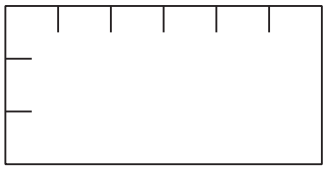
We can measure the area of this shape by the number of squares because the squares tile the shape.

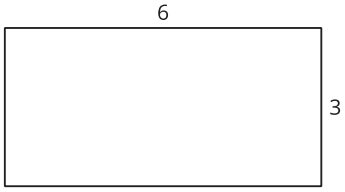
Section B: Relate Area to Multiplication

In this section, students relate the area of rectangles to multiplication. They see that rectangles can be tiled with squares in equal-size rows (or columns), so if the rectangle is 6 units by 4 units, there are 6 groups of 4 or 4 groups of 6. The number of square units is then 6×4 or 4×6.

Students come to understand that multiplying the side lengths of a rectangle gives the same number of squares as counting them. A rectangle that is 3 units by 6 units can be tiled with 3 rows of 6 squares, so its area is 3×6 or 18 square units.





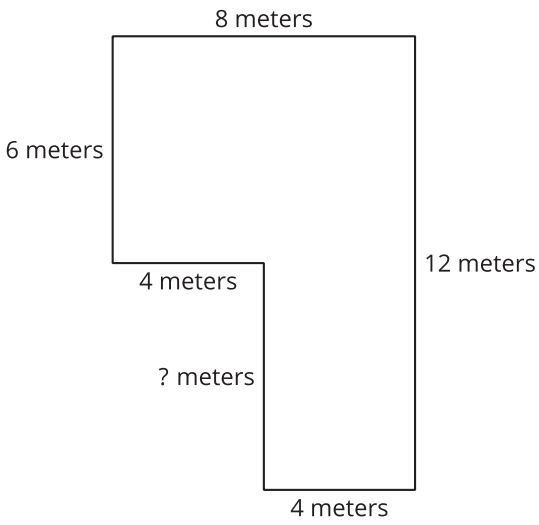


Students then use these ideas to solve real-world story problems related to area.

Section C: Find Area of Figures Composed of Rectangles

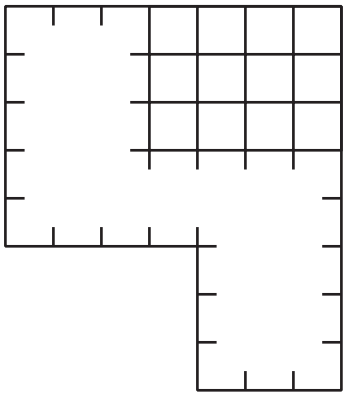
In this section, students find the area of figures composed of rectangles. They do so by decomposing (breaking apart) the figures into non-overlapping rectangles, finding the area of each rectangle, and adding all the areas.

Students also use the structure of rectangles to find missing side lengths in figures composed of rectangles.



Try it at home!

Near the end of the unit, ask your student to find the area of this figure:



Questions that may be helpful as they work:

- How can this figure be decomposed into rectangles?
- How many rows (or columns) are there in each rectangle?
- What multiplication expressions would you use to find the area?
- Where do we see this kind of design in our home or in places we visit?

Family Support Materials

Wrapping Up Addition and Subtraction Within 1,000

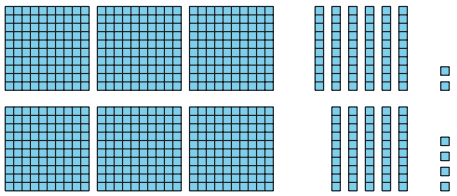
In this unit, students use their understanding of place value to round whole numbers and to add and subtract within 1,000. They also solve two-step problems.

Section A: Add within 1,000

In this section, students revisit numbers within 1,000 and consider ways to decompose (break apart) the numbers based on place value (hundreds, tens, and ones). To add and subtract numbers within 1,000, they start by using diagrams and strategies learned in grade 2. Then, they make sense of algorithms (steps that work every time, no matter the numbers involved) that make adding more efficient.

