

# USING COLOR TILES TO TEACH FACTORS & SQUARES

Volume 16

Developed with Kristin Ulrich  
Grades 3-5



## Time

60-75 minutes

## Content

Use a concrete model to create arrays that explicitly teach students the factors of given multiples. In using this model, the teacher can explicitly explain the difference between prime and composite numbers.

## Objectives

*Students will be able to ...*

- Differentiate between prime and composite numbers.
- Construct a variety of arrays for a given number.
- List the factors of a given number.
- Sort numbers according to their factors.

## Teacher Notes

Put students in pairs for this activity. It is recommended that your groupings are heterogenous. Each group needs at least 50 color tiles. The color of each tile does not matter. Each student should also have their own worksheet.

## Materials

- Plastic Square Color Tiles (Cat. No. TB21925) or Foam Square Color Tiles (TB21926)
- Anchor chart that includes definition of factor, product, prime number, and composite number
- Worksheet and answer key (attached with lesson plan download)

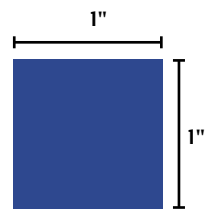
## Common Core State Standards

**CCSS.Math.Content.3.OA.C.7** — Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that  $8 \times 5 = 40$ , one knows that  $40 \div 5 = 8$ ) or properties of operations. By the end of Grade 3, know from memory all products of two one-digit numbers.

**CCSS.Math.Content.4.OA.B.4** — Find all factor pairs for a whole number in the range 1-100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1-100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1-100 is prime or composite.

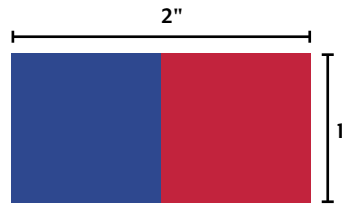
## Activity

1. Have each pair start with one color tile. Point out that it's a perfect square, with each side measuring 1", making it a rectangle as well. Since they are working with one tile, ask what times what will give them 1 as a product ( $1 \times 1$ ). This answer can also be deduced by seeing that the top is 1" long and the side is 1" long. Have students write the array of  $1 \times 1$  in the Possible Rectangle Dimensions section of the worksheet.



2. Since there are no other tiles being worked with yet, no other rectangles can be made; so it's time to move on to the Factors section of the worksheet. Remind students that a factor is a number multiplied by another number to get to a product, and that a product is the answer to a multiplication problem. Use the Anchor Chart when discussing the terms "factor" and "product." Ask students what number is the only factor of 1 ( $1$ ), then have them write 1 in the Factors column.
3. Refer to the Anchor Chart when reviewing the definitions of prime and composite numbers. Since the only factor of 1 is 1, and the definition of prime says the number has to be greater than 1, students should write *neither* in the Prime or Composite column. Tell students that 1 is the only number on the list where they will use *neither* instead of *prime* or *composite*.

4. Students should now add a second color tile and make a rectangle. The students should be able to say that the rectangle is one color tile wide and two color tiles long. Ask what times what gives a product of 2 ( $1 \times 2$ ), then have students write that array in the Possible Rectangle Dimensions column of the worksheet.



