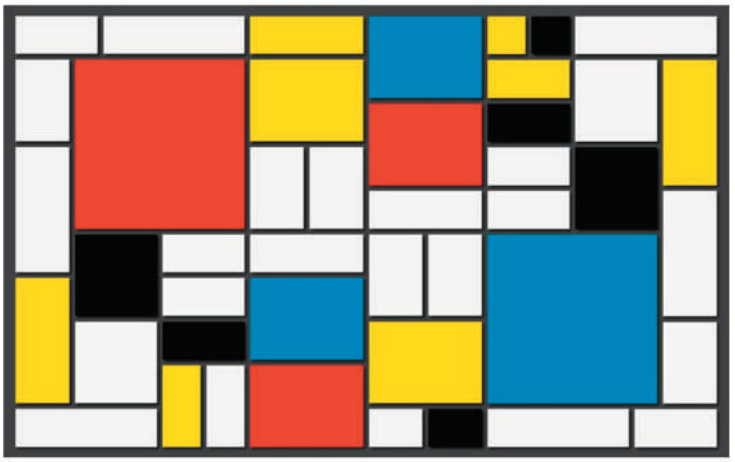
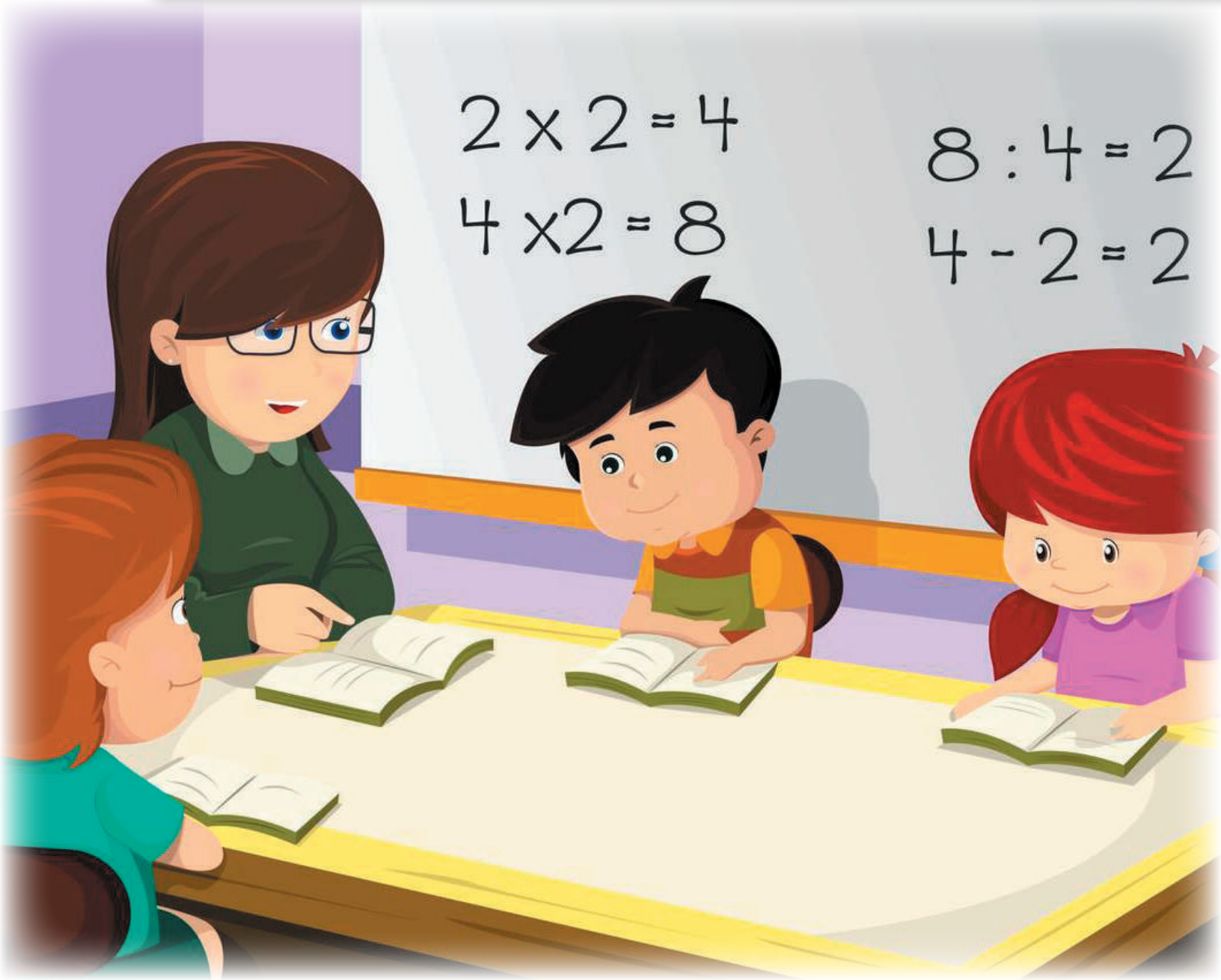
Core Knowledge® MATHEMATICS