For example, here are three ways to find the value of $362 + 354$:

using base-ten blocks or diagrams



using expanded form

$$\begin{array}{r} 300 + 60 + 2 \\ +\ 300 + 50 + 4 \\ \hline 600 + 110 + 6 \end{array}$$

recording partial sums vertically

$$\begin{array}{r} 362 \\ +\ 354 \\ \hline 6 \\ 110 \\ +\ 600 \\ \hline 716 \end{array}$$

Using the standard algorithm for addition is not required until grade 4. Students who already know the standard algorithm still need to make sense the role of place value in the algorithm to support their work with decimals and fractions in future grades.

Section B: Subtract within 1,000

In this section, students analyze and use algorithms for subtraction, while continuing to use base-ten blocks and diagrams to think about subtraction. They notice that it is difficult to use drawings to show a hundred being decomposed or regrouped into tens (or a ten into ones), and that an algorithm is helpful.

Students make sense of a subtraction algorithm that uses expanded form to show how numbers are being regrouped. This non-conventional notation allows students to see the meaning behind the digits above the numbers in the standard algorithm.

subtracting using expanded form

$$\begin{array}{rrcrcr} & \overset{400}{\cancel{5}00} & + & \overset{120}{\cancel{2}0} & + & 8 \\ - & 200 & + & 70 & + & 1 \\ \hline \end{array}$$

standard subtraction algorithm

$$\begin{array}{r} \overset{4}{\cancel{5}}\ \overset{12}{\cancel{2}}\ 8 \\ -\ 2\ 7\ 1 \\ \hline \end{array}$$

As with addition, the standard algorithm for subtraction is not expected until grade 4. The work here focuses on making sense of the regrouping sometimes required when we subtract.

Section C: Round within 1,000

In this section, students learn to round whole numbers to the nearest ten or hundred, using number line diagrams in their reasoning. For example, they can see that for 364, the nearest ten (or multiple of 10) is 360, and the nearest hundred (or multiple of 100) is 400.

Section D: Solve Two-Step Problems

In this section, students apply their work with addition, subtraction, and multiplication to solve problems that require two steps, such as:

Mai had 104 beads. She bought two packs of beads and now she has 124 beads. How many beads were in each pack?

Try it at home!

Near the end of the unit, ask your student to find answers to the following problems using an algorithm of their choice:

- $293 + 592$
- $728 - 384$

Questions that may be helpful as they work:

- Can you explain the steps in your algorithm?
- Does your answer make sense? How do you know?
- Can you round your answer to the nearest multiple of 10? 100?

Family Support Materials

Relating Multiplication to Division

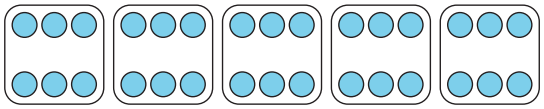
In this unit, students make sense of division and learn to multiply and divide whole numbers within 100. They also use the four operations to represent and solve two-step word problems. Students work toward these end-of-year goals:

- fluently multiply and divide within 100
- know from memory all products of two one-digit numbers

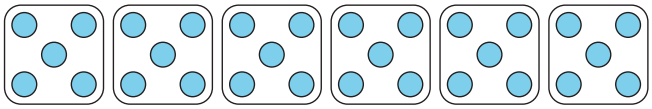
Section A: What is Division?

In this section, students think about division in terms of equal-size groups, just as they have done with multiplication. For instance, the expression $30 \div 5$ can represent putting 30 objects into 5 equal groups, or putting 30 objects into groups of 5. Students see that, in general, dividing can mean answering the question "how much is in one group?" or "how many equal groups can be made?"

30 objects put into 5 equal groups



30 objects put into groups of 5

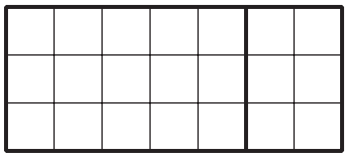


Section B: Relating Multiplication and Division

In this section, students make connections between the result of division and the missing factor in a multiplication equation.