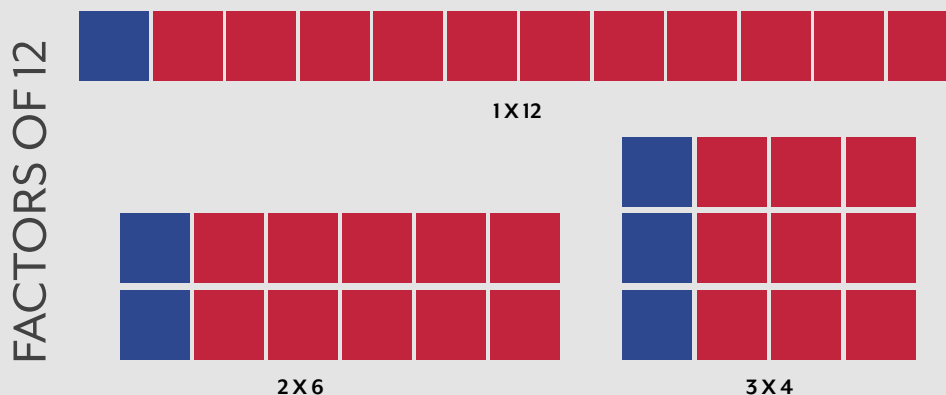
5. Ask if there are any other ways to get the product of 2. Students should say that they can reverse the numbers to get the same product ( $2 \times 1$ ), but tell them that since  $2 \times 1$  uses the same factors as  $1 \times 2$ ,  $2 \times 1$  won't be added to the list. The only time an array will be added to the list is when a completely different set of factors is used. However, since students should know by now that 1 and 2 are the factors of 2, those numbers can be placed in the Factors column of the worksheet.
6. Based on the definitions of prime and composite that are given on the Anchor Chart, students should be able to determine that 2 is a prime number, since the only factors it has are 1 and itself. They should write *prime* in the Prime or Composite column.
7. Continue with the same line of questioning for three tiles, then move on to four tiles. For four tiles, students should already be able to come up with  $1 \times 4$ , but when asked if there are any other rectangles that can be made with these tiles, they should realize that they can make a rectangle that represents  $2 \times 2$ . Since  $2 \times 2$  also equals 4, and it uses different factors than  $1 \times 4$ ,  $2 \times 2$  can be added to the Rectangle Dimensions column. Since those are all the rectangles they can make with four tiles, students should write 1, 2, and 4 in the Factors column. Using the definitions for prime and composite, they should also know that they can write *composite* in the Prime or Composite column.
8. Have students take another look at the  $2 \times 2$  rectangle they've created. Ask what other name can be applied to that shape (*square*). Point out that the two factors they multiplied to get that square are exactly the same. When the same number is multiplied by itself to get a product, they are finding the square of that number, so in this case, 2 squared equals 4.
9. Continue with the same procedures for tiles 5-8. For nine tiles, students should quickly determine that  $1 \times 9$  belongs in the Possible Rectangle Dimensions column. A rectangle can't be made that is two color tiles wide because a tile will be left over, but they will be able to make one that is three color tiles wide. They can add  $3 \times 3$  to the Possible Rectangle Dimensions column. This is a perfect square, meaning that 3 squared equals 9. Since there are no other rectangles that can be made with color tiles, students can add 1, 3, and 9 to the Factors column, and *composite* to the Prime or Composite column since 9 has factors other than 1 and itself.



## Practice

### Student/Group

Continue with the same procedure for 10 tiles, then have students work on numbers 11-15 in their pairs the same way they did for numbers 1-10. They should start with one row, then two, then three, and so on until all possible factors for a given multiple have been discovered. After 15 tiles, use the Checking for Understanding questions below with them, then allow the pairs to complete the rest of the problems.



## Check for Understanding

1. What is an array your group came up with for 11? ( $1 \times 11$ )
2. Were there any other arrays you were able to create? (No)
3. What are the factors of 11? (1, 11)
4. Is 11 prime or composite? (Prime)
5. How do you know? (Its only factors are 1 and itself.)
6. What is an array your group came up with for 12? ( $1 \times 12$ ,  $2 \times 6$ , and  $3 \times 4$  are all acceptable answers.)
7. Were there any other arrays you were able to create? (Yes, take answers until all three above answers have been given.)
8. What are the factors of 12? (1, 2, 3, 4, 6, 12)
9. Is 12 prime or composite? (Composite)
10. How do you know? (It has factors other than 1 and itself.)
11. What is an array your group came up with for 13? ( $1 \times 13$ )
12. Were there any other arrays you were able to create? (No)
13. What are the factors of 13? (1, 13)
14. Is 13 prime or composite? (Prime)
15. How do you know? (Its only factors are 1 and itself.)
16. What is an array your group came up with for 14? ( $1 \times 14$  and  $2 \times 7$  are both acceptable answers.)
17. Were there any other arrays you were able to create? (Yes, take answers until both have been said.)
18. What are the factors of 14? (1, 2, 7, 14)
19. Is 14 prime or composite? (Composite)
20. What is an array your group came up with for 15? ( $1 \times 15$  and  $3 \times 5$  are both acceptable answers.)
21. Were there any other arrays you were able to create? (Yes, take answers until both have been said.)
22. What are the factors of 15? (1, 3, 5, 15)
23. Is 15 prime or composite? (Composite)

