UNIT 1 · STANDARD 6.NS.4

Prime Factorization

Lesson 1-1

Name: _____ Date: _____ Class: _____

Key Vocabulary

Level 1 support

Picture first, then the word, then a plain-language meaning. Say each word out loud.

7 has only two factors: 1 × 7. So 7 is prime.

Prime number

A number bigger than 1 that you can only divide by 1 and itself.

12 = 1 × 12, 2 × 6, 3 × 4 — six factors, so 12 is composite

Composite number

A number bigger than 1 that you can divide by more than just 1 and itself.

36 = 2 × 2 × 3 × 3 = $2^2 \times 3^2$

Prime factorization

Writing a number as prime numbers multiplied together.

24 → 4 × 6 → (2 × 2) × (2 × 3) → 2 × 2 × 2 × 3

Factor tree

A picture that splits a number into its prime numbers, step by step.

2^3 means 2 × 2 × 2 = 8

Exponent

A small number that tells how many times to multiply a number by itself.

Key Ideas & Notes

- The space station received 60 supply crates.
- Mission Control needs to break this quantity into its prime components so the sorting robots can distribute them into equally sized pods.
- Help the crew find the prime factorization of 60!
- Sort these numbers — which are prime and which are composite?

Think About It

- What number are we breaking down into factors?
- What's the difference between a factor and a prime factor?
- How many different ways can we start breaking 60 apart?

My Notes

Guided Examples

Example 1

Which of the following is a prime number?

Solution: 17 has exactly two factors: 1 and 17. $15 = 3 \times 5$, $21 = 3 \times 7$, and $9 = 3 \times 3$, so they are all composite.

Answer: A. 17

Example 2

What is the prime factorization of 30?

Solution: $30 = 2 \times 15 = 2 \times 3 \times 5$. All three factors (2, 3, 5) are prime, so $2 \times 3 \times 5$ is the prime factorization.

Answer: A. $2 \times 3 \times 5$

Example 3

What is the prime factorization of 18?

Solution: $18 = 2 \times 9 = 2 \times 3 \times 3$. Both 2 and 3 are prime, so $2 \times 3 \times 3$ is the prime factorization.

Answer: A. $2 \times 3 \times 3$

Write About the Math

The Writing Revolution

I can explain how I broke a number down using the words prime number, composite number, factor, and exponent.

1. Kernel Sentence

subject + verb

Model: Prime factorization is writing a number as prime numbers multiplied together.
Factorización prima es escribir un número como números primos multiplicados.

Write a kernel sentence about prime factorization. Use a subject and a verb.
Escribe una oración base sobre factorización prima. Usa un sujeto y un verbo.

2. Sentence Expansion

because · but · so

Kernel: Prime factorization matters in math
Factorización prima importa en matemáticas

Expand the kernel three ways. Add a reason, a contrast, and a result.

because *porque*

Prime factorization matters in math because ____.
Factorización prima importa en matemáticas porque ____.

but *pero*

Prime factorization matters in math, but ____.
Factorización prima importa en matemáticas, pero ____.

so *entonces*

Prime factorization matters in math, so ____.
Factorización prima importa en matemáticas, entonces ____.

3. Sentence Types (4 ways to write a math idea)

Statement
Afirmación

Tell one true fact about prime factorization.
Di un hecho verdadero sobre prime factorization.

Prime factorization ____.

Question
Pregunta

Ask a question about prime factorization.
Haz una pregunta sobre prime factorization.

How does ____ ?
¿Cómo ____ ?

Exclamation
Exclamación

Show excitement about prime factorization.
Muestra entusiasmo sobre prime factorization.

Wow, ____ !
¡Guau, ____ !

Command
Mandato

Tell a partner what to do with prime factorization.
Dile a un compañero qué hacer con prime factorization.

First, ____ .
Primero, ____ .

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4. Explain Your Reasoning (use a sentence starter)

I broke ____ into ____ because ____.
Separé ____ en ____ porque ____.

A prime number is ____.
Un número primo es ____.

This helps in real life when ____.
Esto ayuda en la vida real cuando ____.

Try It

Solve on your own. Check the answer key when you are done.

1. Which of these numbers is composite?

A. 27

B. 23

C. 29

D. 31

Show your work:

2. Two students found different factor trees for 60. Student A started with 2 × 30. Student B started with 6 × 10. Which statement is true?

A. Both get the same prime factorization: 2 × 2 × 3 × 5

B. Only Student A gets the correct prime factorization

C. Only Student B gets the correct prime factorization

D. They will get different prime factorizations

Show your work:

Stretch Your Thinking

Level 2 enrichment

Challenge task — explain your reasoning in full sentences.

Choose any two-digit composite number. Show TWO different factor trees that both lead to the same prime factorization. Explain why every composite number has only one prime factorization.

Sentence starter: I chose the number ____. My first factor tree starts with ____ × ____, and my second starts with ____ × ____. Both give the same prime factorization: ____. This happens because ____.

Show your work:

Reflect — Exit Ticket

What is the prime factorization of 40?

A. 2 × 2 × 2 × 5

B. 4 × 10

C. 5 × 8

D. 2 × 20

Your answer:

Answer Key & Teacher Guide

1. **Try It 1:** A. 27 — *27 = 3 × 9 = 3 × 3 × 3, so it has more than two factors. 23, 29, and 31 are all prime.*
2. **Try It 2:** A. Both get the same prime factorization: 2 × 2 × 3 × 5 — *The Fundamental Theorem of Arithmetic says every composite number has exactly one prime factorization. No matter how you start the factor tree, you always end with 2 × 2 × 3 × 5.*
3. **Exit Ticket:** A. 2 × 2 × 2 × 5 — *40 = 2 × 20 = 2 × 2 × 10 = 2 × 2 × 2 × 5. All factors (2, 2, 2, 5) are prime.*

Writing (TWR) — what to look for

- **Kernel sentence:** A complete sentence needs a subject and a verb. Example: Prime factorization is writing a number as prime numbers multiplied together.
- **Expansion:** *because* gives a reason, *but* shows a contrast or exception, *so* shows a result. Answers vary; each must keep the kernel idea and add the correct kind of detail.
- **Sentence types:** Statement ends with a period, question with "?", exclamation with "!", and a command starts with an action verb (a "bossy" verb).