How to support your student as they learn about **Composing and Decomposing**

Mathematics is a connected set of ideas, and your student knows a lot. Encourage them to use the mathematics they already know when seeing new concepts in this module.

Module Introduction

In this module your student will learn more about numbers and shapes and their relationships. There are four topics in this module: *Factors and Multiples, Positive Rational Numbers, Shapes and Solids,* and *Decimals*. Your student will use what they already know about area, number properties, and volume in this module.

Academic Glossary

Each module will highlight an important term. Knowing and using these terms will help your student think, reason, and communicate their math ideas.

Term	Analyze
Definition	• To study or look closely for patterns. • To break down a concept into smaller parts to gain a better understanding of it.
Questions to Ask Your Student	• Do you see any patterns? • Have you seen something like this before? • What happens if the shape, model, or numbers change?
Related Phrases	• Examine • Evaluate • Determine • Observe • Consider • Investigate • What do you notice?

Example: Topic 1 Lesson 2

Determine the least common multiple of 6 and 9.

a. List the first 9 multiple of 6.
b. List the first 6 multiples of 9.
c. What is the least common multiple of 6 and 9?

TABLE OF CONTENTS

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Math Process Standards

Each module will focus on a process (or a pair of processes) that will help your student become a mathematical thinker. The "I can" statements listed below help your student to develop their mathematical learning and understanding.

Communicate mathematical ideas, reasoning, and their implications using multiple representations including symbols, diagrams, graphs, and language as appropriate.

I can:

- explain what a problem "means" in my own words.
- create a plan and change it if necessary.
- ask useful questions when trying to understand the problem.
- explain my reasoning and defend my solution.
- reflect on whether my results make sense.

Look for examples of these processes in the Topic Summaries.

The Carnegie Learning Way

Our Instructional Approach

Carnegie Learning's instructional approach is based on how people learn and real-world understandings. It is based on three key components:

ENGAGE	DEVELOP	DEMONSTRATE
Purpose: Provide an introduction that creates curiosity and uses what students already know and have experienced. **Questions to Ask:** How does this problem look like something you did in class?	**Purpose:** Build a deep understanding of mathematics through different activities. **Questions to Ask:** Do you know another way to solve this problem? Does your answer make sense?	**Purpose:** Reflect on and evaluate what was learned. **Questions to Ask:** Is there anything you do not understand?

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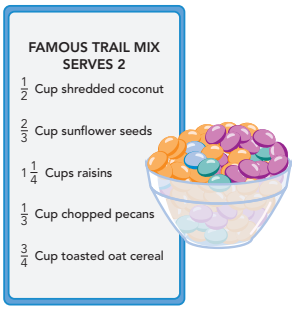
Module Overview

TOPIC 1	TOPIC 2	TOPIC 3	TOPIC 4
Factors and Multiples	**Positive Rational Numbers**	**Shapes and Solids**	**Decimals**
6 Days	10 Days	11 Days	9 Days
Your student will study the relationship between numbers and area.	**Your student will review fraction multiplication and use the inverse relationship between multiplication and division to understand fraction by fraction division.**	**Your student will study the relationships of angles and side lengths of triangles, as well as the area of triangles, parallelograms, and trapezoids, by decomposing and composing parts of shapes.**	**Your student will plot, compare, and order decimals on a number line and understand decimal multiplication and division.**
Did you know that? You can use an area model to represent the product of the two numbers 15 and 42. 40 | 2 10 | 400 | 20 5 | 200 | 10 Can you name the expression? [*400 + 20 + 200 + 10*]	What in the world?  Dividing fractions is commonly used when cooking and baking. How many cups of chopped pecans would you need for half the serving size? [$\frac{1}{6}$ *cup of chopped pecans*]	Did you know that?  A **composite figure** is a figure made up of more than one simple geometric figure. The house shown above is a composite figure. Can you name the 4 different shapes in the image? [*rectangles, triangle, squares, trapezoid*]	Did you know that?  You can compare decimals to solve real-world problems. Which runner ran the fastest? [*Vonetta*]

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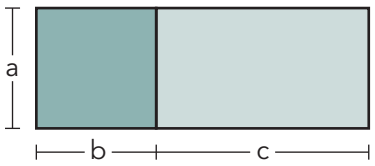
Topic 1: Factors and Multiples

Key Terms		
• numeric expression • equation • Distributive Property • base • power	• exponent • common factor • relatively prime • greatest common factor (GCF)	• multiple • Commutative Property • least common multiple (LCM)

The **Distributive Property**, when applied for multiplication, states that for any numbers a, b, and c, $a(b + c) = ab + ac$.