## Intervention

- Ask students to work through number 25 on the sheet. Eliminate questions about 6, 8, 9, and 10 multiples. Focus on multiples of 2, 3, 4, and 5. Use red tiles for multiples of 2, yellow tiles for multiples of 3, green tiles for multiples of 4, and blue tiles for multiples of 5.

**Example:** Start with one row of two blue tiles to represent  $1 \times 2$ . Add another row of blue tiles to represent  $2 \times 2$ . Continue adding a row until you get to 24 on the chart. Fill in the chart as these discoveries are made. Follow the same protocol with multiples of 3. Start with one row of three yellow tiles to represent  $1 \times 3$ . Add another row of three yellow tiles to represent  $2 \times 3$ .

## Extension

- Put two groups together and have students continue with numbers 51-100. Encourage students to further explore the idea of square numbers. They've investigated 12 through 72 with this exercise. Using color tiles, they can explore through 202.

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## Factors and Squares Worksheet

**Directions:** Fill in the chart. Follow the steps listed below, then answer the questions below the chart.

1. Put a star next to all the Number of Tiles that have a factor of 2.
2. Circle all the Number of Tiles that have a factor of 3.
3. Underline all the Number of Tiles that have a factor of 4.
4. Put a square around all the Number of Tiles that have a factor of 5.
5. Put a smile next to all the Number of Tiles that have a factor of 7.
6. Highlight the Number of Tiles that are perfect squares.

| Number of Tiles | Possible Rectangle Dimensions | Factors | Prime or Composite |
|-----------------|-------------------------------|---------|--------------------|
| 1               |                               |         |                    |
| 2               |                               |         |                    |
| 3               |                               |         |                    |
| 4               |                               |         |                    |
| 5               |                               |         |                    |
| 6               |                               |         |                    |
| 7               |                               |         |                    |
| 8               |                               |         |                    |
| 9               |                               |         |                    |
| 10              |                               |         |                    |
| 11              |                               |         |                    |
| 12              |                               |         |                    |
| 13              |                               |         |                    |
| 14              |                               |         |                    |
| 15              |                               |         |                    |
| 16              |                               |         |                    |
| 17              |                               |         |                    |
| 18              |                               |         |                    |
| 19              |                               |         |                    |
| 20              |                               |         |                    |
| 21              |                               |         |                    |
| 22              |                               |         |                    |
| 23              |                               |         |                    |
| 24              |                               |         |                    |
| 25              |                               |         |                    |
| 26              |                               |         |                    |
| 27              |                               |         |                    |
| 28              |                               |         |                    |
| 29              |                               |         |                    |
| 30              |                               |         |                    |
| 31              |                               |         |                    |
| 32              |                               |         |                    |
| 33              |                               |         |                    |
| 34              |                               |         |                    |
| 35              |                               |         |                    |

Name: \_\_\_\_\_

## Factors and Squares Worksheet Continued

| Number of Tiles | Possible Rectangle Dimensions | Factors | Prime or Composite |
|-----------------|-------------------------------|---------|--------------------|
| 36              |                               |         |                    |
| 37              |                               |         |                    |
| 38              |                               |         |                    |
| 39              |                               |         |                    |
| 40              |                               |         |                    |
| 41              |                               |         |                    |
| 42              |                               |         |                    |
| 43              |                               |         |                    |
| 44              |                               |         |                    |
| 45              |                               |         |                    |
| 46              |                               |         |                    |
| 47              |                               |         |                    |
| 48              |                               |         |                    |
| 49              |                               |         |                    |
| 50              |                               |         |                    |

