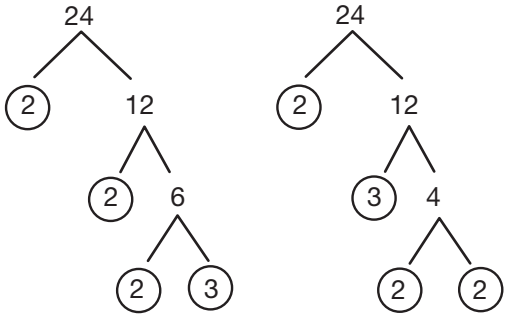
Student Guide

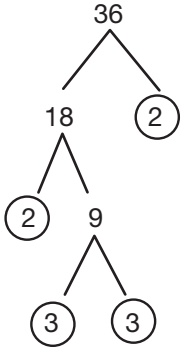
Questions 1–9 (SG pp. 98–99)

1.* $2 \times 2 \times 2 \times 3$, in any order. Two possible factor trees are:

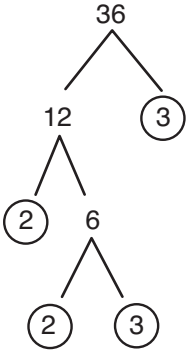


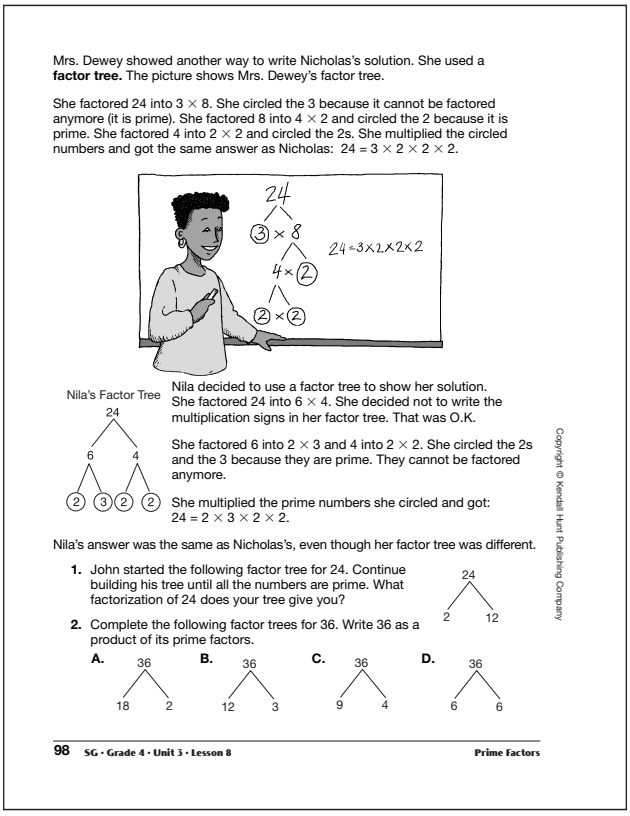
2. Factor trees will vary. One possible factor tree for each follows.

A. $2 \times 2 \times 3 \times 3$ in any order.



B. $2 \times 2 \times 3 \times 3$ in any order.





Mrs. Dewey showed another way to write Nicholas's solution. She used a **factor tree.** The picture shows Mrs. Dewey's factor tree.

She factored 24 into 3×8. She circled the 3 because it cannot be factored anymore (it is prime). She factored 8 into 4×2 and circled the 2 because it is prime. She factored 4 into 2×2 and circled the 2s. She multiplied the circled numbers and got the same answer as Nicholas: $24 = 3 \times 2 \times 2 \times 2$.

Nila's Factor Tree

Nila decided to use a factor tree to show her solution. She factored 24 into 6×4. She decided not to write the multiplication signs in her factor tree. That was O.K.

She factored 6 into 2×3 and 4 into 2×2. She circled the 2s and the 3 because they are prime. They cannot be factored anymore.

She multiplied the prime numbers she circled and got: $24 = 2 \times 3 \times 2 \times 2$.

Nila's answer was the same as Nicholas's, even though her factor tree was different.

1. John started the following factor tree for 24. Continue building his tree until all the numbers are prime. What factorization of 24 does your tree give you?

