Factors

Tile Problems and Factors

Use *Square-Inch Grid Paper* or tiles to help you solve these problems. Write a number sentence to go with each problem.

1. Roberto made a rectangle with 6 rows and 5 tiles in each row. How many tiles did he use?
2. Jackie made a rectangle with 21 tiles. There were 7 tiles in each row. How many rows were there?
3. Shannon made a rectangle with 32 tiles. If there were 4 rows, how many tiles were in each row?
4. Then Shannon made a different rectangle with her 32 tiles. What other rectangle could Shannon have made?
5. A rectangle of 12 tiles has 3 different colors. There is an equal number of tiles of each color. How many tiles of each color are there?

When a rectangle can be made with tiles, the 2 sides of the rectangle are called **factors** of the total number of tiles used. Roberto's rectangle in Question 1 has sides of 6 and 5 tiles so he can write the number sentence $6 \times 5 = 30$. Roberto's rectangle shows that 5 and 6 are **factors** of 30.

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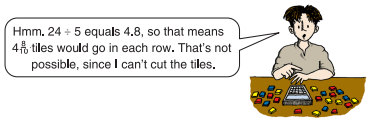
6. Jackie's rectangle shows that 7 is a factor of 21. Use the number sentence you wrote for Question 2 to name another factor of 21.
7. Use your number sentence in Question 3 to name two factors of 32.
8. Did you find two more factors in Question 4? What are they?

Finding Factors



Jacob wondered whether he could arrange 24 tiles into 5 rows. He wanted to know if 5 is a factor of 24. He used his calculator to divide 24 into 5 groups.

The **factors** of a number must be **whole numbers** that can be multiplied to get the number. For example, $3 \times 8 = 24$, so 3 and 8 `are factors of 24. Three and eight are whole numbers. All the factors of 24 are 1, 2, 3, 4, 6, 8, 12, and 24, because we can multiply pairs of numbers to get 24 in the following ways: 1×24, 2×12, 3×8, and 4×6.

The factors of a number can also be described as the whole numbers that divide the number evenly. 2 is a factor of 24 because $24 \div 2 = 12$. But 5 is not a factor of 24 because $24 \div 5 = 4.8$, and 4.8 is not a whole number.

The number sentence $24 = 3 \times 8$ tells us:

- 24 is a multiple of both 3 and 8.
- 3 and 8 are both factors of 24.

Remember, a **multiple** of a number is the product of that number and another number.

The factors of a number tell us which numbers of rows are possible in rectangles made with that number of tiles. Jacob couldn't make a rectangle with 5 rows and 24 tiles because 5 is not a factor of 24.

9. **A.** Is it possible to make a rectangle with 24 tiles and 6 rows? If so, how many tiles will be in each row? Use your calculator to check.
   B. Is it possible to make a rectangle with 24 tiles and 7 rows? Use your calculator to check. Explain.

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Questions 1–16 (SG pp. 79–81)

1.* 30 tiles; $6 \times 5 = 30$

2.* 3 rows; $3 \times 7 = 21$, or $21 \div 7 = 3$

3.* 8 tiles; $4 \times 8 = 32$

4.* 2 possible rectangles:
2 rows with 16 tiles, $2 \times 16 = 32$
1 row with 32 tiles, $1 \times 32 = 32$

5.* 4 tiles of each color; $4 \times 3 = 12$

6. 3; $7 \times 3 = 21$

7. 4 and 8; $4 \times 8 = 32$

8. Possible factors: 2 and 16; $2 \times 16 = 32$ or 1 and 32; $1 \times 32 = 32$

9. A. Yes; 4 tiles in each row; $24 \div 6 = 4$

B. No; $24 \div 7 = 3.4285714\ldots$; The answer on the calculator is not a whole number.

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

10. A. No; Explanations will vary. Using the calculator: $38 \div 5 = 7.6$. You cannot make a rectangle with 5 rows and 38 tiles.

B. No; Explanations will vary. You cannot multiply 5 by a whole number to get 38.

C. Yes; Explanations will vary. Using the calculator: $35 \div 5 = 7$, which is a whole number. You can make a rectangle with 5 rows and 35 tiles. There would be 7 tiles in each row.

D. Yes, $5 \times 7 = 35$

11. A. Yes; Explanations will vary. $32 \div 8 = 4$. You can make a rectangle with 8 rows and 32 tiles. There will be 4 tiles in each row.