For example, the value of $30 \div 6$ is the missing factor in $\_\_\_\_\_ \times 6 = 30$. This understanding helps students recognize division facts based on the multiplication facts they know.

Students also learn to use properties of operations to multiply. For example, if they know 3×7, they also know 7×3.



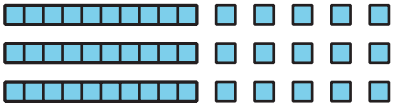
They can also decompose (or break apart) the 7 in 7×3 into 5 and 2, and then find $(5 \times 3) + (2 \times 3)$. An area diagram can show this strategy for multiplying.

Section C: Multiplying Larger Numbers

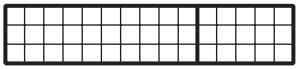
In this section, students use different strategies to multiply larger numbers. First, they multiply a single-digit number by a multiple of 10, relying on what they know about place value. For instance, 2×40 means 2 groups of 4 tens, or $2 \times 4 \times 10$. Then, they multiply a single-digit number by other two-digit numbers.

Students see that it is helpful to break apart the two-digit numbers by place value, into tens and ones. For example, 3×15 can be calculated by finding 3×10 and 3×5. They use base-ten blocks or diagrams and area diagrams (with and without a grid) to help them find such products.

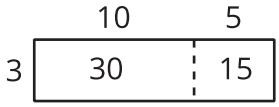
base-ten blocks or diagrams



gridded area diagram



ungridded area diagram



Section D: Dividing Larger Numbers

In this section, students divide larger numbers. They continue to use the relationship between multiplication and division and their understanding of place value to find quotients. For example, to find the value of $78 \div 3$, they may think about putting 78 in 3 equal groups and use multiplication to find what is in each group.

$$3 \times 10 = 30$$
$$3 \times 10 = 30$$
$$3 \times 6 = 18$$
$$10 + 10 + 6 = 26$$

$$3 \times 20 = 60$$
$$3 \times 6 = 18$$
$$20 + 6 = 26$$

Try it at home!

Near the end of the unit, ask your student to find answers to the following problems:

- 6×16
- $98 \div 7$

Questions that may be helpful as they work:

- How did you break up the problem to make it easier for you to solve?
- Can you rewrite the division problem as a multiplication problem?

Family Support Materials

Fractions as Numbers

In this unit, students develop an understanding of fractions as numbers. They represent fractions with diagrams and number lines and compare and find equivalent fractions.

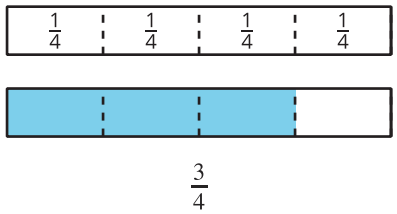
Section A: Introduction to Fractions

In this section, students use diagrams and fraction strips to learn about fractions.

In grade 2, they learned about halves, thirds, and fourths. Now, they partition 1 whole into 6 or 8 parts, describe each part as "a sixth" and "an eighth," and write the notation $\frac{1}{6}$ and $\frac{1}{8}$.

Students learn that the notation $\frac{1}{b}$ means 1 whole is partitioned into b parts and each part has size $\frac{1}{b}$.

In these diagrams, each part is a unit fraction with the size $\frac{1}{4}$.

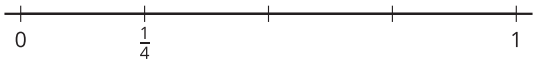


Students see that composing unit fractions create non-unit fractions (fractions with numerators greater than 1). For example, putting together 3 parts of $\frac{1}{4}$ gives $\frac{3}{4}$.

Section B: Fractions on the Number Line

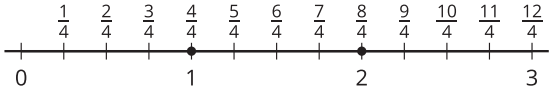
In this section, students locate fractions on the number line. They learn that, just like whole numbers, fractions can be represented as distances from 0 on the number line.

