GRADE 5 SUPPLEMENT

Set A2 Number & Operations: Primes, Composites & Common Factors

Includes

Skills & Concepts

★ identify prime and composite numbers

★ find factors and multiples of whole numbers less than 100 and identify which are prime or composite

★ identify common factors of a set of whole numbers

Bridges in Mathematics Grade 5 Supplement
Set A2 Numbers & Operations: Primes, Composites & Common Factors

Bridges in Mathematics is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

The Math Learning Center is a nonprofit organization serving the education community. Our mission is to inspire and enable individuals to discover and develop their mathematical confidence and ability. We offer innovative and standards-based professional development, curriculum, materials, and resources to support learning and teaching. To find out more, visit us at www.mathlearningcenter.org.

Set A2 ★ Activity 1

ACTIVITY

Primes & Common Factors

Overview
Students identify the prime and composite numbers between 1 and 10. Next, they represent 36 as the product of primes between 1 and 10 and learn how to show the information on a factor tree. Finally, they create factor trees for 24 and 30 and use the prime factorization of both numbers to find their common factors.
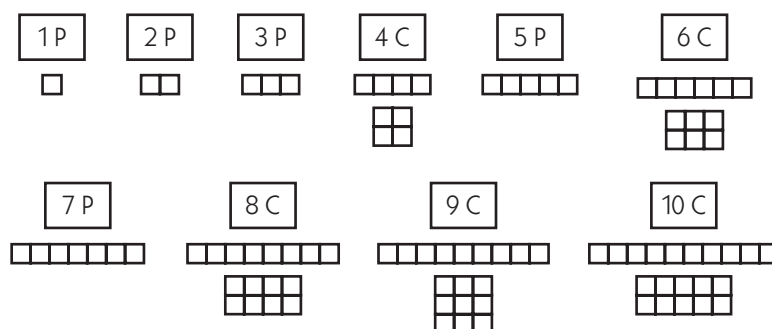
Skills & Concepts
★ identify prime and composite numbers

★ find factors and multiples of whole numbers less than 100 and identify which are prime or composite

★ identify common factors of a set of whole numbers

You'll need
★ Word Resource Cards (*composite number, factor, prime number, product*)

★ class set of tile

★ small sticky notes (10 for every group of 4 students)

★ Student Math Journals

Instructions for Primes & Common Factors

1. Have students form groups of 4. Give each group at least 100 tile and 10 small sticky notes. Then list the numbers from 1 to 10 on the board. Which are prime and which are composite? How do students know for sure? Use the Word Resource Cards to review the fact that prime numbers only have 2 factors, while composite numbers have more than 2 factors. Then have each group work together to build all the possible rectangles for each number you've listed. Ask them to label each set with a sticky note on which they've written the number and a P or a C to indicate whether the number is prime or composite.

2. As they finish, have them compare their work with groups nearby. Then work with input from the class to erase all but the prime numbers from the board. At this point, you may need to review the fact that since the number 1 has just one factor (itself), it is considered neither prime nor composite.

Activity 1 Primes & Common Factors (cont.)

3. Now write 36 on the board. Is it prime or composite? If it's composite, what are its factor pairs? Ask students to pair-share their ideas, using their tile to help if necessary. Then invite volunteers to share their thinking with the class. As they do, make a labeled quick sketch of each of the factor pairs named, and write an equation to match on the board.

4. Next, ask students to consider the list of prime numbers between 1 and 10. Can they think of a way to write 36 as the product of *only* these prime numbers? Give them the following example: 36 is the product of 6 × 6. In turn, 6 is the product of 2 prime numbers, 2 and 3. So it's possible to write 36 as the product of 2 × 3 × 2 × 3. Then ask students if there are other ways to write 36 as the product of only 2, 3, 5, and/or 7. Have them work alone or in pairs and record their work in their journal. If they are stuck, encourage them to use one of the equations on the board as a starting point.

5. Then invite them to share their solutions as a whole group. As they will discover, the only way (except for the order of the factors) to express 36 as the product of prime numbers is to multiply 2 × 2 × 3 × 3.

