



Core Knowledge[®] MATHEMATICS



Wrapping Up Multiplication and Division with Multi-Digit Numbers

Student Workbook



Creative Commons Licensing

This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.



You are free:

- to Share**—to copy, distribute, and transmit the work
- to Remix**—to adapt the work

Under the following conditions:

Attribution—You must attribute the work in the following manner:

CKMath 6–8 was originally developed by Open Up Resources and authored by Illustrative Mathematics, <https://www.illustrativemathematics.org>, and is copyrighted as 2017–2019 by Open Up Resources. It is licensed under the Creative Commons Attribution 4.0 International License (CC BY 4.0). The Open Up Resources 6–8 Math Curriculum is available at: <https://www.openupresources.org/math-curriculum/>.

Adaptations and updates to the IM 6–8 Math English language learner supports and the additional English assessments marked as "B" are copyright 2019 by Open Up Resources and licensed under the Creative Commons Attribution 4.0 International License (CC BY 4.0).

Adaptations and updates to the IM K–8 Math Spanish translation of assessments marked as "B" are copyright 2019 by Illustrative Mathematics. These adaptations and updates are licensed under the Creative Commons Attribution 4.0 International License (CC BY 4.0).

This particular work is based on additional work of the Core Knowledge® Foundation (www.coreknowledge.org) made available through licensing under a Creative Commons Attribution-Non Commercial-Share Alike 4.0 International License. This does not in any way imply that the Core Knowledge Foundation endorses this work.

Noncommercial—You may not use this work for commercial purposes.

Share Alike—If you alter, transform, or build upon this work, you may distribute the resulting work only under the same or similar license to this one.

With the understanding that:

For any reuse or distribution, you must make clear to others the license terms of this work. The best way to do this is with a link to this web page:

<https://creativecommons.org/licenses/by-nc-sa/4.0/>

Copyright © 2023 Core Knowledge Foundation

www.coreknowledge.org

All Rights Reserved.

Core Knowledge®, Core Knowledge Curriculum Series™, Core Knowledge Math™ and CKMath™ are trademarks of the Core Knowledge Foundation.

Trademarks and trade names are shown in this book strictly for illustrative and educational purposes and are the property of their respective owners. References herein should not be regarded as affecting the validity of said trademarks and trade names.

ISBN: 979-8-88970-896-4

Wrapping Up Multiplication and Division with Multi-Digit Numbers

Table of Contents

Lesson 1	Estimate and Find Products	1
Lesson 2	Partial Products in Diagrams	4
Lesson 3	Partial Products in Algorithms	7
Lesson 4	Standard Algorithm: One-digit and Multi-digit Numbers with Composing	10
Lesson 5	Standard Algorithm: Multi-digit Numbers without Composing	13
Lesson 6	Standard Algorithm: Multi-digit Numbers with Composing	16
Lesson 7	Building Multiplication Fluency	20
Lesson 8	Multiplication Fluency	23
Lesson 9	The Birds	26
Lesson 10	World's Record Folk Dance	30
Lesson 11	Different Partial Quotients	34
Lesson 12	An Algorithm Using Partial Quotients	37
Lesson 13	Divide Using Partial Quotients	40
Lesson 14	Practice an Algorithm Using Partial Quotients	43
Lesson 15	Find Missing Side Length	46
Lesson 16	World's Record Noodle Soup	50
Lesson 17	Fractions as Partial Quotients (optional)	53
Lesson 18	Lots of Milk	56

Lesson 19	Trash Talk	59
Lesson 20	Shipping Trash	62
Lesson 21	Food Waste Journal (optional)	65
Cumulative Practice Problems		
Section A:	Multi-digit Multiplication Using the Standard Algorithm	69
Section B:	Multi-digit Division Using Partial Quotients	78
Section C:	Let's Put it to Work	83



Wrapping Up Multiplication and Division with Multi-Digit Numbers

Student Workbook

Core Knowledge Mathematics™

Lesson 1: Estimate and Find Products

- Let's estimate and calculate products.

Warm-up: Number Talk: A Multiple of 10

Find the value of each product mentally.

- 50×6

- 50×60

- 50×600

- 600×500

1.1: Reasonable Estimates

1. Which estimate for the product 18×149 is most reasonable? Explain or show your reasoning.

A. 2,000

B. 4,000

C. 3,000

D. 1,500

2. Are any of the estimates unreasonable? Explain or show your reasoning.

3. Do you think the actual product will be more or less than your estimate? Explain or show your reasoning.

1.2: Multiply by 18

Find the value of each expression. Explain or show your reasoning.

1. 18×9

2. 18×49

3. 18×149

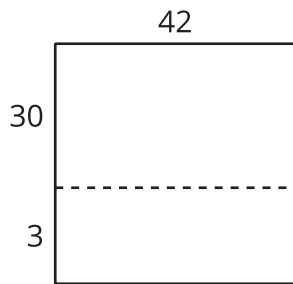
Lesson 2: Partial Products in Diagrams

- Let's interpret diagrams that can help us find products.

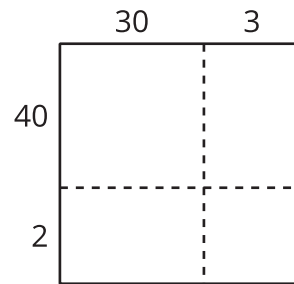
Warm-up: Which One Doesn't Belong: Diagrams to Find Products

Which one doesn't belong?