Factors and Multiples



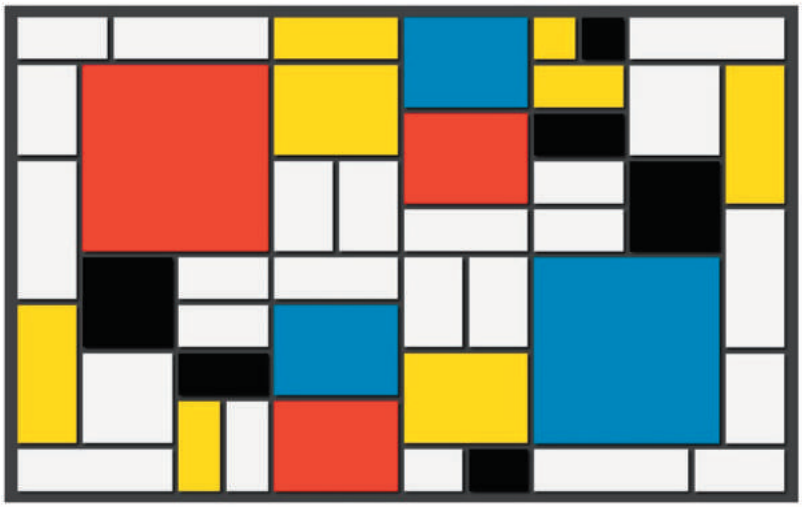
Student Workbook



ISBN: 979-8-88970-906-0

Factors and Multiples

Table of Contents



Factors and Multiples

Student Workbook

Core Knowledge Mathematics™

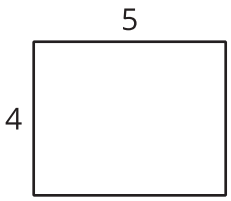
Lesson 1: Multiples of a Number

- Let's build some rectangles.

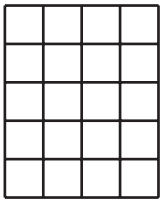
Warm-up: Which One Doesn't Belong: All Kinds of Area

Which one doesn't belong?

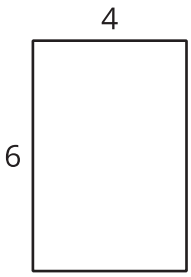
A



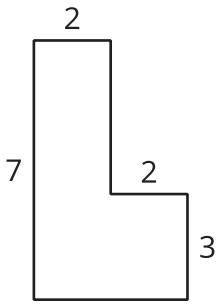
B



C

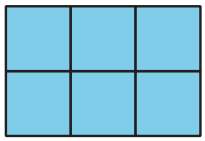


D



1.1: Build Rectangles and Find Area

1. Build 5 different rectangles with each of the given widths. Record the area of each rectangle in the table.



	area of rectangle				
2 tiles wide					
3 tiles wide					
4 tiles wide					

2. Discuss with a partner what you notice about the areas in each row of the table.

3. Predict the area of another rectangle that has each width. Explain your reasoning.

   - 2 tiles:

   - 3 tiles:

   - 4 tiles:

1.2: What Areas Can You Build?