Students partition the interval from 0 to 1 into b equal parts. They label the first tick mark with a unit fraction $\frac{1}{b}$.



Then, students locate non-unit fractions on the number line by counting unit fractions. They notice that certain fractions are in the same location as whole numbers on the number line.

For example, $\frac{4}{4}$ is at the same location as 1 and $\frac{8}{4}$ is at the same location as 2.

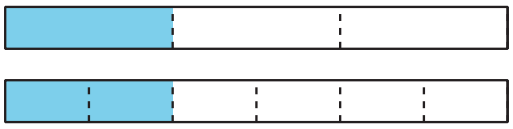


The terms "numerator" and "denominator" are introduced here.

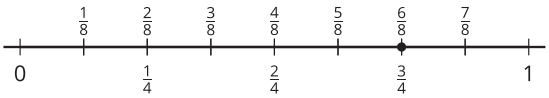
Section C: Equivalent Fractions

In this section, students learn that equivalent fractions are fractions that are the same size. They use fraction strips and diagrams to show and find equivalent fractions.

The shaded parts of the diagrams show that $\frac{1}{3}$ and $\frac{2}{6}$ are the same size, so $\frac{1}{3} = \frac{2}{6}$.

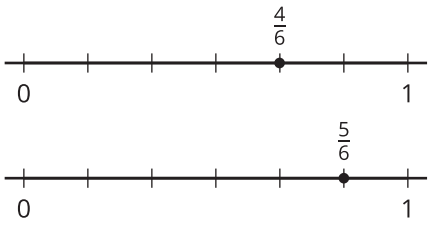


The number line diagram shows that $\frac{6}{8}$ and $\frac{3}{4}$ are at the same location or are the same distance from 0, so $\frac{6}{8} = \frac{3}{4}$.



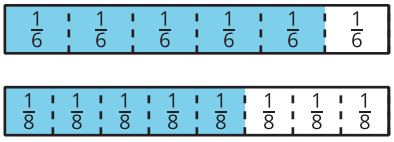
Section D: Fraction Comparisons

In this section, students compare fractions. They learn that comparisons are only valid if the fractions being compared refer to the same whole.



Students first compare fractions with the same denominator (such as $\frac{4}{6}$ and $\frac{5}{6}$).

Then, they compare fractions with the same numerator (such as $\frac{5}{6}$ and $\frac{5}{8}$).



Try it at home!

Near the end of the unit, ask your student to show the fractions $\frac{5}{8}$ and $\frac{6}{4}$ on a fraction strip and a number line.

Questions that may be helpful as they work:

- How did you determine how many partitions that needed to be made?
- How did you know how many parts to shade in?
- How did you know where to place the fraction on the number line?
- Which fraction is larger? How do you know?