1. List the multiples of 2 from your list: \_\_\_\_\_  
 \_\_\_\_\_

2. List the multiples of 3 from your list: \_\_\_\_\_  
 \_\_\_\_\_

3. List the multiples of 4 from your list: \_\_\_\_\_  
 \_\_\_\_\_

4. List the multiples of 5 from your list: \_\_\_\_\_  
 \_\_\_\_\_

5. List the multiples of 7 from your list: \_\_\_\_\_  
 \_\_\_\_\_

6. List the perfect squares from your list: \_\_\_\_\_  
 \_\_\_\_\_

**Bonus**

7. On what other two lists are **all** the multiples of 6 written on? \_\_\_\_\_

8. On what other two lists are **all** the multiples of 8 written on? \_\_\_\_\_

9. On what other list are **all** the multiples of 9 written on? \_\_\_\_\_

10. On what other two lists are **all** the multiples of 10 written on? \_\_\_\_\_

Name: \_\_\_\_\_

## Factors and Squares Worksheet Answer Key

**Directions:** Fill in the chart. Follow the steps listed below, then answer the questions below the chart.

1. Put a star next to all the Number of Tiles that have a factor of 2.
2. Circle all the Number of Tiles that have a factor of 3.
3. Underline all the Number of Tiles that have a factor of 4.
4. Put a square around all the Number of Tiles that have a factor of 5.
5. Put a smile next to all the Number of Tiles that have a factor of 7.
6. Highlight the Number of Tiles that are perfect squares.

| Number of Tiles | Possible Rectangle Dimensions                       | Factors                   | Prime or Composite |
|-----------------|---|---------------------------|--------------------|
| 1               | $1 \times 1$ ( $1^2$ )                              | 1                         | Neither            |
| 2               | $1 \times 2$  | 1, 2                      | Prime              |
| 3               | $1 \times 3$  | 1, 3                      | Prime              |
| 4               | $1 \times 4, 2 \times 2$ ( $2^2$ )                  | 1, 2, 4                   | Composite          |
| 5               | $1 \times 5$  | 1, 5                      | Prime              |
| 6               | $1 \times 6, 2 \times 3$                            | 1, 2, 3, 6                | Composite          |
| 7               | $1 \times 7$  | 1, 7                      | Prime              |
| 8               | $1 \times 8, 2 \times 4$                            | 1, 2, 4, 8                | Composite          |
| 9               | $1 \times 9, 3 \times 3$ ( $3^2$ )                  | 1, 3, 9                   | Composite          |
| 10              | $1 \times 10, 2 \times 5$                           | 1, 2, 5, 10               | Composite          |
| 11              | $1 \times 11$                                       | 1, 11                     | Prime              |
| 12              | $1 \times 12, 2 \times 6, 3 \times 4$               | 1, 2, 3, 4, 6, 12         | Composite          |
| 13              | $1 \times 13$                                       | 1, 13                     | Prime              |
| 14              | $1 \times 14, 2 \times 7$                           | 1, 2, 7, 14               | Composite          |
| 15              | $1 \times 15, 3 \times 5$                           | 1, 3, 5, 15               | Composite          |
| 16              | $1 \times 16, 2 \times 8, 4 \times 4$ ( $4^2$ )     | 1, 2, 4, 8, 16            | Composite          |
| 17              | $1 \times 17$                                       | 1, 17                     | Prime              |
| 18              | $1 \times 18, 2 \times 9, 3 \times 6$               | 1, 2, 3, 6, 9, 18         | Composite          |
| 19              | $1 \times 19$                                       | 1, 19                     | Prime              |
| 20              | $1 \times 20, 2 \times 10, 4 \times 5$              | 1, 2, 4, 5, 10, 20        | Composite          |
| 21              | $1 \times 21, 3 \times 7$                           | 1, 3, 7, 21               | Composite          |
| 22              | $1 \times 22, 2 \times 11$                          | 1, 2, 11, 22              | Composite          |
| 23              | $1 \times 23$                                       | 1, 23                     | Prime              |
| 24              | $1 \times 24, 2 \times 12, 3 \times 8, 4 \times 6$  | 1, 2, 3, 4, 6, 8, 12, 24  | Composite          |
| 25              | $1 \times 25, 5 \times 5$ ( $5^2$ )                 | 1, 5, 25                  | Composite          |
| 26              | $1 \times 26, 2 \times 13$                          | 1, 2, 13, 26              | Composite          |
| 27              | $1 \times 27, 3 \times 9$                           | 1, 3, 9, 27               | Composite          |
| 28              | $1 \times 28, 2 \times 14, 4 \times 7$              | 1, 2, 4, 7, 14, 28        | Composite          |
| 29              | $1 \times 29$                                       | 1, 29                     | Prime              |
| 30              | $1 \times 30, 2 \times 15, 3 \times 10, 5 \times 6$ | 1, 2, 3, 5, 6, 10, 15, 30 | Composite          |
| 31              | $1 \times 31$                                       | 1, 31                     | Prime              |
| 32              | $1 \times 32, 2 \times 16, 4 \times 8$              | 1, 2, 4, 8, 16, 32        | Composite          |
| 33              | $1 \times 33, 3 \times 11$                          | 1, 3, 11, 33              | Composite          |
| 34              | $1 \times 34, 2 \times 17$                          | 1, 2, 17, 34              | Composite          |
| 35              | $1 \times 35, 5 \times 7$                           | 1, 5, 7, 35               | Composite          |