1. Elena is building rectangles with a width of 3 units and an area of 30 square units or less.

    a. Build the rectangles Elena could make and draw the rectangles on grid paper. Label the area and the side lengths of each rectangle.

    b. What is the area of each rectangle you built?

    c. What do you notice about the areas?

2. Why is 28 square units not a possible area for a rectangle with a width of 3 units?

3. If the area of the rectangle can be more than 30 square units, find 2 other areas it could have. Explain or show your reasoning.

4. What is an area that is not possible for a rectangle with a width of 3 units? Explain or show your reasoning.

Lesson 2: Factor Pairs

- Let's learn about factor pairs.

Warm-up: Number Talk: Multiplication

Find the value of each expression mentally.

- 2×7

- 4×7

- 3×7

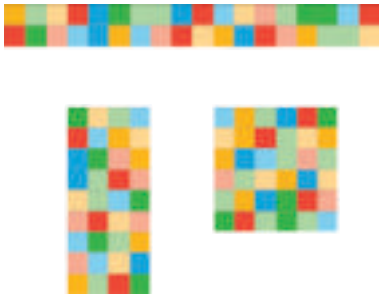
- 7×7

2.1: How Many Rectangles?

Your teacher will assign 2 numbers to your group. Each number represents the area of a rectangle.

1. On grid paper:
    - Draw all the possible rectangles that have the given area.
    - Label the area and the side lengths.
    - Use each pair of side lengths only once.

      (For example, if you draw a rectangle with 4 units across and 6 units down, you don't need to also draw a rectangle with 6 units across and 4 units down because they have the same pair of side lengths.)
2. When you think you've drawn all the possible rectangles for both areas, cut out your rectangles and put them on a poster for each area you were assigned.
3. Display your poster for all to see.



2.2: How Many Rectangles: Gallery Walk

As you visit each poster, discuss with your partner:

1. What do you notice? Use the following sentence frames when you share:
    a. “I notice that some of the posters . . . .”
    b. “I notice the posters for numbers _____ and _____ are alike because . . . .”
2. How do you know that all possible rectangles were found for the given area?

Lesson 3: Prime and Composite Numbers

- Let’s identify prime and composite numbers.

3.1: Card Sort: Area

Your teacher will give you a set of cards to sort.

1. Sort the cards by area. Record your sorting results. Be prepared to explain your choices.

2. For each group of sorted cards, think of at least one more rectangle. Name its length and width. Be prepared to explain your reasoning.

3.2: Prime or Composite?

The table shows different areas. How many rectangles can be made for each area?

Complete the table and be prepared to explain or show your reasoning.

Rectangles with the same pair of side lengths should be counted only once. For example, if you count a rectangle with 4 units across and 6 units down, you don't need to also count a rectangle with 6 units across and 4 units down.

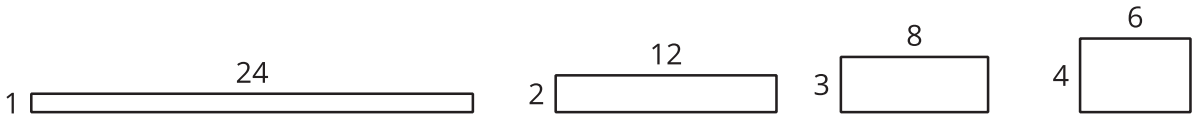
area	how many rectangles?	prime or composite?
2 square units		
10 square units		
48 square units		
11 square units		
21 square units		
23 square units		
60 square units		
32 square units		
42 square units		
31 square units		
56 square units		

Section Summary

Section Summary
In this section, we used our understanding of the area of rectangles to learn about factors, multiples, factor pairs, prime numbers, and composite numbers.

If we know the side length of a rectangle, we can find the areas that the rectangle could have. For instance, a rectangle with a side length of 3 could have an area of 3, 6, 9, 12, 15, or other numbers that result from multiplying of a whole number and 3. We call these numbers **multiples** of 3.

If we know the area of a rectangle, we can find the side lengths that it could have. For example, a rectangle with an area of 24 square units can have side lengths of 1 and 24, 2 and 12, 3 and 8, or 4 and 6. We call these possible pairs of side lengths the **factor pairs** of 24.