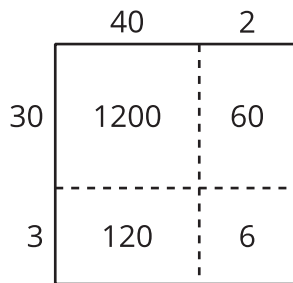
A



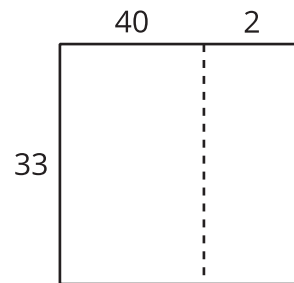
B



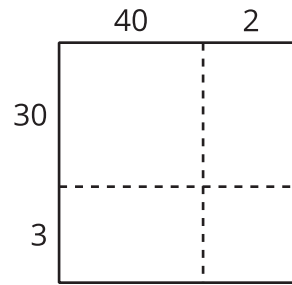
C



D

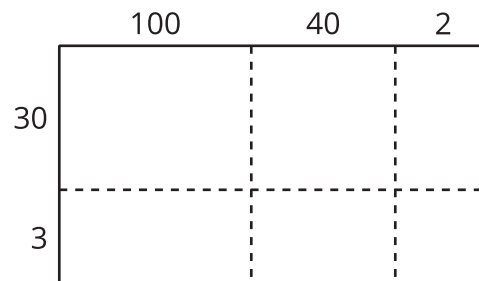


2.1: Decompose in Many Ways



1. Write the value of each product inside the rectangles.
2. Find the value of 42×33 .

3. This diagram represents 142×33 .



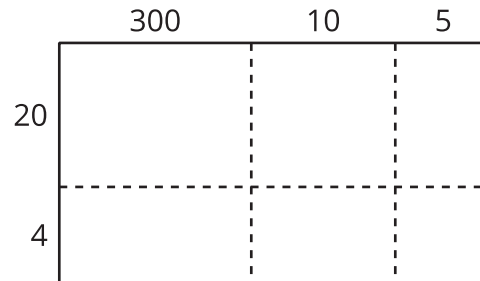
Write the value of each product inside the rectangles.

4. Find the value of 142×33 .

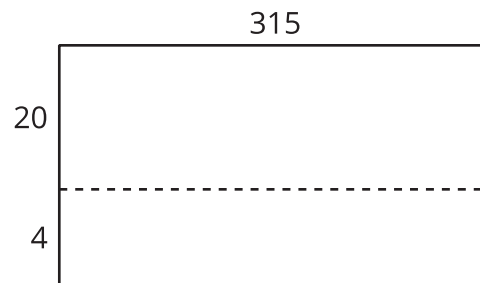
2.2: Calculate in Many Ways

Here are some different diagrams that represent 315×24 . For each diagram, write a multiplication expression inside each rectangle to represent the product.

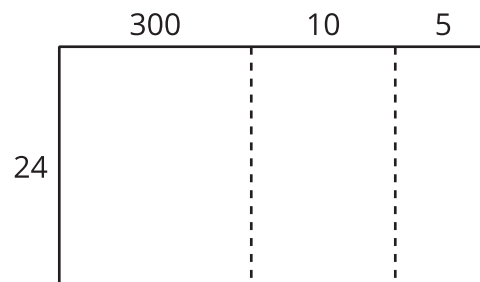
1.



2.



3.



4. Use one of the diagrams to find the value of 315×24 .

5. Explain why you chose that diagram to find the product.

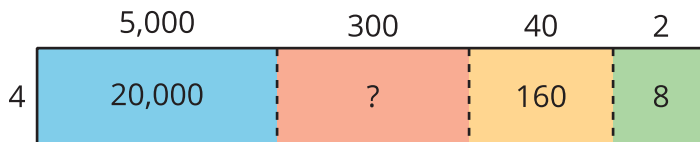
Lesson 3: Partial Products in Algorithms

- Let's find partial products.

Warm-up: Which One Doesn't Belong: Multiplying Large Numbers

Which one doesn't belong?

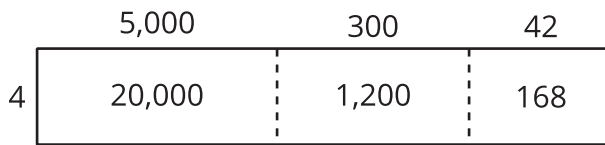
A



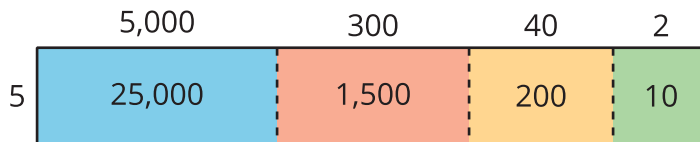
B

$$(4 \times 5,000) + (4 \times 300) + (4 \times 40) + (4 \times 2)$$

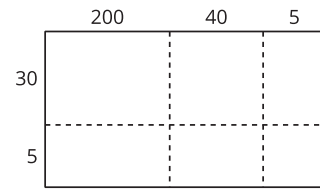
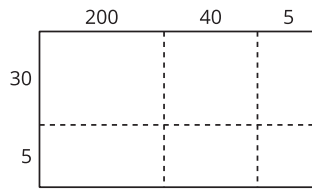
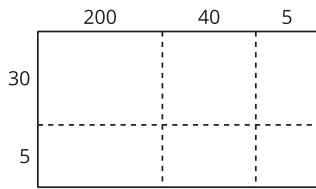
C



D



3.1: Partial Products Everywhere



1. Take turns picking out a set of expressions that are equal to 245×35 when added together. Use the diagrams if they are helpful.