The **exponent** of the power is the number of times the base is used as a factor.

$8^4 = 8 \cdot 8 \cdot 8 \cdot 8$

exponent

A **multiple** is the product of a given whole number and another whole number.

multiples of 10:

10 20 30 40 50 …

$10 \cdot 1$ $10 \cdot 2$ $10 \cdot 3$ $10 \cdot 4$ $10 \cdot 5$ …

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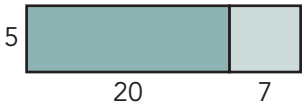
In this topic, students will learn more about factors and multiples. They use area models to show the factors of a given number and the **common factors** of two or more numbers. Students use factor trees to organize the prime factors of a number. Then, they use tables to determine common factors, the greatest common factor (GCF), and the least common multiple (LCM) of two or more numbers.

Area Models

The equation $5 \cdot 27 = 135$ shows that the expression $5 \cdot 27$ is equal to the expression 135. An **equation** is a mathematical sentence that uses an equals sign to show that two or more quantities are the same as one another.



The area model shows the side length of 27 split into two parts.

$5 \cdot 27 = 5(20 + 7)$

The factors for each region are $(5 \cdot 20) + (5 \cdot 7)$.

The area of each smaller region is $100 + 35$.

The total area is 135.

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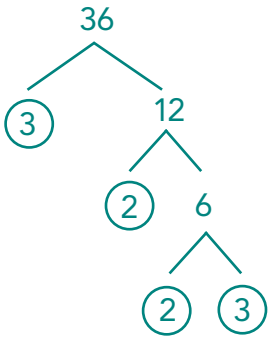
Factor Trees to Determine the Prime Factors of a Number

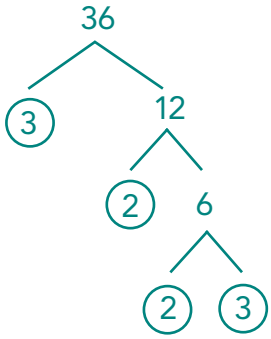
A factor tree is a way to organize the prime factors of a number. Choose any factor pair to get started.

- Begin with the number 36.
- Pick any whole number factor pair of 36, other than 1 and 36.
- Draw a branch from 36 to each factor, 3 and 12.
- Since both of the factors are not prime, you are not finished.
- Use branches to write a factor pair for 12.
- Since both of the factors of 12 are not prime, you are not finished.
- Because 2 and 3 are prime, this factor tree is complete.



$36 = 2 \cdot 2 \cdot 3 \cdot 3$

Repeated Multiplication as a Power



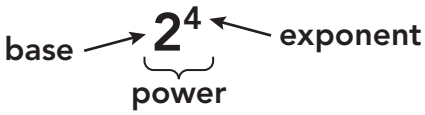
$36 = 2 \cdot 2 \cdot 3 \cdot 3$

$36 = 2^2 \cdot 3^2$

The prime factorization shown has repeated factors. You can represent repeated multiplication as a power. A **power** has two parts: the base and the exponent.

The **base** of a power is the factor multiplied by itself repeatedly, and the **exponent** of the power is the number of times you use the base as a factor.

$$2 \cdot 2 \cdot 2 \cdot 2 = 2^4$$



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Using a Table to Determine the GCF and LCM

You can organize the prime factors of two or more numbers into a table. Only list shared factors that are in both rows in the same column.

Number	Prime Factors				
56	2	2	2		7
42	2			3	7

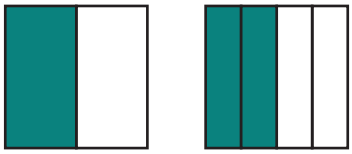
In the table shown, the common prime factors of 56 and 42 are 2 and 7.

The **greatest common factor (GCF)** is the product of the shared prime factors. $2 \cdot 7 = 14$, so the GCF of 56 and 42 is 14. The **least common multiple (LCM)** is the product of the shared and non-shared prime factors. Both 2 and 7 are shared factors. They are only used once in the product. $2 \cdot 2 \cdot 2 \cdot 3 \cdot 7 = 168$, so the LCM of 56 and 42 is 168.