We also learned that a number that has only one factor pair—1 and the number itself—is called a **prime number**. For instance, 5 is prime because its only factor pair is 1 and 5.

A number that has two or more factor pairs is a **composite number**. For instance, 15 is composite because its factor pairs are 1 and 15, and 3 and 5.

Lesson 4: Multiplication Practice

- Let's practice multiplication.

Warm-up: Number Talk: Factors Over Ten

Find the value of each expression mentally.

- 10×6
- 3×6
- 13×6
- 12×4

4.1: Card Sort: Multiplication

Take turns sorting the multiplication expressions into one of these groups:

- know it right away
- can find it quickly
- don't know it yet

Multiplication expressions I'm going to practice:

A.

B.

C.

D.

E.

Lesson 5: More Multiples

- Let's solve problems that involve factors and multiples.

Warm-up: Estimation Exploration: Banquet Seating

About how many chairs are in the room?

Record an estimate that is:

too low	about right	too high

5.1: Choose the Right Tables

Students are preparing for a party. The school has tables where 6 people can sit and tables where 8 people can sit.

The students can only choose one type of table and they want to avoid having empty seats.

1. Jada's class has 18 students. Which tables would you choose for Jada's class? Explain or show your reasoning.

2. Noah's class has 30 students. Which tables would you choose for Noah's class? Explain or show your reasoning.

3. Which tables would you choose for Noah's and Jada's classes together? Can you find more than one option? Explain or show your reasoning.

4. If you also want places for Noah's teacher and Jada's teacher to sit, which tables would you choose? Explain or show your reasoning.

5.2: Hot Dogs and Buns

Each package of hot dogs has 10 hot dogs. Each package of hot dog buns has 8 buns.

1. Lin expects to need 50 hot dogs for a class picnic.

    a. How many packages of hot dogs should Lin get? Explain or show your reasoning.

    b. Can Lin get exactly 50 hot dog buns? How many packages of hot dog buns should Lin get? Explain or show your reasoning.

2. Diego expects to need 72 hot dogs for a class picnic.

    a. How many packages of hot dogs should Diego get? Explain or show your reasoning.

    b. How many packages of hot dog buns should Diego get? Explain or show your reasoning.

3. Is it possible to buy exactly the same number of hot dogs and buns? If you think so, what would that number be? If not, explain your reasoning.

Lesson 6: The Locker Problem

- Let’s figure out what's happening in a game about lockers.

6.1: Questionable Lockers

The picture shows lockers in a school hallway.

The 20 students in Tyler's fourth-grade class are playing a game in a hallway that is lined with 20 lockers in a row.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

- The first student starts with the first locker and goes down the hallway and opens all the lockers.
- The second student starts with the second locker and goes down the hallway and shuts every other locker.
- The third student stops at every third locker and opens the locker if it is closed or closes the locker if it is open.

This process continues until all 20 students in the class have touched the lockers.

Create a representation to show what you understand about this problem. Consider:

- How does your representation show lockers?
- How does your representation keep track of students who touch lockers?
- How does your representation show which lockers are open or closed?

6.2: An Open and Shut Case

The 20 students in Tyler's fourth-grade class are playing a game in a hallway with 20 lockers in a row.

Your goal is to find out which lockers will be touched as all 20 students take their turn touching lockers.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

1. Which locker numbers does the 3rd student touch?

2. Which locker numbers does the 5th student touch?

3. How many students touch locker 17? Explain or show how you know.

4. Which lockers are only touched by 2 students? Explain or show how you know.

5. Which lockers are touched by only 3 students? Explain or show how you know.

6. Which lockers are touched the most? Explain or show how you know.

If you have time: Which lockers are still open at the end of the game? Explain or show how you know.

Lesson 7: Find Factors and Multiples

- Let's find factors and multiples of whole numbers from 1–100.

Warm-up: Number Talk: Division

Find the value of each expression mentally.

