



Is 3 or 8 a prime number? Explain. [3 is prime; it has exactly two factors; 8 has more than two factors.]

Prime or Composite?

Is 27 a prime number or a composite number?
You can use divisibility rules to help you decide.
Since 27 is an odd number it is not divisible by 2.
Since the sum of the digits is $2 + 7 = 9$, then 27 is divisible by 3. So, 27 also has factors of 3 and 9.
So, 27 is composite.

Prevent Misconceptions

Students might wonder whether 1 is a prime number because they are not sure whether it has one or two factors. Draw a square on the board to represent an array for 1. Explain that all numbers have 1 as a factor. Then explain that the other factor for 1 is itself. So 1 is neither prime nor composite.

Is 11 prime or composite?

Since 11 is an odd number, it is NOT divisible by 2.

It is also NOT divisible by 3, 4, 5, 6, 7, 8, 9, or 10.

So, 11 is prime.

What other numbers less than 20 are prime?
[5, 7, 13, 17, 19]

Lesson
4-8

Prime and Composite Numbers

What are prime and composite numbers?

Every whole number greater than 1 is either a prime number or a composite number. A **prime number** has exactly two factors, 1 and itself. A **composite number** has more than two factors.

$$1 \times 3 = 3$$

$$1 \times 8 = 8$$

$$2 \times 4 = 8$$

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So, 11 is prime.

8. No. A factor tree shows the prime factorization of a number, so the last row has to be prime factors.

Guided Practice*

Do you know HOW?

For 1 through 6, write whether the number is prime or composite.

- | | |
|-----------|-----------|
| 1. 41 | 2. 72 |
| Prime | Composite |
| 3. 22 | 4. 37 |
| Composite | Prime |
| 5. 106 | 6. 287 |
| Composite | Composite |

Do you UNDERSTAND?

- The prime factorization of a number is $2 \times 3 \times 3 \times 5 \times 7$. What is the number?
630
- When beginning a factor tree for a composite number, does it matter which factor pair you start with? Explain.
See above.

Independent Practice

In 9 through 20, use a factor tree to find the prime factorization of each number.

Tip Think of the basic multiplication facts to use for the factor pairs.

Leveled Practice

- | | | | |
|---|---|---|--|
| 9. 20
2×10
$2 \times 2 \times 5$ | 10. 12
2×6
$2 \times 2 \times 3$ | 11. 42
3×14
$3 \times 2 \times 7$ | 12. 27
3×9
$3 \times 3 \times 3$ |
| 13. 15
3×5 | 14. 30
2×15
$2 \times 3 \times 5$ | 15. 24
4×6
$2 \times 2 \times 2 \times 3$ | 16. 16
4×4
$2 \times 2 \times 2 \times 2$ |
| 17. 23
1×23 | 18. 40
2×20
$2 \times 2 \times 2 \times 5$ | 19. 60
2×30
$2 \times 2 \times 3 \times 5$ | 20. 45
3×15
$3 \times 3 \times 5$ |

*For another example, see Set H on page 119.

Lesson 4-8

107

Another Example How can you write a composite number as a product of prime factors?

Write 24 as a product of prime factors.

A product of prime factors is called the **prime factorization** of a number. A **factor tree** is a diagram that shows the prime factorization of a composite number.

One Way

Find a factor pair for 24.

$$4 \times 6$$

Write each factor that is not prime as a product of prime numbers.

$$2 \times 2 \times 2 \times 3$$

Last "branch" of the tree contains all prime numbers.

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

Another Way

You can use a different factor pair for 24.

$$3 \times 8$$

Tip Continue until all "branches" end in prime numbers.

- What are the first 10 prime numbers? How do you know?
2, 3, 5, 7, 11, 13, 17, 19, 23, 29 Each has 2 factors, 1 and itself.
- When you write the prime factorization of a composite number, why do you not include 1 and the number itself?
1 and the number itself are not prime numbers.

2 Guided Practice



Formative Assessment

Remind students to use divisibility rules to help them decide if numbers are prime or composite.

Exercise 8

Error Intervention

If students have trouble making factor trees, then suggest an alternative that is a string of equivalent equations:

$$28 = 4 \times 7$$

$$28 = 2 \times 2 \times 7$$

The factors in the last equation must all be prime numbers. This is the prime factorization of the number. Prime factorizations are typically written in numerical order.

Reteaching For another example and more practice, assign Reteaching Set H on p. 119.

3 Independent Practice

Remind students to break down numbers into their factors until they get only prime numbers. Students who have trouble breaking down numbers should work on Exercises 9–16. Students who can construct their own factor tree should work on Exercises 17–20. These students could be challenged to write answers in exponential form. Example: $2 \times 2 \times 2 \times 2 \times 2 = 2^5$

Early Finishers Have students show that 5 is prime and that 6 is composite by making arrays with counters.

See **Extensions** on page 119E.