Topic 2: Positive Rational Numbers

Key Terms	
• unit fraction • equivalent fraction • benchmark fractions • algorithm	• rational number • reciprocal • multiplicative inverse • complex fraction

Fractions that represent the same part-to-whole relationship are **equivalent fractions**.



$\frac{1}{2}$ $\frac{2}{4}$

The **multiplicative inverse** of a number $\frac{a}{b}$ is the number $\frac{b}{a}$, where a and b are nonzero numbers. The product of any nonzero number and its multiplicative inverse is 1. The multiplicative inverse of a number is also known as the **reciprocal** of a number.

The multiplicative inverse of $\frac{3}{7}$ is $\frac{7}{3}$.

$\frac{3}{7} \cdot \frac{7}{3} = \frac{21}{21} = 1$

The multiplicative inverse of 5 is $\frac{1}{5}$.

$\frac{5}{1} \cdot \frac{1}{5} = \frac{5}{5} = 1$

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In this topic, students will focus on fraction multiplication and division. They will create physical models to represent and compare fractions, and determine equivalent fractions. They use an area model for multiplication with fractions before using an **algorithm**, or step-by-step method.

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Using Area Models to Multiply Fractions

MATH PROCESS STANDARDS

How do the activities in *Positive Rational Numbers* promote student expertise in the math process standards?

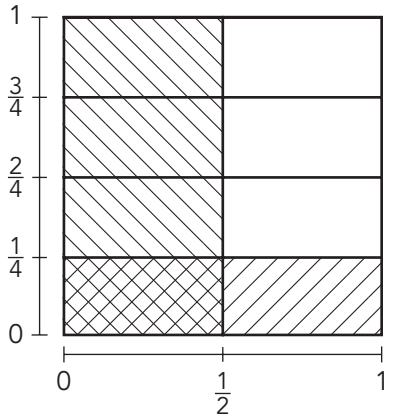
NOTE: This is an example of the math process standard:

Communicate mathematical ideas, reasoning, and their implications using multiple representations including symbols, diagrams, graphs, and language as appropriate.

- I can explain what this area model means in my own words.

Refer to page 2 for more "I can" statements.

Consider the expression $\frac{1}{4} \cdot \frac{1}{2}$ represented in the area model shown.

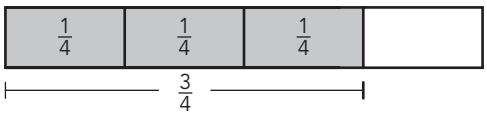


How are the factors of the product $\frac{1}{4} \cdot \frac{1}{2}$ represented in the model?

Also in this topic, students use models of fractions with division, and then use a dividing across strategy.

Using Strip Diagrams to Represent Quotients with Fractions

A strip diagram can show the quotient of two fractions, such as $\frac{3}{4} \div \frac{1}{4}$. The division expressions asks, "How many $\frac{1}{4}$ are in $\frac{3}{4}$?"



There are 3 one-fourths in $\frac{3}{4}$, so $\frac{3}{4} \div \frac{1}{4} = 3$.

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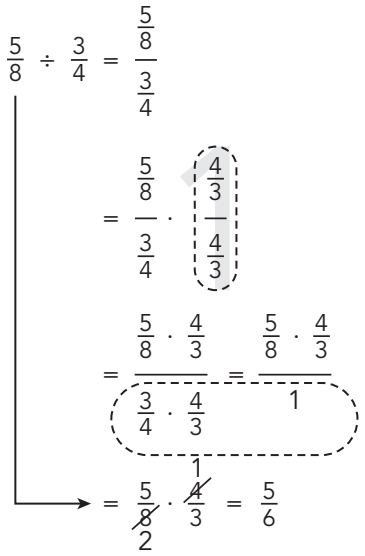
Finally, students learn the standard algorithm, or steps, for dividing fractions. They rewrite division expressions as multiplication by the reciprocal, or multiplicative inverse.

Dividing Fractions



Rewrite the division expression as a **complex fraction**.

Multiply the numerator and denominator by the multiplicative inverse of $\frac{3}{4}$.