- $12 \div 3$

- $30 \div 3$

- $60 \div 3$

- $72 \div 3$

7.1: Factor and Multiple Statements

1. Complete a statement using the word “factor” and a statement using the word “multiple” for each number.

number	factor	multiple
10	____ is a factor of ____ because . . .	____ is a multiple of ____ because . . .
7	____ is a factor of ____ because . . .	____ is a multiple of ____ because . . .
50	____ is a factor of ____ because . . .	____ is a multiple of ____ because . . .
16	____ is a factor of ____ because . . .	____ is a multiple of ____ because . . .

number	factor	multiple
35	____ is a factor of ____ because . . .	____ is a multiple of ____ because . . .
20	____ is a factor of ____ because . . .	____ is a multiple of ____ because . . .
19	____ is a factor of ____ because . . .	____ is a multiple of ____ because . . .
6	____ is a factor of ____ because . . .	____ is a multiple of ____ because . . .

2. As you compare statements with your partner, discuss one thing you notice and one thing you wonder.

Section Summary

Section Summary
In this section, we used what we learned about factors, multiples, and prime and composite numbers between 1–100 to play games and solve problems.

We learned that numbers can share factors and multiples. For example:

- The number 2 is a factor of 6 and and also a factor of 8.
- The number 24 is a multiple 6 and also a multiple of 8.

Knowing about factors and multiples helped us answer questions such as:

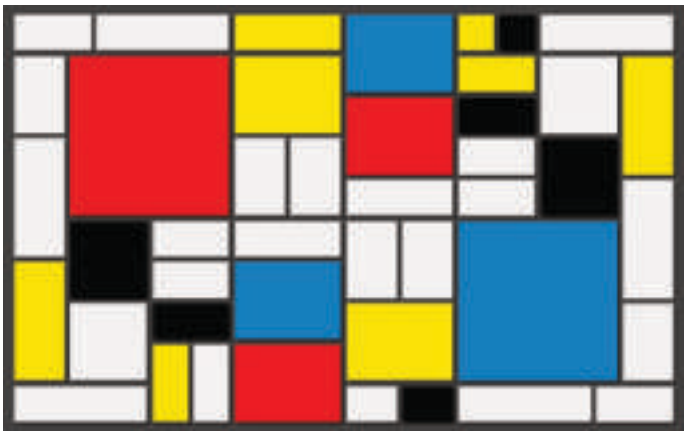
- “Can we put 24 chairs in 6 equal rows? What about 7 equal rows or 8 equal rows?”
- “If there are 20 lockers in a row and a student touches every fourth locker, how many lockers would they touch? Which locker numbers would they touch?”

Lesson 8: Mondrian's Art

- Let’s make art with rectangles.

Warm-up: Notice and Wonder: Piet Mondrian’s Art

What do you notice? What do you wonder?



8.1: My Mondrian Outline

Create an outline for art in the Mondrian style, starting with an 18-by-24 grid.

Your artwork should:

- be partitioned into at least 12 rectangles
- include two different rectangles that have the same area
- include at least one rectangle whose area is a prime number

Try at least one of these challenges. Make a design where:

- all but two of the rectangles have a prime number for its area
- no two rectangles share a side entirely

8.2: Analyze the Rectangles

Trade artwork with your partner.

Using your partner's artwork, look for and describe each of the following:

1. Rectangles that have the same area

2. Rectangles with an area that is a prime number

3. Rectangles with an area that is a composite number

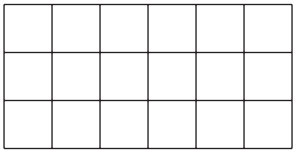
4. Which challenge they completed

Section A: Practice Problems

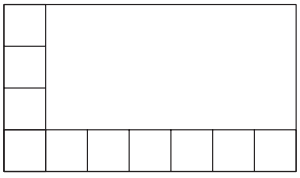
1. **Pre-unit**

   Find the area of each rectangle. Explain your reasoning.

   a.



   b.