> **Xavier** *We started with 36 = 2 × 18. We split the 18 into 2 × 9, and then we split the 9 into 3 × 3, so we got 2 × 2 × 3 × 3.*

> **Teacher** *Did anyone get a different answer?*

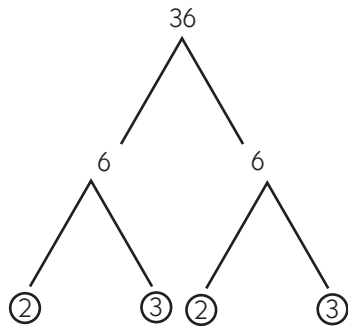> **Maria** *We did. We started with 3 × 12, and split the 12 into 3 × 4. Then we realized we could split the 4 into 2 × 2, so we got 3 × 3 × 2 × 2.*

> **Teacher** *Do you notice anything similar about these solutions, including my example?*

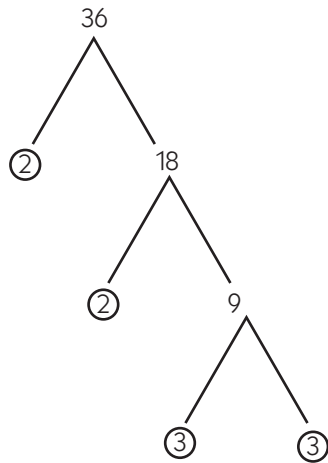> **Delia** *Not matter how you do it, you get two 2s and two 3s, just in different order.*

6. Explain that 2 × 2 × 3 × 3 is called the *prime factorization* of 36. One way to find the prime factorization of a number is by making a *factor tree*. This involves starting with any pair of factors for a number and then factoring those factors until you can't do so anymore. Work with class input to create several different factor trees for 36 at the board.
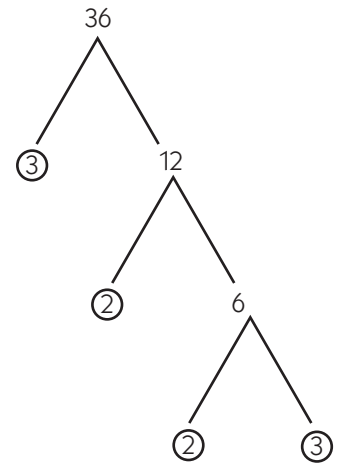
Activity 1 Primes & Common Factors (cont.)

$36 = 2 \times 2 \times 3 \times 3$
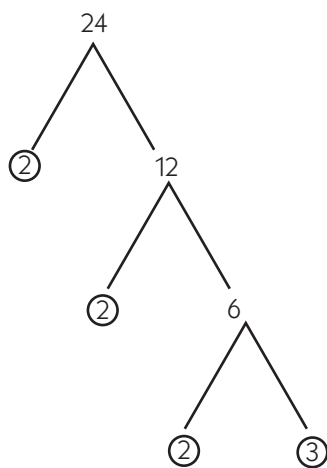
$36 = 2 \times 2 \times 3 \times 3$

$36 = 2 \times 2 \times 3 \times 3$

7. Have students list the steps for making a factor tree in their journals, along with an example for 36.
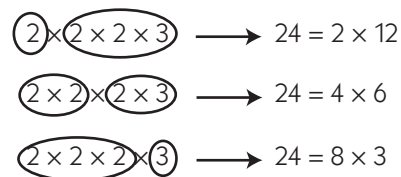- write the number at the top of the tree.
- choose any pair of factors for the first set of branches.
- keep factoring until you have to stop because all the factors are prime.

....

Note *Advise students that you can start with any pair of factors but, it may be easiest to start with the pair that includes 2 if the starting number is even, or 3, 5, or 7 if it's odd.*

....

8. Ask students to make a factor tree for 24 in their journal, starting with a pair of branches that uses 2 as one of the factors. After they've had a minute to work, ask them to help you record the tree at the board. Then explain that prime factorization can be used to find all the factor pairs except the 1 and the number itself, as shown below.