Perform multiplication and rewrite the denominator as 1.

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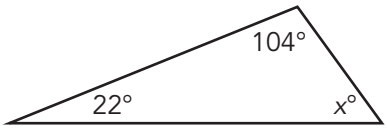
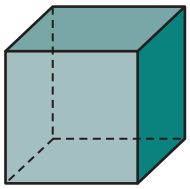
Topic 3: Shapes and Solids

Key Terms		
• Triangle Inequality Theorem • Triangle Sum Theorem • parallelogram • variable • straightedge	• trapezoid • geometric solid • polyhedron • face • edge	• vertex • right rectangular prism • cube • volume • unit cube

The **Triangle Sum Theorem** states that the sum of the measures of the interior angles of a triangle is 180°.

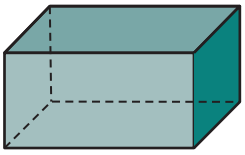


A **geometric solid** is a bounded three-dimensional geometric figure.



Cube

A **right rectangular prism** is a **polyhedron** with three pairs of congruent and parallel rectangular **faces**.



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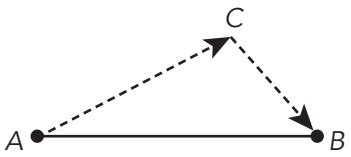
In this topic, students determine if three given line segments will create a triangle or not.

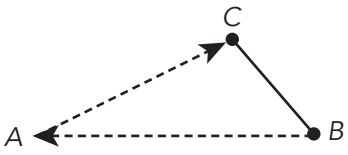
Triangle Inequality Theorem

The **Triangle Inequality Theorem** states that the sum of the lengths of any two sides of a triangle is greater than the length of the third side.

$AC + CB > AB$

$BA + AC > BC$





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Also in this topic, students use hands-on tools to learn about the sum of the interior angles of a triangle and the relationship between triangle side and angle measures.

Triangle Sum Theorem

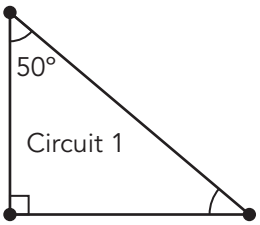
The **Triangle Sum Theorem** states the relationship between the three angles in a triangle.

THEOREM

TRIANGLE SUM THEOREM

The sum of the measures of the interior angles of a triangle is 180°.

Trevor organizes a bike race called the Tri-Cities Criterium. Criteriums consist of several laps around a closed circuit. He designs a triangular circuit.



Use the Triangle Sum Theorem to determine the measure of the third angle in the triangular circuit.

$x + 90° + 50° = 180°$

$x + 140° = 180°$

$x = 40°$

From their knowledge of rectangles and area, students also develop the formula, or rule, for determining the area of parallelograms, triangles, and **trapezoids**. Students calculate the **volume** of right rectangular prisms.

Area of a Parallelogram

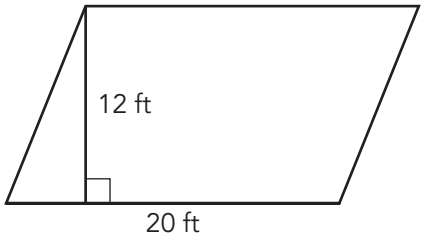
A **parallelogram** is a four-sided figure with two pairs of parallel sides with each pair equal in length. In a parallelogram, the height is the distance from the base to the opposite side at a right angle. The area of a parallelogram is equal to $b \cdot h$, where the variable b represents the base and h represents the height. A **variable** is a letter used to represent a number.

For example, in this parallelogram, the base, b, is 20 feet and the height, h, is 12 feet.

Area of a parallelogram $= bh$

$= (20)(12)$

$= 240$ square feet



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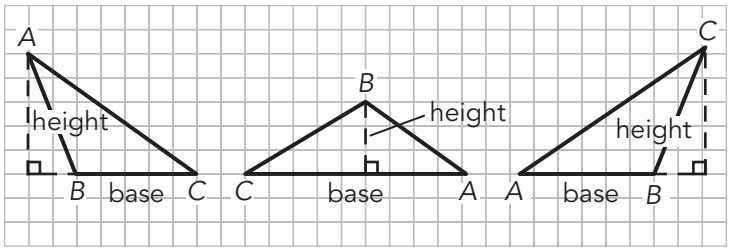
Area of a Triangle

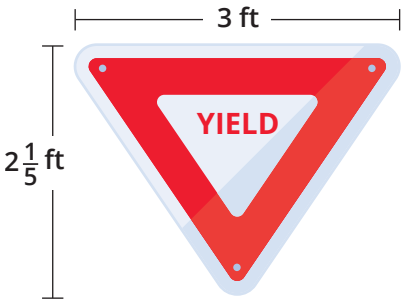
The area of a triangle is equal to $\frac{1}{2}bh$. The base of a triangle can be any of its sides.