2. Explain how you know the sum of your expressions is equal to 245×35 .

3. What is the value of 245×35 ? Explain or show your reasoning.

Lesson 4: Standard Algorithm: One-digit and Multi-digit Numbers with Composing

- Let's use the standard algorithm to multiply one-digit numbers and multi-digit numbers.

Warm-up: Number Talk: Partial Product

Find the value of each product mentally.

- 3×3

- 3×20

- 3×600

- 3×623

4.1: Compose with the Standard Algorithm

Here is how Han calculated 318×3 using partial products.

$$\begin{array}{r} 318 \\ \times 3 \\ \hline 954 \end{array}$$

Here is how Elena calculated 318×3 using the standard algorithm.

$$\begin{array}{r} 2 \\ 318 \\ \times 3 \\ \hline 954 \end{array}$$

1. What does the 2 in Elena's calculation represent? Explain or show your reasoning.
2. What does the 5 in Elena's solution represent? Explain or show your reasoning.

4.2: Use the Standard Algorithm

Calculate each product using Elena's strategy.

1. $3,615 \times 4$

2. $16,023 \times 3$

3. $27,326 \times 3$

4. $10,215 \times 6$

Lesson 5: Standard Algorithm: Multi-digit Numbers without Composing

- Let's use the standard algorithm to multiply two-digit numbers and three-digit numbers.

Warm-up: Number Talk: Partial Products

Find the value of each product mentally.

- 20×3

- 24×3

- 120×3

- 140×3

5.1: Compare Two Algorithms

Two algorithms for finding the value of 413×21 are shown.

$$\begin{array}{r}
 413 \\
 \times 21 \\
 \hline
 3 \text{ step 1} \\
 10 \text{ step 2} \\
 400 \text{ step 3} \\
 60 \text{ step 4} \\
 200 \text{ step 5} \\
 + 8,000 \text{ step 6} \\
 \hline
 8,673 \text{ step 7}
 \end{array}$$

step 1

$$\begin{array}{r}
 413 \\
 \times 21 \\
 \hline
 3
 \end{array}$$

step 2

$$\begin{array}{r}
 413 \\
 \times 21 \\
 \hline
 13
 \end{array}$$

step 3

$$\begin{array}{r}
 413 \\
 \times 21 \\
 \hline
 413
 \end{array}$$

step 4

$$\begin{array}{r}
 413 \\
 \times 21 \\
 \hline
 413 \\
 60
 \end{array}$$

step 5

$$\begin{array}{r}
 413 \\
 \times 21 \\
 \hline
 413 \\
 260
 \end{array}$$

step 6

$$\begin{array}{r}
 413 \\
 \times 21 \\
 \hline
 413 \\
 8,260
 \end{array}$$

step 7

$$\begin{array}{r}
 413 \\
 \times 21 \\
 \hline
 413 \\
 + 8,260 \\
 \hline
 8,673
 \end{array}$$

1. How are the two algorithms the same? How are they different?
2. Explain or show where you see each step from the first algorithm in the second algorithm.
3. How do the final steps in the two algorithms compare?

5.2: Use the Standard Algorithm

Use the standard algorithm to find the value of each expression.

1. 202×12

2. 122×33

3. 321×24

4. Diego found the value of 301×24 . Here is his work.
Why doesn't Diego's answer make sense?

$$\begin{array}{r} 301 \\ \times 24 \\ \hline 1,204 \\ + 602 \\ \hline 1,806 \end{array}$$

Lesson 6: Standard Algorithm: Multi-digit Numbers with Composing

- Let's multiply with the standard algorithm and compose new units.

Warm-up: Number Talk: Three Factors

Find the value of each product mentally.

- $(2 \times 3) \times 10$

- $(2 \times 40) \times 10$

- $(2 \times 200) \times 10$

- $(2 \times 243) \times 10$

3. Use the standard algorithm to find the value of 182×41 .

4. Use the standard algorithm to find the value of 304×23 .

6.2: All the Products

Find the value of each product using the standard algorithm.

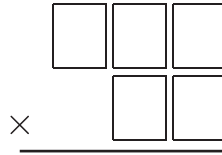
1. 647×9

2. 647×50

3. 647×59

4. 264×38

7.1: Greatest Product



Directions:

- Partner A chooses a number card and writes the number in one of the blanks for Round 1.
- Partner B does the same.
- Repeat until each partner has a two-digit by three-digit multiplication problem.
- Find the product.
- The partner with the greater product wins a point.
- The partner with the most points after 5 rounds wins the game.

7.2: Desperately Seeking 9 New Units

Tyler notices that when he uses the standard algorithm and composes a new unit, sometimes there is 1 new unit, sometimes 2, all the way up to 8. He has not seen an example with 9 of the new unit.

1. For each of these products, how many of each new unit do you compose?

a. 256×5

b. 587×8

c. 809×9

2. Do you think it is possible to compose 9 of a new unit with the standard multiplication algorithm?

Lesson 8: Multiplication Fluency

- Let's practice multiplication.

Warm-up: Number Talk: The Distributive Property

Find the value of each expression mentally.

- 6×15

- 6×17

- $6 \times 2\frac{1}{3}$

- $6 \times 2\frac{2}{3}$

8.1: Fluency Practice Choice Time

Choose a game.