B. No; Explanations will vary. $36 \div 8 = 4.5$. You cannot make a rectangle with 8 rows and 36 tiles.

C. 32 is a multiple of 8; $8 \times 4 = 32$

12. A. Yes; Yes; $48 \div 6 = 8$; 8 students in each row

B. No; No; $48 \div 7 = 6.8571429\ldots$

C. Yes; Yes; $48 \div 8 = 6$; 6 students in each row

D. 6 and 8

13. A. 1, 2, 3, 4, 6, 12

B. 1, 2, 4, 8, 16

C. 1, 5, 25

14. A. 1 rectangle: 1 row of 13 tiles.

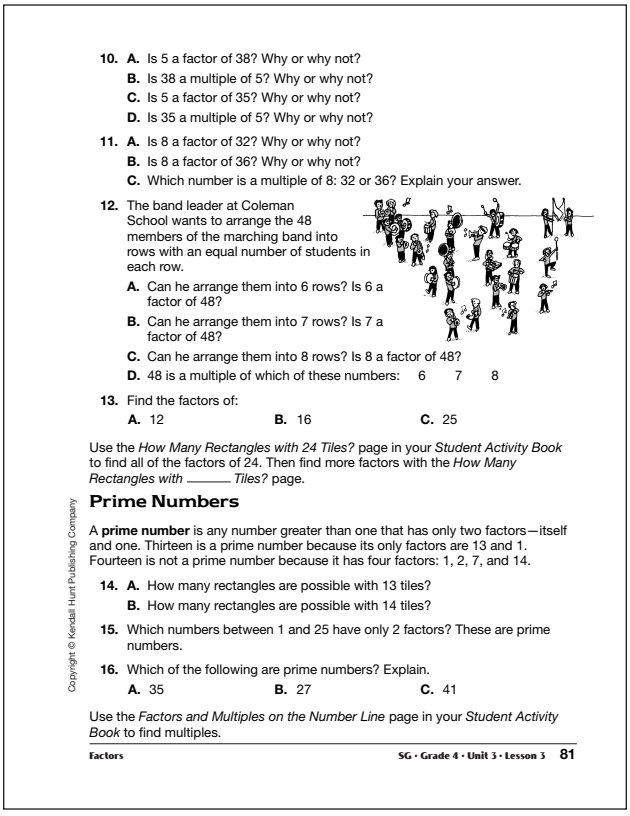
B. 2 rectangles: 1 row of 14 tiles and 2 rows of 7 tiles

15. 2, 3, 5, 7, 11, 13, 17, 19, 23

16. A.* No; Explanations will vary. 35 has more than 2 factors (1, 5, 7, 35)

B.* No; Explanations will vary. 27 has more than 2 factors (1, 3, 9, 27)

C.* Yes; Explanations will vary. Systematic testing for factors by division shows that 41 has only 2 factors (1 and 41).



10. **A.** Is 5 a factor of 38? Why or why not?
B. Is 38 a multiple of 5? Why or why not?
C. Is 5 a factor of 35? Why or why not?
D. Is 35 a multiple of 5? Why or why not?

11. **A.** Is 8 a factor of 32? Why or why not?
B. Is 8 a factor of 36? Why or why not?
C. Which number is a multiple of 8: 32 or 36? Explain your answer.

12. The band leader at Coleman School wants to arrange the 48 members of the marching band into rows with an equal number of students in each row.
A. Can he arrange them into 6 rows? Is 6 a factor of 48?
B. Can he arrange them into 7 rows? Is 7 a factor of 48?
C. Can he arrange them into 8 rows? Is 8 a factor of 48?
D. 48 is a multiple of which of these numbers: 6 7 8

13. Find the factors of:
A. 12 **B.** 16 **C.** 25

Use the *How Many Rectangles with 24 Tiles?* page in your *Student Activity Book* to find all of the factors of 24. Then find more factors with the *How Many Rectangles with _____ Tiles?* page.

Prime Numbers

A **prime number** is any number greater than one that has only two factors—itself and one. Thirteen is a prime number because its only factors are 13 and 1. Fourteen is not a prime number because it has four factors: 1, 2, 7, and 14.

14. **A.** How many rectangles are possible with 13 tiles?
B. How many rectangles are possible with 14 tiles?

15. Which numbers between 1 and 25 have only 2 factors? These are prime numbers.

16. Which of the following are prime numbers? Explain.
A. 35 **B.** 27 **C.** 41

Use the *Factors and Multiples on the Number Line* page in your *Student Activity Book* to find multiples.