$24 = 2 \times 2 \times 2 \times 3$

$2 \times (2 \times 2 \times 3) \longrightarrow 24 = 2 \times 12$

$(2 \times 2) \times (2 \times 3) \longrightarrow 24 = 4 \times 6$

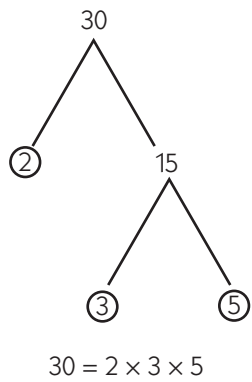$(2 \times 2 \times 2) \times 3 \longrightarrow 24 = 8 \times 3$

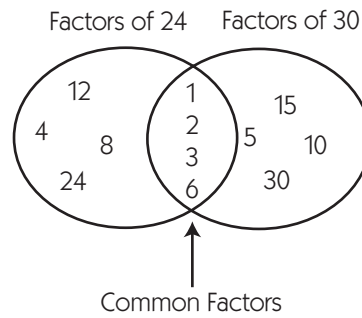and there is also $24 = 1 \times 24$

9. Have students make a factor tree for 30 in their journals and use the prime factors to find all the factor pairs. Then record the tree and the factors pairs at the board with their help. Do 24 and 30 share any

Activity 1 Primes & Common Factors (cont.)

of the same factors? Yes: 1, 2, 3, and 6. Explain that these are called *common factors*. Use a Venn diagram to summarize the information on the board as students do so in their journals.

30 = 2 × 3 × 5

30 = 2 × 15

30 = 6 × 5

30 = 3 × 10

and there is also 30 = 1 × 30

Factors of 24   Factors of 30

Common Factors

Set A2 ★ Activity 2

Factor Riddles

Overview

Students review prime factorization and use prime factors to determine all the common factors of 40 and 60. Then they work on a set of number riddles that involve prime factorization.

Skills & Concepts

★ identify prime and composite numbers

★ find factors and multiples of whole numbers less than 100 and identify which are prime or composite

★ identify common factors of a set of whole numbers

Recommended Timing

Anytime after Set A2 Activity 1

You'll need

★ Factor Riddles (pages A2.8 and A2.9, run a class set)

★ Student Math Journals

Instructions for Factor Riddles

1. Ask students to help you list the prime numbers between 1 and 10 on the board. If necessary, remind them that 1 is neither prime nor composite because it only has one factor. Then write the number 40 at the board. Is it prime or composite? Call on volunteers to share and explain their answers.
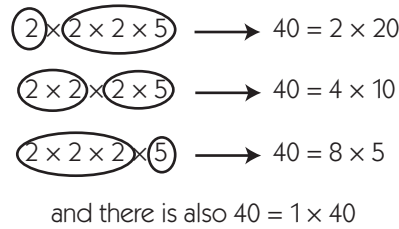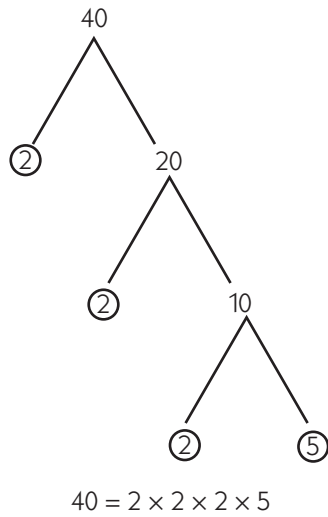
> **Carter** *It's composite because it's even.*

> **Teacher** *Are all even numbers composite?*

> **Yaritza** *No, because 2 is an even number, and it's prime, remember? I think 40 is a composite number because it has more factors than just 1 and itself, like 4 and 10.*

2. Review the fact that a composite number can be written as the product of prime numbers. This is called *prime factorization*. One way to find the prime factorization of a number is to make a factor tree. Work with class input to make a factor tree for 40 at the board. Start with a pair of branches that uses 2 as one of the factors. Ask students to record the tree in their journals and use the prime factorization of 40 to find all the factor pairs. After they've had a minute to work, ask them to help you list the pairs at the board.

Activity 2 Factor Riddles (cont.)