- Greatest Product
- Number Puzzles: Multiplication and Division

8.2: Targeted Products

1. Using the digits 3, 5, 6, 8, and 9 make a product whose value is close to 50,000.

$$\begin{array}{r} \square \square \square \\ \times \quad \square \square \\ \hline \end{array}$$

2. Using the digits 3, 5, 6, 8, and 9 make a product whose value is close to 20,000.

$$\begin{array}{r} \square \square \square \\ \times \quad \square \square \\ \hline \end{array}$$

Lesson 9: The Birds

- Let's solve multiplication problems.

Warm-up: Notice and Wonder: For the Birds

What do you notice? What do you wonder?



9.1: Home is Where the Bird Lives

Different types of birds use different types of houses. The table gives you the recommended side lengths for birdhouses of various species.

type of bird	side lengths of floor	height	volume estimate
chickadee	4 in by 4 in	6 to 10 in	
wood duck	10 in by 18 in	10 to 24 in	
barn owl	10 in by 18 in	15 to 18 in	
red-headed woodpecker	6 in by 6 in	12 to 15 in	
bluebird	5 in by 5 in	6 to 12 in	
swallow	6 in by 6 in	6 to 8 in	

Estimate a possible volume for each birdhouse. Be prepared to explain your reasoning.

9.2: What is the Volume?

Use the criteria from the table to determine the recommended range of volumes for each type of birdhouse.

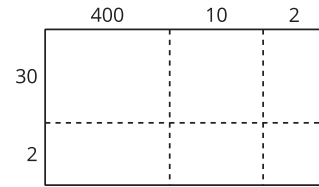
type of bird	side lengths of floor	height	range of volume
chickadee	4 in by 4 in	6 to 10 in	
wood duck	10 in by 18 in	10 to 24 in	
barn owl	10 in by 18 in	15 to 18 in	
red-headed woodpecker	6 in by 6 in	12 to 15 in	
bluebird	5 in by 5 in	6 to 12 in	
swallow	6 in by 6 in	6 to 8 in	

Section Summary

Section Summary

In this unit we found products of a three-digit number and a two-digit number. We first represented the products with diagrams that help us break down the product by place value.

This diagram breaks up the product 412×32 by place value. If we find and add up all of the partial products, we will get the product of 412×32 .



Then we learned a new algorithm to multiply numbers, the standard algorithm for multiplication.

We can see the partial products are organized in a different way. 824 represents the partial product for 2×412 and 12,360 represents the partial product for 30×412 .

$$\begin{array}{r}
 412 \\
 \times 32 \\
 \hline
 824 \\
 + 12,360 \\
 \hline
 13,184
 \end{array}$$

We noticed that sometimes we need to compose a new unit when we use the standard algorithm, and we represent that unit with notation. Sometimes, we may have to compose more than one new unit.

The 1 above the 1 in 216 represents the ten from the product 3×6 and the 2 represents 2 hundreds from the product 40×6 .

$$\begin{array}{r}
 216 \\
 \times 43 \\
 \hline
 648 \\
 + 8,640 \\
 \hline
 9,288
 \end{array}$$

Lesson 10: World's Record Folk Dance

- Let's explore division with multi-digit numbers.

Warm-up: How Many Do You See: World Record Event

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



10.1: How Many Groups of 8 Dancers?

There were 4,704 people at the record breaking folk dance in Peru. How many groups of 8 dancers were there? Explain or show your thinking.

10.2: More Groups of Dancers

1. 4,704 people participate in the Peruvian folk dance. They need to be organized into groups of 4.

a. Write a division expression to represent the situation.

b. How many groups of 4 will there be? Explain or show your thinking.

c. Compare your work with your partner's. What is the same? What is different?

2. 4,704 people participate in the Peruvian folk dance. They need to be organized into groups of 2.

a. Write a division expression to represent the situation.

b. How many groups of 2 will there be? Explain or show your thinking.

c. Compare your work with your partner's. What is the same? What is different?

Lesson 11: Different Partial Quotients

- Let's use what we know about multiplication and place value to find quotients.

Warm-up: Notice and Wonder: Ways to Record

What do you notice? What do you wonder?

Clare's strategy:

$$\begin{array}{r} 364 \div 13 \\ 13 \times 10 = 130 \\ 13 \times 20 = 260 \\ 13 \times 5 = 65 \\ 13 \times 3 = 39 \end{array} \quad \begin{array}{r} 364 \\ -260 \\ \hline 104 \\ -65 \\ \hline 39 \\ -39 \\ \hline 0 \end{array}$$

Jada's strategy:

$$\begin{array}{r} 130 \div 13 = 10 \\ 130 \div 13 = 10 \\ 65 \div 13 = 5 \\ 39 \div 13 = 3 \\ \hline 364 \div 13 = 28 \end{array}$$

11.1: Division Expressions

Take turns:

1. Choose a set of expressions that, when added together, is equal to $308 \div 14$. Not all expressions will be used.
2. Explain to your partner how you know that your cards represent a sum that is equal to $308 \div 14$.

(Pause for teacher directions.)

3. Choose one of the sets of expressions whose sum is equal to $308 \div 14$ and use it to find the value of $308 \div 14$.

11.2: Choose Your Own Partial Quotients

For each expression, choose one of the partial quotients and, beginning with that expression, find the value of the quotient.

1. $360 \div 15$

$150 \div 15$

$300 \div 15$

$60 \div 15$

2. $945 \div 45$

$45 \div 45$

$450 \div 45$

$900 \div 45$

3. $992 \div 31$

$62 \div 31$

$341 \div 31$

$310 \div 31$

4. How did you decide which partial quotient to use to begin finding the quotient?
Did you change your mind with any of the problems?

Lesson 12: An Algorithm Using Partial Quotients

- Let's make sense of an algorithm using partial quotients.