Name: \_\_\_\_\_

## Factors and Squares Worksheet Answer Key Continued

| Number of Tiles | Possible Rectangle Dimensions   | Factors                      | Prime or Composite |
|-----------------|---|------------------------------|--------------------|
| 36              | $1 \times 36, 2 \times 18, 3 \times 12, 4 \times 9, 6 \times 6 (6^2)$ | 1, 2, 3, 4, 6, 9, 12, 18, 36 | Composite          |
| 37              | $1 \times 37$   | 1, 37                        | Prime              |
| 38              | $1 \times 38, 2 \times 19$  | 1, 2, 19, 38                 | Composite          |
| 39              | $1 \times 39, 3 \times 13$  | 1, 3, 13, 39                 | Composite          |
| 40              | $1 \times 40, 2 \times 20, 4 \times 10, 5 \times 8$                   | 1, 2, 4, 5, 8, 10, 20, 40    | Composite          |
| 41              | $1 \times 41$   | 1, 41                        | Prime              |
| 42              | $1 \times 42, 2 \times 21, 3 \times 14, 6 \times 7$                   | 1, 2, 3, 6, 7, 14, 21, 42    | Composite          |
| 43              | $1 \times 43$   | 1, 43                        | Prime              |
| 44              | $1 \times 44, 2 \times 22, 4 \times 11$                               | 1, 2, 4, 11, 22, 44          | Composite          |
| 45              | $1 \times 45, 3 \times 15, 5 \times 9$                                | 1, 3, 5, 9, 15, 45           | Composite          |
| 46              | $1 \times 46, 2 \times 23$  | 1, 2, 23, 46                 | Composite          |
| 47              | $1 \times 47$   | 1, 47                        | Prime              |
| 48              | $1 \times 48, 2 \times 24, 3 \times 16, 4 \times 12, 6 \times 8$      | 1, 2, 3, 4, 6, 8, 12, 24, 48 | Composite          |
| 49              | $1 \times 49, 7 \times 7 (7^2)$                                       | 1, 7, 49                     | Composite          |
| 50              | $1 \times 50, 2 \times 25, 5 \times 10$                               | 1, 2, 5, 10, 25, 50          | Composite          |

- List the multiples of 2 from your list: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50
- List the multiples of 3 from your list: 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48
- List the multiples of 4 from your list: 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48
- List the multiples of 5 from your list: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50
- List the multiples of 7 from your list: 7, 14, 21, 28, 35, 42, 49
- List the perfect squares from your list: 1, 4, 9, 16, 25, 36, 49

**Bonus**

- On what other two lists are **all** the multiples of 6 written on? Multiples of 2 and 3
- On what other two lists are **all** the multiples of 8 written on? Multiples of 2 and 4
- On what other list are **all** the multiples of 9 written on? Multiples of 3
- On what other two lists are **all** the multiples of 10 written on? Multiples of 2 and 5