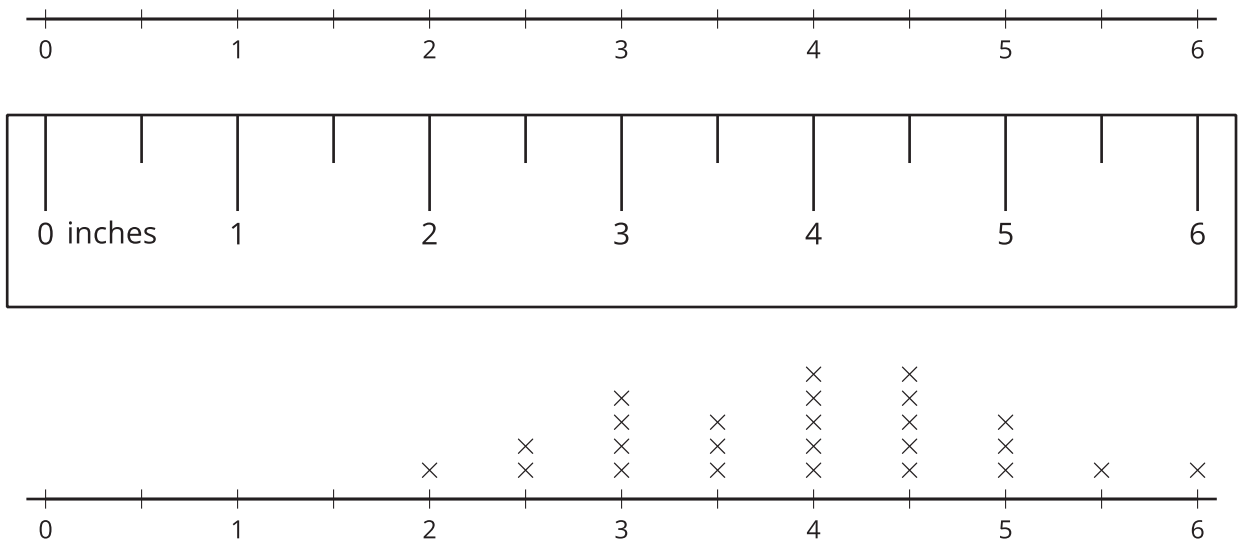
Family Support Materials

Measuring Length, Time, Liquid Volume, and Weight

In this unit, students measure lengths in halves and fourths of an inch and represent measurement data on line plots. They learn about units for measuring weight, liquid volume, and time. They then use the four operations to solve problems involving measurement.

Section A: Measurement Data on Line Plots

In this section, students measure in halves and fourths of an inch, learn to use mixed numbers to represent lengths greater than 1, and interpret and create line plots that represent lengths.



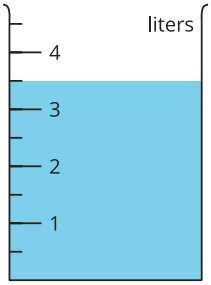
Students relate the fractions on a ruler to those on a number line. The work here reinforces the idea that whole numbers can be expressed as fractions.

Section B: Weight and Liquid Volume

In this section, students learn to estimate and measure weight (in grams and kilograms) and liquid volume (in liters).

Students make sense of grams and kilograms by holding objects that are about 1 gram and about 1 kilogram. They see, for example, that a paper clip weighs about 1 gram and a regular cantaloupe weighs about 1 kilogram.

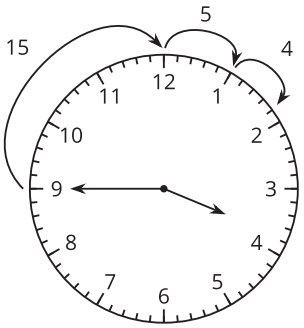
To make sense of liters, students engage in activities that require pouring water into containers. They also estimate the volume of liquid in everyday objects such as a bottle, a bucket, a sink, and so on.



Students also analyze the scale on liquid measuring tools, as shown here, and make sense of fractional units of liquid volume.

Section C: Problems Involving Time

In this section, students learn to tell and write time to the nearest minute. They solve elapsed-time problems where the start time, the end time, or the duration is unknown.



To reason about time, students use representations that make sense to them, including drawings, tables, equations, or words.

For example, the clock shows how students could think about 24 minutes after 3:45.

Section D: Explore the Fair

In this section, students apply what they learned in this unit to solve problems that involve measurements. All the activities use the context of a state or county fair. The work here gives students many opportunity to make sense of problems, use all four operations, and think carefully about their strategies and solutions.

Try it at home!

Near the end of the unit, ask your student to find the following measurements of objects around your home:

- length measured to the nearest quarter inch
- weight measured in kilograms or grams
- liquid volume in liters

Questions that may be helpful as they work:

- Before you measure, estimate the object's length, weight or volume. Why do you think it will be that measurement?
- Can you create a line plot of your data?

Family Support Materials

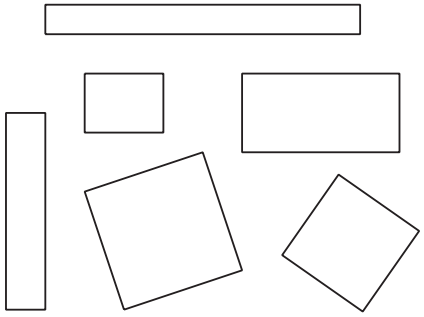
Two-dimensional Shapes and Perimeter

In this unit, students reason about attributes (features) of shapes and learn about perimeter.