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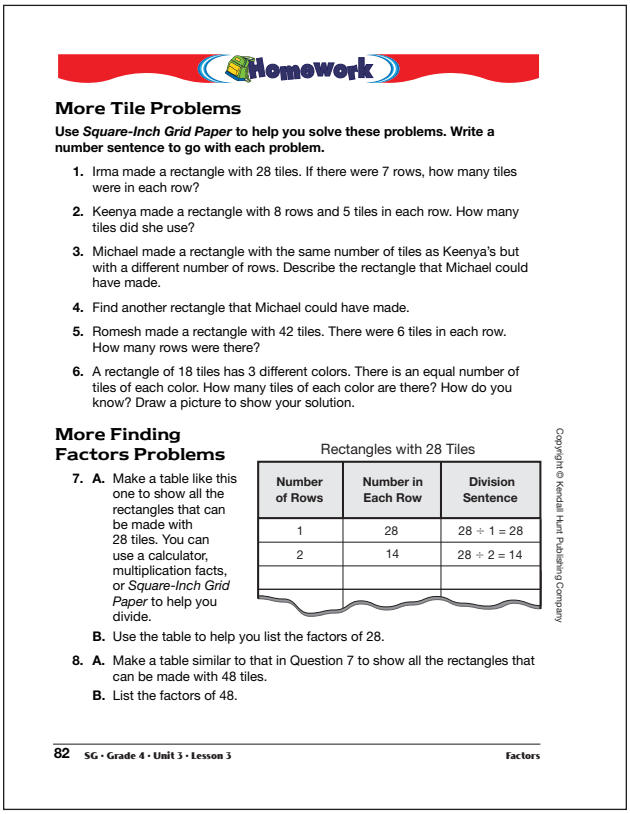
***Answers and/or discussion are included in the lesson.**



Homework

More Tile Problems

Use *Square-Inch Grid Paper* to help you solve these problems. Write a number sentence to go with each problem.

1. Irma made a rectangle with 28 tiles. If there were 7 rows, how many tiles were in each row?
2. Keenya made a rectangle with 8 rows and 5 tiles in each row. How many tiles did she use?
3. Michael made a rectangle with the same number of tiles as Keenya's but with a different number of rows. Describe the rectangle that Michael could have made.
4. Find another rectangle that Michael could have made.
5. Romesh made a rectangle with 42 tiles. There were 6 tiles in each row. How many rows were there?
6. A rectangle of 18 tiles has 3 different colors. There is an equal number of tiles of each color. How many tiles of each color are there? How do you know? Draw a picture to show your solution.

More Finding Factors Problems

7. **A.** Make a table like this one to show all the rectangles that can be made with 28 tiles. You can use a calculator, multiplication facts, or *Square-Inch Grid Paper* to help you divide.

Rectangles with 28 Tiles

Number of Rows	Number in Each Row	Division Sentence
1	28	28 ÷ 1 = 28
2	14	28 ÷ 2 = 14

B. Use the table to help you list the factors of 28.

8. **A.** Make a table similar to that in Question 7 to show all the rectangles that can be made with 48 tiles.
B. List the factors of 48.

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Homework (SG pp. 82–83)

Questions 1–15

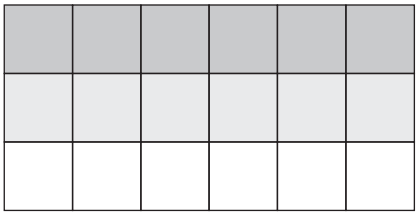
1. 4 tiles; 28 ÷ 7 = 4

2. 40 tiles; 8 × 5 = 40

3–4. 3 possible rectangles
1 row with 40 tiles, 1 × 40 = 40
2 rows with 20 tiles, 2 × 20 = 40
4 rows with 10 tiles, 4 × 10 = 40

5. 7 rows; 42 ÷ 6 = 7

6. 6 tiles of each color; 18 ÷ 3 = 6



7. A.

Rectangles with 28 Tiles

Number of Rows	Number in Each Row	Division Sentence
1	28	28 ÷ 1 = 28
2	14	28 ÷ 2 = 14
4	7	28 ÷ 4 = 7
7	4	28 ÷ 7 = 4
14	2	28 ÷ 14 = 2
28	1	28 ÷ 28 = 1

B. 1, 2, 4, 7, 14, 28

8. A.

Rectangles with 48 Tiles

Number of Rows	Number in Each Row	Division Sentence
1	48	48 ÷ 1 = 48
2	24	48 ÷ 2 = 24
3	16	48 ÷ 3 = 16
4	12	48 ÷ 4 = 12
6	8	48 ÷ 6 = 8
8	6	48 ÷ 8 = 6
12	4	48 ÷ 12 = 4
16	3	48 ÷ 16 = 3
24	2	48 ÷ 24 = 2
48	1	48 ÷ 48 = 1

B. 1, 2, 3, 4, 6, 8, 12, 16, 24, 48

9. A. Yes; Explanations will vary. $3 \times 9 = 27$; If you skip count by 3s you hit 27. You can make a rectangle with 3 rows and 27 tiles. 9 tiles would be in each row.