Warm-up: Notice and Wonder: Incomplete Solution

What do you notice? What do you wonder?

$$\begin{array}{r} 20 \\ 16 \overline{)448} \\ \underline{-320} \quad (20 \times 16) \\ 128 \\ \quad \underline{00} \quad (5 \times 16) \end{array}$$

12.1: Elena's Work

1. Find the value of $448 \div 16$. Show your thinking. Organize it so it can be followed by others.

(Pause for teacher directions.)

2. This is Elena's work. Describe the steps Elena took to find the value of $448 \div 16$.

$$\begin{array}{r} \boxed{28} \\ 3 \\ 5 \\ 20 \\ 16 \overline{)448} \\ \underline{-320} \quad (20 \times 16) \\ 128 \\ \underline{-80} \quad (5 \times 16) \\ 48 \\ \underline{-48} \quad (3 \times 16) \\ 0 \end{array}$$

12.2: Complete the Solution

Use Elena's strategy to complete the following problems:

1.

$$\begin{array}{r} 20 \\ 20 \\ 12 \overline{)492} \\ -240 \quad (20 \times 12) \\ \hline 252 \\ -240 \quad (20 \times 12) \\ \hline \end{array}$$

2.

$$\begin{array}{r} 40 \\ 15 \overline{)630} \\ \hline \end{array} \quad (40 \times 15)$$

3.

$$14 \overline{)364}$$

Lesson 13: Divide Using Partial Quotients

- Let's use an algorithm using partial quotients to divide three-digit and four-digit dividends by two-digit divisors.

Warm-up: Number Talk: Divide

Find the value of each expression mentally.

- $110 \div 10$

- $121 \div 11$

- $132 \div 12$

- $154 \div 14$

13.1: Compare Solutions

1. Use an algorithm using partial quotients to find the value of one of the quotients. Be prepared to explain how you found the quotient.

Partner 1:

Partner 2:

$$32 \overline{)608}$$

$$19 \overline{)589}$$

2. Explain to your partner how you found the value of the quotient.
3. Pair up with another group and compare your work.

13.2: Estimate and Solve

Estimate the value of each quotient. Then, use an algorithm using partial quotients to find the value.

1. A reasonable estimate for $612 \div 34$ is:

$$34 \overline{)612}$$

2. A reasonable estimate for $529 \div 23$ is:

$$23 \overline{)529}$$

3. A reasonable estimate for $1,044 \div 29$ is:

$$29 \overline{)1,044}$$

Lesson 14: Practice an Algorithm Using Partial Quotients

- Let's practice using an algorithm using partial quotients.

Warm-up: Which One Doesn't Belong: Different Ways

Which one doesn't belong?

A

$$\begin{array}{r} \boxed{16} \\ 82 \overline{)1,312} \end{array}$$

B

$$\begin{array}{r} \boxed{16} \\ 1 \\ 5 \\ 5 \\ 5 \\ 82 \overline{)1,312} \end{array}$$

C

$$\begin{array}{r} 1 \\ 5 \\ 10 \\ 82 \overline{)1,312} \end{array}$$

D

$$\begin{array}{r} \boxed{16} \\ 10 \\ 5 \\ 1 \\ 82 \overline{)1,312} \end{array}$$

14.1: Find the Mistake

For each problem, describe where you see an error in the calculation. Then find the correct whole number quotient.

1.

$$\begin{array}{r} \boxed{29} \\ 4 \\ 5 \\ 20 \\ 46 \overline{)1,656} \\ \underline{-920} \\ 436 \\ \underline{-230} \\ 206 \\ \underline{-184} \\ 22 \end{array}$$

2.

$$\begin{array}{r} \boxed{64} \\ 4 \\ 60 \\ 18 \overline{)972} \\ \underline{-900} \\ 72 \\ \underline{-72} \\ 0 \end{array}$$

3.

$$\begin{array}{r} \boxed{211} \\ 1 \\ 10 \\ 200 \\ 24 \overline{)744} \\ \underline{-480} \\ 264 \\ \underline{-240} \\ 24 \end{array}$$

14.2: Practice Problems

Find the value of each expression. Then check in with a partner to review your work.

1.

$$16 \overline{)768}$$

2.

$$29 \overline{)1,305}$$

3.

$$21 \overline{)8,715}$$

4.

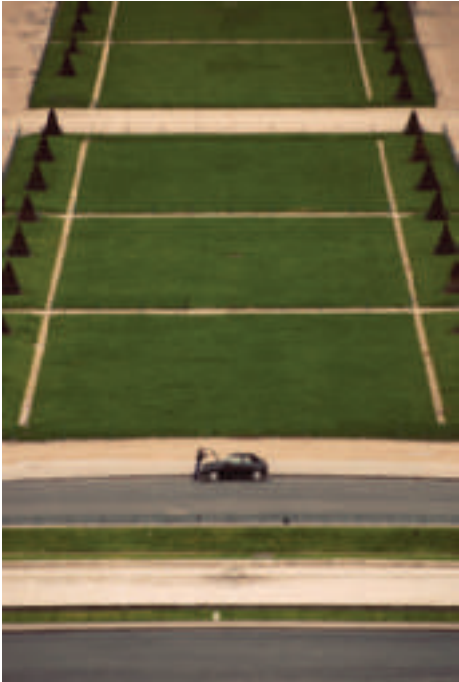
$$53 \overline{)6,572}$$

Lesson 15: Find Missing Side Lengths

- Let's use the relationship between multiplication and division to solve problems.