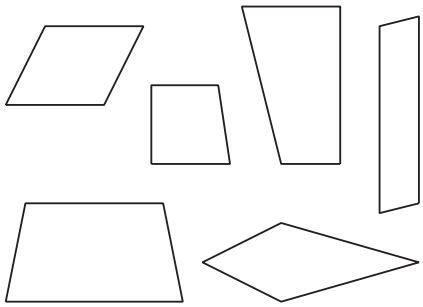
Section A: Reason with Shapes

In this section, students describe, compare, and sort a variety of shapes. Students think about ways to sort triangles and quadrilaterals into more specific categories based on their attributes. They see that triangles and quadrilaterals can be classified and named based on their sides (whether some sides are the same length) and angles (whether they have right angles).

These are rectangles.



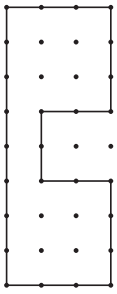
These are not rectangles.

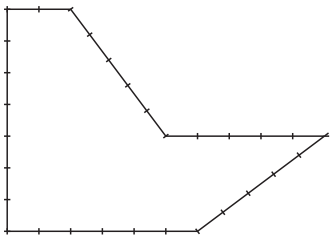


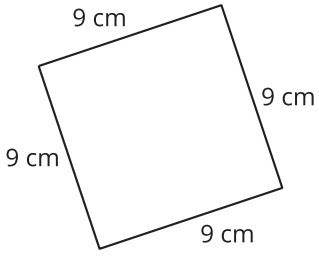
Students see that a shape can have more than one name if it has the attributes that define different shapes. For example, a shape that is a square is also a rhombus and a rectangle.

Section B: What is Perimeter?

In this section, students learn that perimeter is the distance around a shape. They first find perimeter by counting or adding the units of length on each side of a shape. Later, they find the perimeter of shapes whose sides are labeled with lengths.





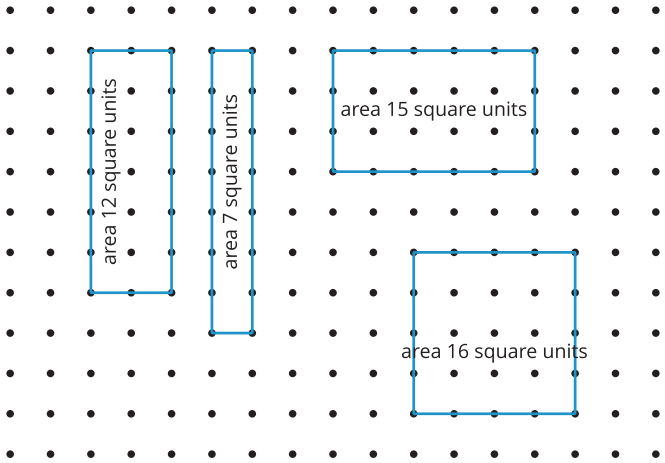


Students also draw shapes with a specified perimeter and see that different shapes can have the same perimeter.

Section C: Expanding on Perimeter

In this section, students solve problems that involve both area and perimeter. They draw rectangles with the same area and different perimeters, and rectangles with the same perimeter and different areas.

For example, the rectangles in the image all have a perimeter of 16 units, but they have different areas.



Section D: Design with Perimeter and Area

In this section, students apply what they've learned about geometric shapes, perimeter, and area to solve design problems. They design a park that has certain components, a West African wax print pattern with certain shapes, and a robot that meet certain requirements.

Try it at home!

Near the end of the unit, ask your student to find:

- these shapes around the house: a rhombus, a rectangle, a square, and a quadrilateral that isn't a rhombus, rectangle, or square
- the area and perimeter of a rectangle in the house

Questions that may be helpful as they work:

- What kind of quadrilateral is this? How do you know?
- Are you measuring area or perimeter? How do you know?