40 = 2 × 2 × 2 × 5

②×②2 × 2 × 5 ⟶ 40 = 2 × 20

②2 × 2②×②2 × 5 ⟶ 40 = 4 × 10

②2 × 2 × 2②×⑤ ⟶ 40 = 8 × 5

and there is also 40 = 1 × 40

3. Write the number 70 on the board, and ask students whether they think 70 and 40 have any common factors. After they've had a minute to discuss their conjectures, have them make a factor tree for 70 in their journals and use it to help list all the factor pairs. Work with their input to record the results at the board. Then ask students to create a Venn diagram in their journals to show the common factors of 40 and 70 as you do so at the board.

②×⑤ × 7 ⟶ 70 = 2 × 35

②2 × 5②×⑦ ⟶ 70 = 10 × 7

②× 5 ×⑦ ⟶ 70 = 14 × 5

and there is also 70 = 1 × 70

Factors of 40   Factors of 70

Common Factors

4. Now tell students you have a number riddle for them to solve. Write the first clue on the board and read it with the class.

<div align="center">Clue 1: I am a common factor of 28 and 40.</div>

Give them a few minutes to create a factor tree and list the factor pairs for 28 (1 × 28, 2 × 14, and 4 × 7) in their journals. Work with their input to record the common factors of 28 and 40 at the board (1, 2, and 4).

5. Write the next two clues on the board and have students use them to identify the mystery number (4).

<div align="center">Clue 2: I am an even number.
Clue 3: I am not prime.</div>

6. Give students each a copy of Factor Riddles. Review the instructions and clarify as needed. You might allow them to work either individually or in pairs as they choose. Encourage them to work on the challenge problems on page 15 if they finish the other problems with time to spare.

Activity 2 Factor Riddles (cont.)

Extension

- Utah State University has developed a library of free virtual manipulatives that includes a factor tree feature that's fun and easy to use. To access this feature, go online to the following URL: http://nlvm.usu.edu/en/nav/vlibrary.html. Click on Number and Operations for Grades 3–5, and then click on Factor Tree. When you've reached the Factor Tree screen, click on the Instructions button in the top right-hand corner for directions about how to use this feature. After you've explored Factor Tree yourself, show students how to set up the screen so they can create factor trees for two different numbers and then find the common factors. This feature is self-correcting, so students are able to get feedback as they work.

INDEPENDENT WORKSHEET

See Set A2 Independent Worksheets 2 and 3 for additional practice with factor trees and common factors.

Factor Riddles page 1 of 2

Solve each of the riddles below. For each one:
- Make a factor tree and list the factor pairs for each number.
- Find the factors shared by each number (their common factors).
- Use the other clues to find the answer to the riddle.
- Show your work.

1 I am a common factor of 27 and 45.

I am an odd number.

When you multiply me by 3, you get a number greater than 10.

What number am I?

2 I am a common factor of 36 and 48.

I am also a factor of 30.

I am an even number.

I am divisible by 3.

What number am I?

NAME _____ DATE _____

Factor Riddles page 2 of 2

3 I am a common factor of 60 and 100.
I am an even number greater than 4.
I am divisible by 4.
What number am I?

CHALLENGE

4 I am an odd number.
I am a common factor of 135 and 210.
I am greater than 7.
What number am I?

5 On another piece of paper, write your own factor riddle for a classmate that includes at least 3 clues. Be sure not to give the answer away before the third clue. Exchange papers with a classmate and see if you can solve each other's riddles.

Hint: Start with the prime numbers and then multiply different combinations of them to get starting numbers.

NAME _____ DATE _____

Set A2 ★ Independent Worksheet 1

INDEPENDENT WORKSHEET

Prime or Composite?

You will need square-inch tiles to complete these sheets.

1 For each of the numbers below:

• use your tiles to build all the possible rectangles that can be formed with that number.

• make a labeled quick sketch to show each rectangle

• record a multiplication sentence for each pair of factors.

• circle the correct word to tell whether the number is prime or composite

Number	Labeled Quick Sketch	Multiplication Sentence for Each Pair of Factors	Prime or Composite?
example 12	1 [rectangle 1×12] 12 2 [rectangle 6×12] 6 12 [rectangle 3×4] 3 4 12	$1 \times 12 = 12$ $2 \times 6 = 12$ $3 \times 4 = 12$	prime or composite?