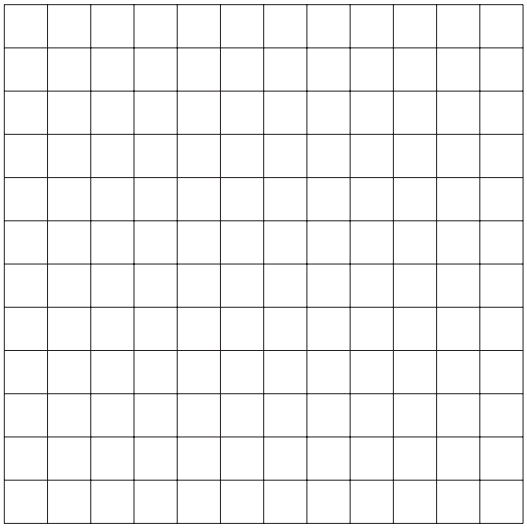


2. **Pre-unit**

   On the grid, draw a rectangle whose area is represented by each expression.

   a. 3×5

   b. 4×8



3. Tyler wants to build a rectangle with an area of 20 square units using square tiles.

    a. Can Tyler build a rectangle with a width of 4 units? Explain or show your reasoning.

    b. Can Tyler build a rectangle with a width of 6 units? Explain or show your reasoning.

(From Unit 1, Lesson 1.)

4. List the possible side lengths of rectangles with an area of 32 square units. Explain or show how you know your list is complete.

(From Unit 1, Lesson 2.)

5. List the factor pairs of each number. Is each number prime or composite? Explain or show your reasoning.

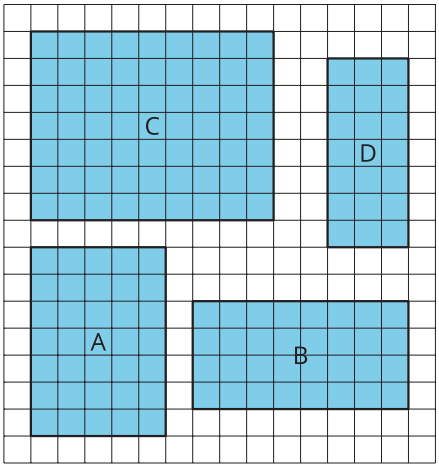
   a. 37

   b. 27

   c. 77

(From Unit 1, Lesson 3.)

6. a. Calculate the area of each rectangle.



   b. How did you use multiplication facts to calculate the areas?

(From Unit 1, Lesson 4.)

7. **Exploration**

   a. You want to arrange all of the students in your class in equal rows.

      i. How many rows can you have? How many students would be in each row?

      ii. What if you add the teacher to the arrangement? How would your rows change?

   b. Find some objects at home (such as silverware, stuffed animals, cards from a game) and decide how many rows you can arrange them in and how many objects are in each row.

8. **Exploration**

   What is the largest prime number you can find? Explain or show why it is a prime number.

Section B: Practice Problems

1. Pens are sold in packages of 5 and also in packages of 6.

   a. Jada wants to buy 60 pens for her class. Which packages of pens and how many should Jada buy if she doesn't want any extras? Explain or show your reasoning.

   b. Han wants to buy 55 pens for his class. Which packages of pens and how many should Han buy? Explain or show your reasoning.

(From Unit 1, Lesson 5.)

2. a. Find the factor pairs of 36.

   b. How many factors does 36 have?

   c. List the factors of 15.

(From Unit 1, Lesson 6.)

3. Select **all** numbers that are multiples of 8.

   A. 16

   B. 28

   C. 40

   D. 54

   E. 66

   F. 72

   G. 84

   H. 96

(From Unit 1, Lesson 7.)

4. **Exploration**

   a. List the multiples of 2 up through 30.

   b. List the multiples of 3 up through 30.

   c. What do you notice about the numbers in the two lists?

5. **Exploration**

   Which number(s) from 1 to 100 have the largest number of factors? Explain or show how you know.

Credits

Illustration and Photo Credits

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:

Factors and Multiples
Fraction Equivalence and Comparison
Extending Operations to Fractions
From Hundredths to Hundred-thousands
Multiplicative Comparison and Measurement
Multiplying and Dividing Multi-digit Numbers
Angles and Angle Measurement
Properties of Two-dimensional Shapes
Putting it All Together

www.coreknowledge.org

Core Knowledge Curriculum Series™

ISBN: 979-8-88970-906-0