Family Support Materials

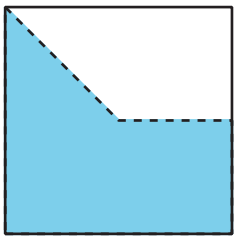
Putting It All Together

In this unit, students apply what they have learned throughout the year to strengthen major concepts and fluency goals of the grade.

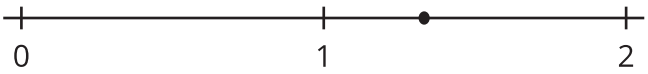
Section A: Fraction Fun

In this section, students revisit and build on important fraction ideas that they have learned in the course. They think about different ways to represent fractions and to estimate the size of fractions presented in different forms: as an area diagram, a shaded strip, and a number line.

What fraction of the square is shaded?



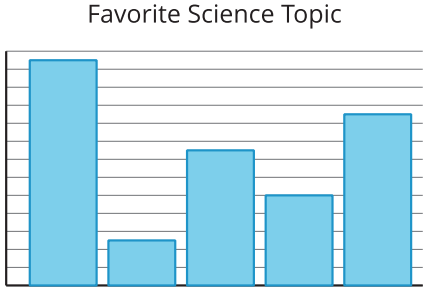
What number is represented by the point on the number line?



Students also practice identifying and locating fractions on the number line, using tape to create a number line that shows a large number of fractions.

Section B: Measurement and Data

In this section, students first use their knowledge of shapes, perimeter, and area to design their own tiny house. They ask and answer questions about the area and perimeter of shapes in their design. Then, they calculate the cost of finishing a room in their tiny house.



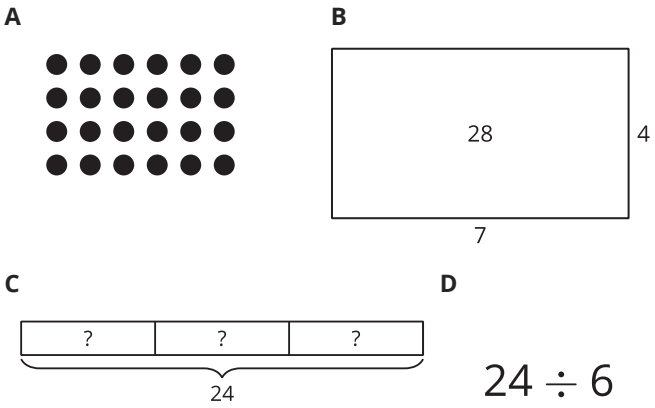
Next, students focus on data collection and representation. They conduct a survey in the school community, organize their data, and represent the data with a scaled graph. They also ask and answer questions about the data.

Section C: Multiplication and Division Games

In this section, students continue to build their fluency with multiplication and division. They reflect on the products within 100 they know from memory or can find quickly and the ones they don't know yet. Students then practice multiplication facts through games.

Students also reinforce their understanding of the connections between multiplication and division by matching equations and diagrams.

Which one doesn't belong?

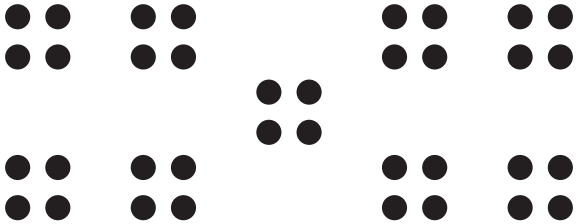


Section D: Create and Design

Throughout the course, students have participated in warm-up routines such as How Many Do You See, Exploration Estimation, Which One Doesn't Belong, True or False, and Number Talk.

In this section, they apply the mathematics they have learned to design warm-ups that use some of these routines.

How many do you see? How do you see them?



Try it at home!

Near the end of the unit, ask your student to share the warm-up routines they created. Questions that may be helpful as they share:

- How did you design the routine?
- How does the routine relate to what you learned this year?
- What might you change to improve the routine?