Warm-up: Estimation Exploration: The Garden

What is the area of one of the large rectangles in the garden?



Record an estimate that is:

too low	about right	too high

15.1: Find the Missing Side Length, Part 1

Complete the table.

area (square feet)	length (feet)	width (feet)
816	24	
1,248		48
	23	253
5,796		36

15.2: Find the Missing Side Length, Part 2

1. Complete the table.

volume (cubic feet)	base (square feet)	height (feet)
375	15	
1,176		28

2. Clare wants to find the height of a rectangular prism with the following measurements:

volume (cubic feet)	length (feet)	width (feet)	height (feet)
882	6	7	

- First, Clare finds the quotient $882 \div 6$. What could she do next to find the height?
- Find the missing height to finish the problem for Clare.

3. Complete the table.

volume (cubic feet)	length (feet)	width (feet)	height (feet)
936	8		9
1,536		48	2
1,008	36		

Section Summary

Section Summary

In this section, we learned how to divide multi-digit whole numbers. To find a quotient like $448 \div 16$ we broke 448 down into multiples of 16 and then added these partial quotients.

$$\begin{array}{r}
 320 \div 16 = 20 \\
 80 \div 16 = 5 \\
 48 \div 16 = 3 \\
 \hline
 448 \div 16 = 28
 \end{array}$$

Then, we worked with a way to record these calculations that we first saw in an earlier course.

$$\begin{array}{r}
 \boxed{28} \\
 3 \\
 5 \\
 20 \\
 16 \overline{)448} \\
 \underline{-320} \quad (20 \times 16) \\
 128 \\
 \underline{-80} \quad (5 \times 16) \\
 48 \\
 \underline{-48} \quad (3 \times 16) \\
 0
 \end{array}$$

Lesson 16: World's Record Noodle Soup

- Let's solve a problem using division with large numbers.

Warm-up: Notice and Wonder: World Record Event

What do you notice? What do you wonder?

A Chinese food company holds the Guinness World Record for making the longest noodle. The noodle measured about 10,119 ft.



16.1: How Many Feet in One Serving?

A Chinese food company cooked a single noodle measuring about 10,119 ft. It served 400 people.

1. If the noodle was shared equally, estimate how many feet of noodle each person was served.

2. Is your estimate lower or higher than the actual length of noodle each person ate? Explain your reasoning without calculating the actual length.

16.2: Han's Estimate

Han said that each person will get about $25\frac{1}{4}$ feet of noodle. Do you agree with Han? Explain or show your reasoning.

Lesson 17: Fractions as Partial Quotients

- Let's use fractions to help us divide whole numbers.

Warm-up: What Do You Know About $\frac{60}{6} + \frac{6}{6}$?

What do you know about $\frac{60}{6} + \frac{6}{6}$?

17.1: Select Expressions

1. Select **all** the expressions that are equivalent to $\frac{78}{6}$. Explain or show your reasoning.

A. $78 \div 6$

B. $\frac{66}{6} + \frac{12}{6}$

C. $\frac{60}{6} + \frac{18}{6}$

D. $(60 \div 6) + (18 \div 6)$

E. $\frac{77}{6} + \frac{8}{6}$

F. $(60 \div 6) + 18$

2. What is the value of $78 \div 6$? Explain or show your thinking.

17.2: Choose One Expression

1. Use each expression to find the value of $165 \div 15$. Explain or show your thinking.

a. $\frac{75}{15} + \frac{80}{15} + \frac{10}{15}$

b. $\frac{30}{15} + \frac{30}{15} + \frac{30}{15} + \frac{60}{15} + \frac{15}{15}$

c. $\frac{150}{15} + \frac{15}{15}$

2. Choose one expression and use it to find the value of $540 \div 18$. Explain or show your thinking.

a. $\frac{180}{18} + \frac{180}{18} + \frac{180}{18}$

b. $\frac{500}{18} + \frac{40}{18}$

c. $\frac{360}{18} + \frac{180}{18}$

3. Which expressions were most helpful? Which expressions were least helpful? Explain or show your thinking.

Lesson 18: Lots of Milk

- Let's make estimates with big numbers.

Warm-up: Estimation Exploration: How Big is the Milk Carton?

What is the volume of the milk carton in cubic inches?



Record an estimate that is:

too low	about right	too high

18.1: Milk for Everyone

In each situation, estimate the volume of milk, in cubic inches, that you or the group would drink in one day. Explain your reasoning.

1. you

2. your class

3. your grade

4. your school

5. 10 schools

18.2: How Big is 1,000,000?

Estimate the number of days it would take each group to drink 1,000,000 cubic inches of milk. Explain your reasoning.

1. 10 local schools

2. your school

3. your grade

4. your class

5. you

Lesson 19: Trash Talk

- Let's multiply to solve problems about the area of the Great Garbage Patch.

Warm-up: Notice and Wonder: Trash and Ice

What do you notice? What do you wonder?



19.2: So Much Trash

The Great Pacific Garbage Patch is a large area in the Pacific Ocean where trash has accumulated. Some estimates indicate that the garbage covers about 1,000,000 square kilometers.

1. Rhode Island is the smallest state. It is about 77 km long and 60 km wide. Which is larger, the garbage patch or Rhode Island? Explain or show your reasoning.
2. Delaware is about 154 km long and 48 km wide. Which is larger, the garbage patch or Delaware? Explain or show your reasoning.
3. New Mexico is about 596 km long and 552 km wide. Which is larger, the garbage patch or New Mexico?
4. Circle an area on the map of the U.S. that you think estimates the area of the garbage patch. Explain your thinking.