Draw a line straight down from the top corner of the triangle to the bottom, or base at a right angle. This is called the height of the triangle.

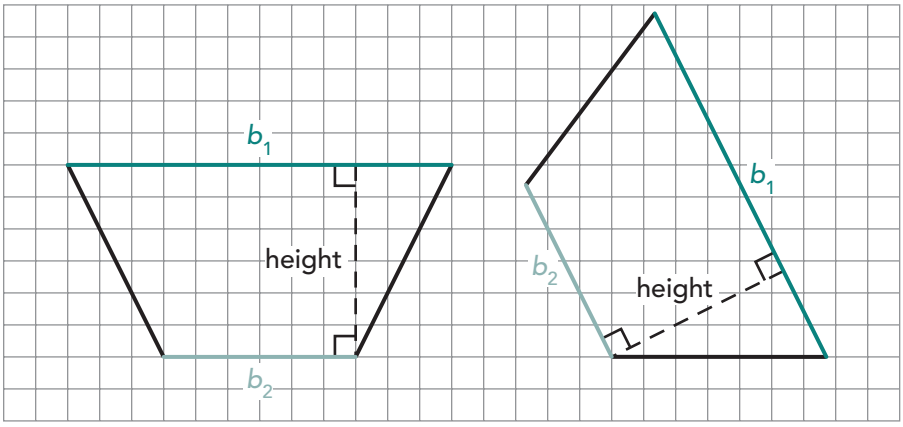
For example, in this triangle, the base, b, is equal to 3 feet and the height, h, is equal to $2\frac{1}{5}$ feet.

$$\text{Area of a triangle} = \frac{1}{2}bh$$
$$= \frac{1}{2}(3)\left(2\frac{1}{5}\right)$$
$$= 3\frac{3}{10} \text{ square feet}$$



Area of a Trapezoid

A trapezoid has two bases that are parallel to each other, often labeled b_1 and b_2. The other two sides of a trapezoid are called the legs of the trapezoid. A height of a trapezoid is the length of the shortest line drawn from one base to the other at a right angle.



The area of a trapezoid is equal to $\frac{1}{2}(b_1 + b_2)h$.

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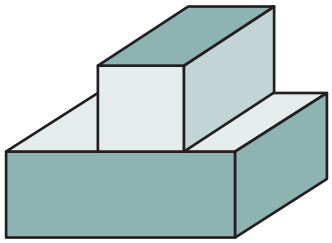
Topic 4: Decimals

Key Terms	
• kite • composite solid	• terminating decimal • repeating decimal
A **composite solid** is made up of more than one geometric solid. 	When you write a fraction as a decimal using division, and a digit or a group of digits repeats without end in the quotient, the resulting decimal is a **repeating decimal**. $\frac{1}{9} = 0.111...$ $\frac{7}{12} = 0.58333...$ $\frac{22}{7} = 3.142857142857...$
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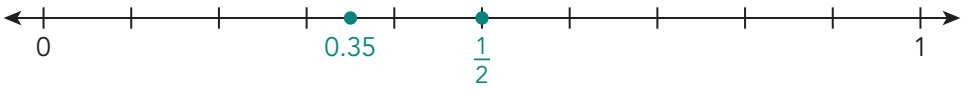
In this topic, students plot decimals on a number line and compare and order decimal values.

Plotting, Comparing, and Ordering Rational Numbers

Compare $\frac{1}{2}$ and 0.35. Which value is greater? First, convert $\frac{1}{2}$ to a decimal. $\frac{1}{2}$ is equivalent to $\frac{5}{10}$, or 0.5. Plot each value on a number line.