B. No; Explanations will vary. $32 \div 7 = 4.5714\ldots$; You cannot make a rectangle with 7 rows and 32 tiles.

10. Possible response: 8, 12, 16, 20, 24

11. A. Yes; Explanations will vary. $7 \times 5 = 35$

B. No; Explanations will vary. $42 \div 8 = 5.25$, 8 is not a factor of 42.

12. A. 1, 2, 3, 6

B. 1, 3, 5, 15

C. 1, 5, 25

D. 1, 2, 13, 26

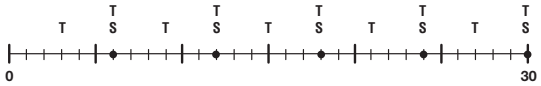
13. A. No; Explanations will vary. 39 has four factors: 1, 3, 13, and 39. You can make more than one rectangle with 39 tiles.

B. No; Explanations will vary. 51 has four factors: 1, 3, 17, and 51. You can make more than one rectangle with 51 tiles.

C. Yes; Explanations will vary. A systematic check for factors shows that 67 has only 1 and itself as factors. (See Content Note in Lesson 2 for a discussion of testing whether a number is prime.)

14. 29, 31, 37, 41, 43, and 47. Solution strategies will vary.

15.

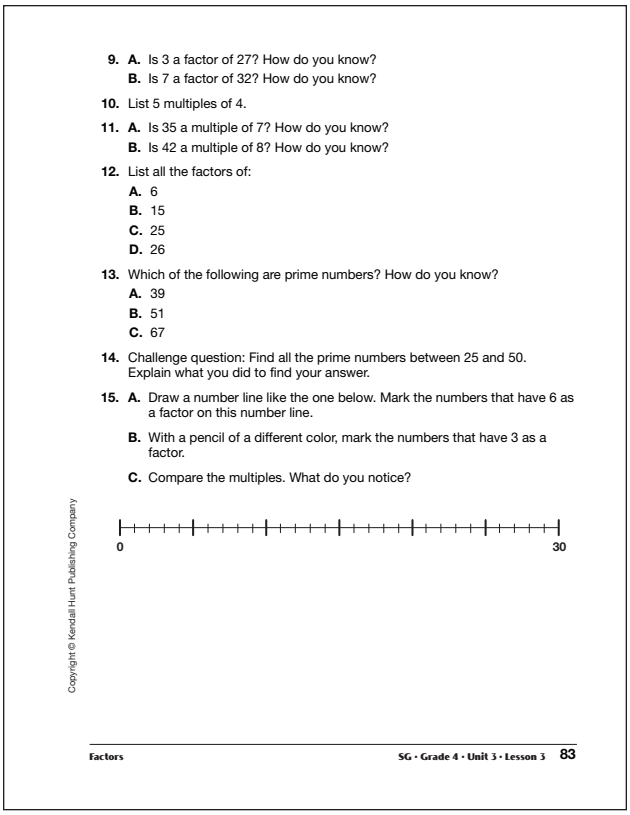


S = 6 T = 3

A. Numbers that have 6 as a factor are 6, 12, 18, 24, and 30.

B. Numbers that have 3 as a factor are 3, 6, 9, 12, 15, 18, 21, 24, 27, 30.

C. Possible responses: Every number that has 6 as a factor also has 3 as a factor, but not vice versa.



9. **A.** Is 3 a factor of 27? How do you know?
   B. Is 7 a factor of 32? How do you know?
10. List 5 multiples of 4.
11. **A.** Is 35 a multiple of 7? How do you know?
    B. Is 42 a multiple of 8? How do you know?
12. List all the factors of:
    A. 6
    B. 15
    C. 25
    D. 26
13. Which of the following are prime numbers? How do you know?
    A. 39
    B. 51
    C. 67
14. Challenge question: Find all the prime numbers between 25 and 50. Explain what you did to find your answer.
15. **A.** Draw a number line like the one below. Mark the numbers that have 6 as a factor on this number line.
    B. With a pencil of a different color, mark the numbers that have 3 as a factor.
    C. Compare the multiples. What do you notice?

0 30

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