Lesson 20: Shipping Trash

- Let's estimate volumes.

Warm-up: Number Talk: Three Factors

Find the value of each expression mentally.

- 8×4

- 8×8

- $8 \times 8 \times 2$

- $8 \times 8 \times 20$

20.1: What a Waste

1. Estimate the value of each quantity.
 - a. The number of cubic feet that the class recycling bin holds.

 - b. The number of cubic feet that the school recycling bins hold.

2. About how many cubic feet of recyclable materials do you think your school produces in each amount of time? Explain or show your reasoning.
 - a. a day

 - b. a week

 - c. a month

 - d. a year

3. Do you think all of the recyclable materials your school produces in a year could fit in your classroom? Show or explain your reasoning.

Lesson 21: Food Waste Journal

- Let's use multiplication and division to think about food waste.

Warm-up: Notice and Wonder: Food Waste

What do you notice? What do you wonder?



21.2: Food Journal

Complete the table for the food waste you produced today. Be prepared to share your reasoning for the estimated weight.

name/type	reason thrown away	estimated weight (ounces)

1. About how many pounds of food waste have you produced so far today?

2. Look back at the weekly estimated pounds of food waste based on the national average in the last activity. Do you think the estimate is more or less than what you actually produce in a week? Explain your reasoning.

21.3: Analyze Food Journals

Use your food waste journal to answer the questions. Be prepared to share.

1. How many pounds of food waste did you or your family produce in a week?

2. If you produce about the same food waste each week as recorded in the food waste journal, how much would you produce in a month? In a year?

3. The average person produces 219 pounds of food waste per year in the United States. With your partner, discuss reasons for the differences between your data and the national average.

Section A: Practice Problems

1. Pre-unit

Han says that the value of the 7 in 735,208 is 10 times the value of the 7 in 137,342. Do you agree with Han? Explain or show your reasoning.

2. Pre-unit

Find the value of each product. Explain or show your reasoning.

a. 27×53

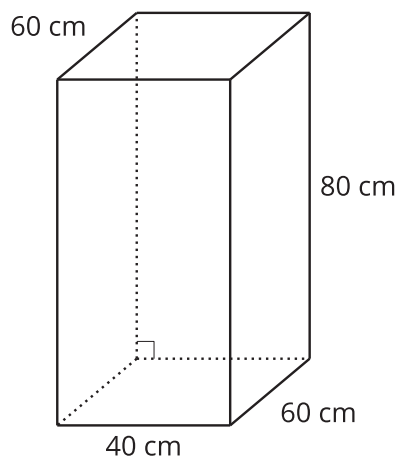
b. 518×6

3. Pre-unit

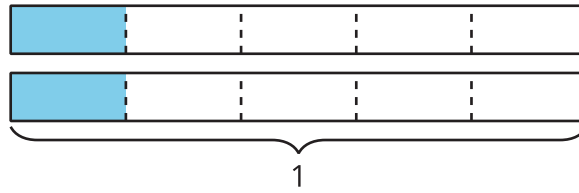
Find the value of $7,518 \div 6$. Explain or show your reasoning.

4. Pre-unit

What is the volume of this rectangular prism? Explain or show your reasoning.



5. Pre-unit



a. Explain or show how the drawing shows $2 \div 5$.

b. Explain or show how the drawing shows $\frac{2}{5}$.

6. Find the value of each product. Explain or show your reasoning.

a. 100×50

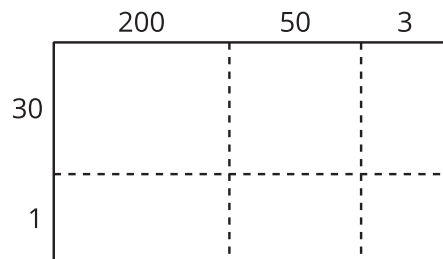
b. 120×50

c. 127×50

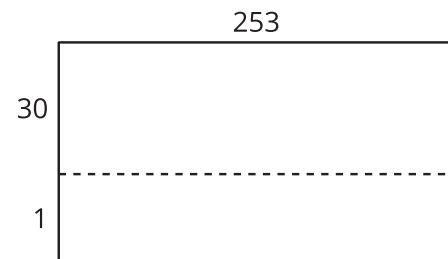
(From Unit 4, Lesson 1.)

7. Complete the diagrams and use each of them to find 253×31 .

A



B



How are the strategies the same? How are they different?

(From Unit 4, Lesson 2.)

8. Find 315×43 using partial products.

(From Unit 4, Lesson 3.)

9. Use the standard algorithm to find the value of $16,452 \times 6$.

(From Unit 4, Lesson 4.)

10. Find the value of 322×41 using the standard algorithm.

(From Unit 4, Lesson 5.)

11. Find the value of 562×34 using the standard algorithm.

(From Unit 4, Lesson 6.)

12. Andre is playing Greatest Product. He says the greatest product it's possible to make in the game is 987×65 . Do you agree with Andre? Explain or show your reasoning.

(From Unit 4, Lesson 7.)

13. Using the digits 1, 2, 3, 4, and 5 make a product that is close to 8,000.

$$\begin{array}{r} \square \square \square \\ \times \quad \square \square \\ \hline \end{array}$$

(From Unit 4, Lesson 8.)

14. The recommended side lengths for a birdhouse for a yellow-bellied sapsucker are 13 cm by 13 cm for the floor and a height of 31 to 38 cm. What are the smallest and largest volumes for these birdhouses? Explain or show your reasoning.

(From Unit 4, Lesson 9.)