2. Complete the following factor trees for 36. Write 36 as a product of its prime factors.

A. 36 — 18, 2
B. 36 — 12, 3
C. 36 — 9, 4
D. 36 — 6, 6

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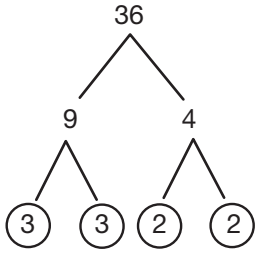
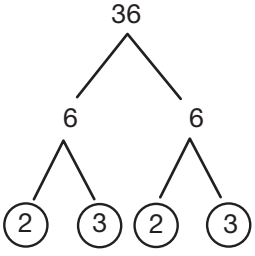
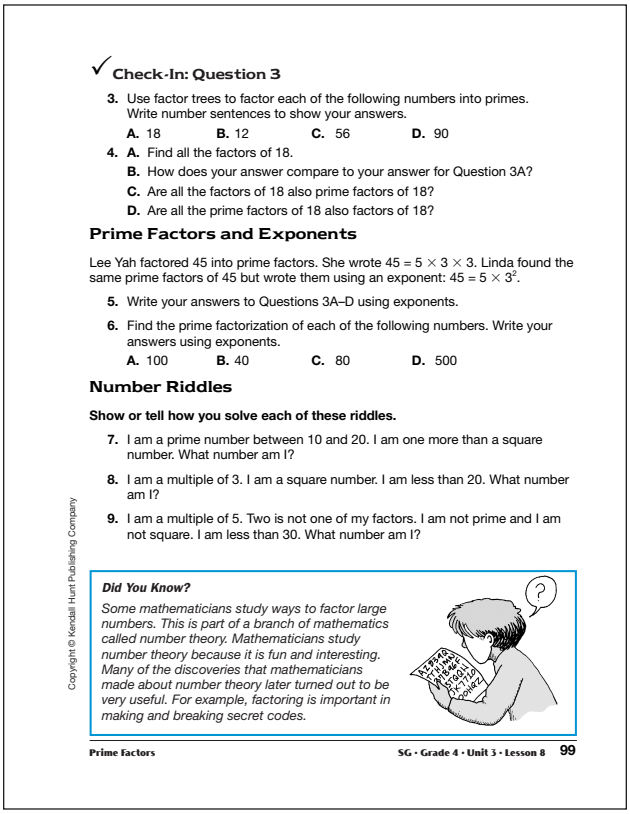
C. $2 \times 2 \times 3 \times 3$ in any order.



D. $2 \times 2 \times 3 \times 3$ in any order.



*** Answers and/or discussion are included in the lesson.**



✓ **Check-In: Question 3**

3. Use factor trees to factor each of the following numbers into primes. Write number sentences to show your answers.
   A. 18 **B.** 12 **C.** 56 **D.** 90
4. **A.** Find all the factors of 18.
   B. How does your answer compare to your answer for Question 3A?
   C. Are all the factors of 18 also prime factors of 18?
   D. Are all the prime factors of 18 also factors of 18?

Prime Factors and Exponents

Lee Yah factored 45 into prime factors. She wrote $45 = 5 \times 3 \times 3$. Linda found the same prime factors of 45 but wrote them using an exponent: $45 = 5 \times 3^2$.

5. Write your answers to Questions 3A–D using exponents.
6. Find the prime factorization of each of the following numbers. Write your answers using exponents.
   A. 100 **B.** 40 **C.** 80 **D.** 500

Number Riddles

Show or tell how you solve each of these riddles.

7. I am a prime number between 10 and 20. I am one more than a square number. What number am I?
8. I am a multiple of 3. I am a square number. I am less than 20. What number am I?
9. I am a multiple of 5. Two is not one of my factors. I am not prime and I am not square. I am less than 30. What number am I?

Did You Know?

Some mathematicians study ways to factor large numbers. This is part of a branch of mathematics called number theory. Mathematicians study number theory because it is fun and interesting. Many of the discoveries that mathematicians made about number theory later turned out to be very useful. For example, factoring is important in making and breaking secret codes.

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3. Check students' factor trees for each of the following.
   A. $2 \times 3 \times 3 = 18$, in any order.
   B. $2 \times 2 \times 3 = 12$, in any order.
   C. $2 \times 2 \times 2 \times 7 = 56$, in any order.
   D. $2 \times 3 \times 3 \times 5 = 90$, in any order.
4. **A.** 18, 9, 6, 3, 2, 1
   B. They are all numbers that can appear in a factor tree for 18.
   C. No, 9 and 6 are not prime numbers.
   D. Yes.
5. $18 = 2 \times 3^2$, $12 = 2^2 \times 3$, $56 = 2^3 \times 7$, $90 = 2 \times 3^2 \times 5$
6. **A.** $100 = 2^2 \times 5^2$
   B. $40 = 2^3 \times 5$
   C. $80 = 2^4 \times 5$
   D. $500 = 2^2 \times 5^3$
7.* 17; Possible response: The prime numbers between 1 and 20 are 11, 13, 17, and 19. 11 is one more than 10 and 10 is not square. 13 is one more than 12 and 12 is not square. 17 is one more than 16. 16 is square.
8. 9; Possible response: I skip count by 3s to 20: 3, 6, (9), 12, 15, 18. Nine is the only square number. $3 \times 3 = 9$.
9. 15; Possible response: I skip count by 5s to 30 and mark out all the even numbers because 2 is not a factor.
   5, ~~10~~, (15), ~~20~~, 25, ~~30~~. Five is prime and 25 is square, so it has to be 15.