Independent Worksheet 1 Prime or Composite? (cont.)

Number	Labeled Quick Sketch	Multiplication Sentence for Each Pair of Factors	Prime or Composite?
1a 18			prime or composite?
b 29			prime or composite?
c 33			prime or composite?

(Continued on next page.)

NAME   DATE

Independent Worksheet 1 Prime or Composite? (cont.)

Number	Labeled Quick Sketch	Multiplication Sentence for Each Pair of Factors	Prime or Composite?
1d 42			prime or composite?

2 Josef says that if you can only build 1 rectangle for a number, that means it's prime. Do you agree with him or not? Use numbers, words, and/or labeled sketches to explain your answer.

3 List all the prime numbers between 20 and 30 in the left-hand box below. List all the composite numbers between 20 and 30 in the right-hand box below. Use your tiles to help decide which are prime and which are composite

Prime Numbers between 20 and 30	Composite Numbers between 20 and 30

NAME _____ DATE _____

Set A2 ★ Independent Worksheet 2

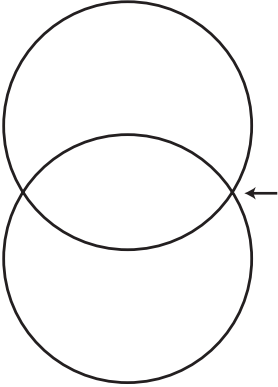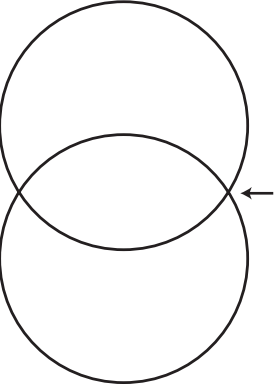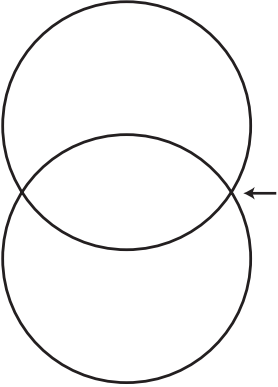## Factor Trees & Common Factors

Find the common factors of each pair of numbers below. To do this:

• Make a factor tree and list the factor pairs for each number.

• Make a Venn Diagram to show their common factors.

Numbers	Factor Tree and Factor Pairs	Factor Tree and Factor Pairs	Venn Diagram
example 12 and 20	12 / 2 6 / 2 3 12 = 2 × 2 × 3 12 = 2 × 6 12 = 4 × 3 12 = 1 × 12	20 / 2 10 / 2 5 20 = 2 × 2 × 5 20 = 2 × 10 20 = 4 × 5 20 = 1 × 20	Factors of 12 Factors of 20 6 12 1 2 4 5 3 10 20 ← Common Factors
1 20 and 28			Factors of 20 Factors of 28 ← Common Factors

(Continued on back.)

Independent Worksheet 2 Factor Trees & Common Factors (cont.)

Numbers	Factor Tree and Factor Pairs	Factor Tree and Factor Pairs	Venn Diagram
2 32 and 40			Factors of 32 Factors of 40 ← Common Factors
3 24 and 54			Factors of 24 Factors of 54 ← Common Factors
4 100 and 120			Factors of 100 Factors of 120 ← Common Factors

NAME _____   DATE _____

Set A2 ★ Independent Worksheet 3

INDEPENDENT WORKSHEET

More Factor Riddles

Solve the factor riddles below. Show your work. You can use a calculator to help if you like.

Factor Riddle	Solution
1 I am a common factor of 24 and 60. I am an even number. I am divisible by 3 and 4. What number am I?	
2 I am an odd number. I am a common factor of 54 and 63. When you multiply me by 2, you get a number greater than 10. What number am I?	

(Continued on back.)

Independent Worksheet 3 More Factor Riddles (cont.)

Factor Riddle	Solution
3 I am a common factor of 80 and 120. I am greater than 5, and I am less than 40. I am divisible by 4. I am also divisible by 10. What number am I?	
4 I am an odd number. I am a common factor of 120 and 150. I am not prime. What number am I?	