16. Exploration

Clare has a strategy for multiplying a number by 99. To find 648×99 she calculates 648×100 and then subtracts 648.

a. Use Clare's strategy to calculate 648×99 .

b. Use the standard algorithm to calculate 648×99 .

c. Which strategy did you prefer? Why?

Section B: Practice Problems

1. a. 480 dancers make groups of 15. How many groups are there? Explain or show your reasoning.

-
- b. 480 dancers make groups of 30. How many groups are there? Explain or show your reasoning.

(From Unit 4, Lesson 10.)

2. a. Explain why $256 \div 4$ is equivalent to $(200 \div 4) + (40 \div 4) + (16 \div 4)$.

b. What is the value of $256 \div 4$? Explain your reasoning.

(From Unit 4, Lesson 11.)

3. Use partial quotients to find the value of $243 \div 9$

$$9 \overline{) 243}$$

(From Unit 4, Lesson 12.)

4. a. Use partial quotients to find the quotient $636 \div 12$.

$$12 \overline{)636}$$

- b. Can you use partial quotients to find $636 \div 12$ in a different way?

(From Unit 4, Lesson 13.)

5. Find $4,250 \div 34$ using partial quotients. Explain your calculations.

(From Unit 4, Lesson 14.)

6. The area of a rectangular field is 8,320 square yards. The width is 65 yards. How long is the field? Explain your reasoning.

(From Unit 4, Lesson 15.)

7. Exploration

- a. Andre made a noodle that was 102 feet long. The noodle broke into two pieces. One piece was 2 times as long as the other. How long were the two noodles? Explain your reasoning.
- b. Priya made a noodle that was 456 feet long. The noodle broke into two pieces. One piece was 5 times as long as the other. How long were the two noodles? Explain your reasoning.

8. Exploration

Lin is calculating $6,596 \div 68$. She calculates $6,800 - 6,596$ and notices that it is 3×68 . Lin concludes that $6,596 \div 68 = 97$.

a. Explain Lin's reasoning.

b. Use Lin's method to calculate $7,448 \div 76$.

Section C: Practice Problems

1. There are 418 students at a school. Han estimates that they each drink about 5 glasses of water each day.
 - a. About how many glasses of water do all of the students together drink in one day?

 - b. About how many glasses of water do all of the students together drink in one week?

 - c. About how many glasses of water do all of the students together drink in one month?

 - d. About how long do you think it would take all of the students to drink 1,000,000 glasses of water?

(From Unit 4, Lesson 18.)

2. Colorado is 610 kilometers long and 450 kilometers wide.

- a. Recall that New Mexico is about 596 km long and 552 km wide. Do you think the area of Colorado is greater than or less than the area of New Mexico? Explain your reasoning.

b. What is the area of Colorado?

(From Unit 4, Lesson 19.)

3. A large cargo ship can carry between 10,000 and 15,000 shipping containers. About how many cargo ships would be needed to carry the 210,000 containers of plastic the United States ships for recycling each year? Explain or show your reasoning.

(From Unit 4, Lesson 20.)

4. Exploration

Han reads that the length of Florida is 721 kilometers and its width is 582 kilometers. Han says "Florida is bigger than New Mexico!" Do you agree with Han? Explain or show your reasoning.

5. Exploration

The Pentagon has 5 floors and the Empire State Building has 102 floors. Noah says that the Empire State Building is bigger. Do you agree with Noah? Investigate and justify your answer.

Credits

CKMath K–8 was originally developed by Open Up Resources and authored by Illustrative Mathematics, <https://www.illustrativemathematics.org>, and is copyrighted as 2017–2019 by Open Up Resources. It is licensed under the Creative Commons Attribution 4.0 International License (CC BY 4.0). The Open Up Resources K–8 Math Curriculum is available at: <https://www.openupresources.org/math-curriculum/>.

Adaptations and updates to the IM K–8 Math English language learner supports are copyright 2019 by Open Up Resources and licensed under the Creative Commons Attribution 4.0 International License (CC BY 4.0),

Adaptations and updates to IM K–8 Math are copyright 2019 by Illustrative Mathematics, including the additional English assessments marked as "B", and the Spanish translation of assessments marked as "B". These adaptations and updates are licensed under the Creative Commons Attribution 4.0 International License (CC BY 4.0).

This particular work is based on additional work of the Core Knowledge® Foundation (www.coreknowledge.org) made available through licensing under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.

Illustration and Photo Credits

Artisticco LLC / Alamy Stock Vector: Cover B

Illustrative Math K–8 / Cover Image, all interior illustrations, diagrams, and pictures / Copyright 2019 / Licensed under the Creative Commons Attribution 4.0 International License (CC BY 4.0).

These materials include public domain images or openly licensed images that are copyrighted by their respective owners, unless otherwise noted/credited. Openly licensed images remain under the terms of their respective licenses.



CKMath™
Core Knowledge **MATHEMATICS™**

CKMath™
Core Knowledge **MATHEMATICS™**

A comprehensive program for mathematical skills and concepts
as specified in the **Core Knowledge Sequence**
(content and skill guidelines for Grades K–8).

Core Knowledge MATHEMATICS™
units at this level include:

Finding Volume
Fractions as Quotients and Fraction Multiplication
Multiplying and Dividing Fractions
**Wrapping Up Multiplication and Division
with Multi-Digit Numbers**
Place Value Patterns and Decimal Operations
More Decimal and Fraction Operations
Shapes on the Coordinate Plane
Putting it All Together

www.coreknowledge.org

Core Knowledge Curriculum Series™