Because $\frac{1}{2}$ is to the right of 0.35 on the number line, $\frac{1}{2}$ is greater than 0.35, or $\frac{1}{2} > 0.35$.

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Students review addition and subtraction of decimal numbers and practice calculating correctly and quickly.

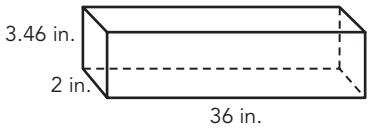
Adding and Subtracting Decimals

When adding or subtracting decimals, it is important to line up the digits on the correct place values. Estimating sums or differences gives students a sense of the reasonableness of an answer before calculating the sum or difference.

	$18.205 - 3.91$
First, estimate the answer so you know the approximate difference.	$18 - 4 = 14$
Then, line up the decimals so that correct place values are in the same column and subtract.	$\begin{array}{r} {\scriptstyle 7\ \ 11\,10} \\ 18.\not{2}\not{0}5 \\ -3.910 \\ \hline 14.295 \end{array}$
Compare the answer to your estimate to check your work.	The estimate of 14 and the difference of 14.295 are reasonably close, so the difference appears to be correct.

Multiplying Decimals

In this topic, students review whole-number and decimal multiplication.



A poster is rolled up and mailed in a cardboard box in the shape of a rectangular prism. Determine the volume of the box.

The formula for determining the volume of a rectangular prism is *volume* = *length* · *width* · *height*, or $V = l \cdot w \cdot h$. Multiply the three values.
$36 \cdot 2 \cdot 3.46 = 249.12$ The volume of the box is 249.12 cubic inches.

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Using a Standard Algorithm to Divide Decimals

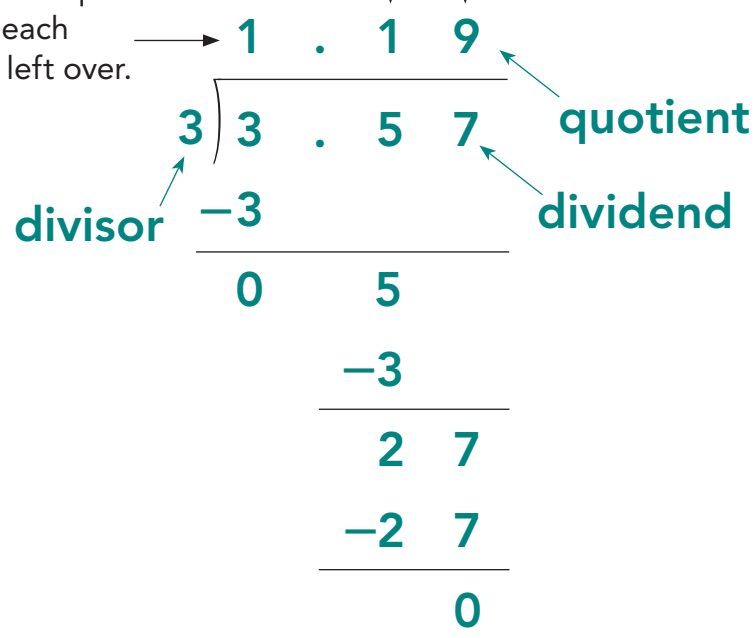
The long division algorithm uses organized estimation and place value to determine a quotient, or the number of times the divisor is contained in the dividend.

Let's use the standard algorithm to solve 3.57 ÷ 3. The dividend is 3.57 and the divisor is 3.

5 tenths divided into 3 equal groups is 1 tenth in each group with 2 tenths left over.

2 tenths and 7 hundredths is 27 hundredths. 27 hundredths divided into 3 equal groups is 9 hundredths in each group with 0 hundredths left over.

3 ones divided into 3 equal groups is 1 one in each group with 0 ones left over.



The quotient is 1.19; therefore, 3.57 ÷ 3 = 1.19.

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Discuss important dates throughout this module such as assessments, assignments, or class events with your student. Use the table to record these dates and reference them as your student progresses through the module.

Important Dates	
Date	Reason

Using the link below, visit the Texas Math Solution Support Center for students and caregivers to access additional resources such as:

- Mathematics Glossaries
- Videos
- Topic Materials
- A Letter to Families and Caregivers

ONLINE RESOURCES FOR FAMILIES AND CAREGIVERS

https://www.carnegielearning.com/texas-help/students-caregivers/