*** Answers and/or discussion are included in the lesson.**

Student Guide

Homework (SG p. 100)

Questions 1–7

1. **A.** 6 is not prime. $2 \times 3 = 6$

   B. 17 is prime. Its only factors are 1 and itself.

   C. 12 is not prime. $2 \times 2 \times 3 = 12$

   D. 39 is not prime. $3 \times 13 = 39$

2. Check students' factor trees for each of the following.

   A. $2 \times 2 \times 5 = 20$, in any order.

   B. $2 \times 2 \times 7 = 28$, in any order.

   C. $2 \times 2 \times 3 \times 5 = 60$, in any order.

   D. $2 \times 2 \times 2 \times 2 \times 3 = 48$, in any order.

   E. $2 \times 3 \times 3 \times 3 = 54$, in any order.

   F. $2 \times 2 \times 2 \times 3 \times 3 = 72$, in any order.

   G. $2 \times 2 \times 5 \times 5 = 100$, in any order.

   H. $2 \times 3 \times 7 = 42$, in any order.

3. **A.** $2 \times 5^2 = 50$, in any order.

   B. $2 \times 3 \times 11 = 66$

   C. $2^5 \times 3 = 96$

   D. $2^2 \times 3 \times 5^2 = 300$

4. 14. Possible response: Multiples of 2 between 10 and 20: ~~12~~, (14), ~~16~~, ~~18~~, 20

   12 and 18 are multiples of 3. 16 is square. The only number left is 14.

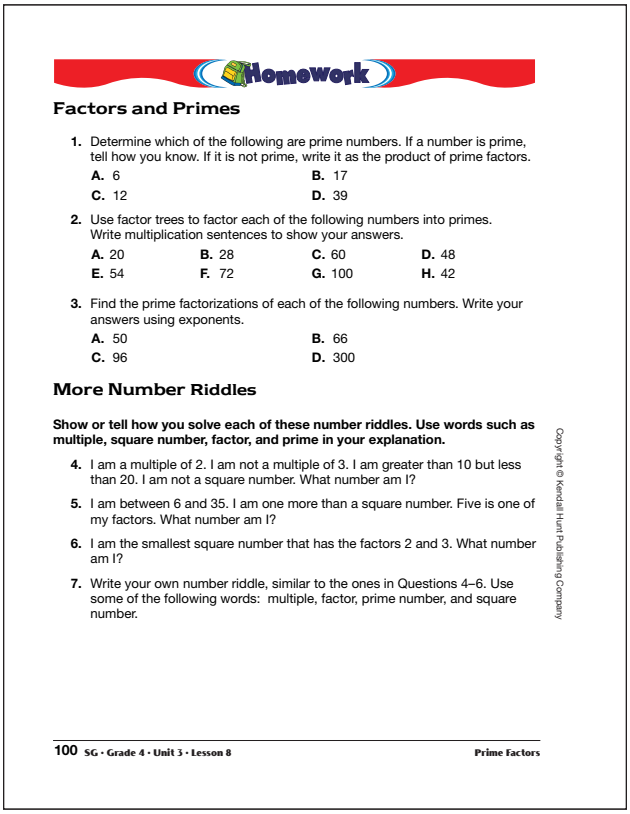
5. 10. The square numbers between 6 and 35 are 9, 16, and 25.

   Add one to each number: (10), 17, 26.

   I circle 10 because it is the only number that has 5 as a factor.

6. 36; $2 \times 3 = 6$, $6 \times 6 = 36$

7. Answers will vary. Check for use of the vocabulary terms from this unit—multiple, factor, prime, and square. Encourage students to use more than one term when writing their riddles.



Homework

Factors and Primes

1. Determine which of the following are prime numbers. If a number is prime, tell how you know. If it is not prime, write it as the product of prime factors.
   A. 6 **B.** 17
   C. 12 **D.** 39
2. Use factor trees to factor each of the following numbers into primes. Write multiplication sentences to show your answers.
   A. 20 **B.** 28 **C.** 60 **D.** 48
   E. 54 **F.** 72 **G.** 100 **H.** 42
3. Find the prime factorizations of each of the following numbers. Write your answers using exponents.
   A. 50 **B.** 66
   C. 96 **D.** 300

More Number Riddles

Show or tell how you solve each of these number riddles. Use words such as multiple, square number, factor, and prime in your explanation.

4. I am a multiple of 2. I am not a multiple of 3. I am greater than 10 but less than 20. I am not a square number. What number am I?
5. I am between 6 and 35. I am one more than a square number. Five is one of my factors. What number am I?
6. I am the smallest square number that has the factors 2 and 3. What number am I?
7. Write your own number riddle, similar to the ones in Questions 4–6. Use some of the following words: multiple, factor, prime number, and square number.

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