Nasco Education

LESSON PLAN

Math

Developed with Kristin Ulrich

Using color tiles to teach factors and squares

Volume 16 | Gr. 3-5

Time: 60-75 mins.

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 x 5 = 40, one knows that 40 ÷ 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.

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 ...

- 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

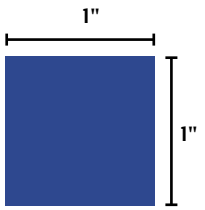
Materials

- Plastic Square Color Tiles (**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)

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.

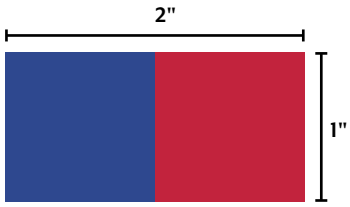
Activity



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 x 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 x 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 x 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 x 1)*, but tell them that since 2 x 1 uses the same factors as 1 x 2, 2 x 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 x 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 x 2. Since 2 x 2 also equals 4, and it uses different factors than 1 x 4, 2 x 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.

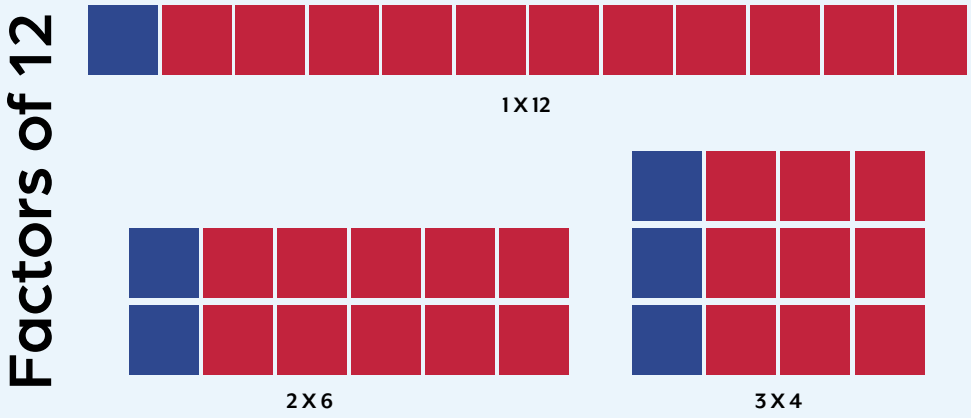
8. Have students take another look at the 2 x 2 rectangle they've created. Ask what other name can be applied to that shape *(square)*. Point out that the two factors they multiplied to get that square are exactly the same. When the same number is multiplied by itself to get a product, they are finding 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 x 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 x 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 x 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 x 12, 2 x 6, and 3 x 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 x 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 x 14 and 2 x 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 x 15 and 3 x 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 x 2. Add another row of blue tiles to represent 2 x 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 x 3. Add another row of three yellow tiles to represent 2 x 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.

Factors and squares — **worksheet**

Name: _____ Date: _____

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			
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33			
34			
35			

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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? _____

Factors and squares — **answer key**

Volume 16

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 x 1 (1^2)	1	Neither
2	1 x 2	1, 2	Prime
3	1 x 3	1, 3	Prime
4	1 x 4, 2 x 2 (2^2)	1, 2, 4	Composite
5	1 x 5	1, 5	Prime
6	1 x 6, 2 x 3	1, 2, 3, 6	Composite
7	1 x 7	1, 7	Prime
8	1 x 8, 2 x 4	1, 2, 4, 8	Composite
9	1 x 9, 3 x 3 (3^2)	1, 3, 9	Composite
10	1 x 10, 2 x 5	1, 2, 5, 10	Composite
11	1 x 11	1, 11	Prime
12	1 x 12, 2 x 6, 3 x 4	1, 2, 3, 4, 6, 12	Composite
13	1 x 13	1, 13	Prime
14	1 x 14, 2 x 7	1, 2, 7, 14	Composite
15	1 x 15, 3 x 5	1, 3, 5, 15	Composite
16	1 x 16, 2 x 8, 4 x 4 (4^2)	1, 2, 4, 8, 16	Composite
17	1 x 17	1, 17	Prime
18	1 x 18, 2 x 9, 3 x 6	1, 2, 3, 6, 9, 18	Composite
19	1 x 19	1, 19	Prime
20	1 x 20, 2 x 10, 4 x 5	1, 2, 4, 5, 10, 20	Composite
21	1 x 21, 3 x 7	1, 3, 7, 21	Composite
22	1 x 22, 2 x 11	1, 2, 11, 22	Composite
23	1 x 23	1, 23	Prime
24	1 x 24, 2 x 12, 3 x 8, 4 x 6	1, 2, 3, 4, 6, 8, 12, 24	Composite
25	1 x 25, 5 x 5 (5^2)	1, 5, 25	Composite
26	1 x 26, 2 x 13	1, 2, 13, 26	Composite
27	1 x 27, 3 x 9	1, 3, 9, 27	Composite
28	1 x 28, 2 x 14, 4 x 7	1, 2, 4, 7, 14, 28	Composite
29	1 x 29	1, 29	Prime
30	1 x 30, 2 x 15, 3 x 10, 5 x 6	1, 2, 3, 5, 6, 10, 15, 30	Composite
31	1 x 31	1, 31	Prime
32	1 x 32, 2 x 16, 4 x 8	1, 2, 4, 8, 16, 32	Composite
33	1 x 33, 3 x 11	1, 3, 11, 33	Composite
34	1 x 34, 2 x 17	1, 2, 17, 34	Composite
35	1 x 35, 5 x 7	1, 5, 7, 35	Composite

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

1. 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

2. List the multiples of 3 from your list: 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48

3. List the multiples of 4 from your list: 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48

4. List the multiples of 5 from your list: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

5. List the multiples of 7 from your list: 7, 14, 21, 28, 35, 42, 49

6. List the perfect squares from your list: 1, 4, 9, 16, 25, 36, 49

Bonus

7. On what other two lists are **all** the multiples of 6 written on? Multiples of 2 and 3

8. On what other two lists are **all** the multiples of 8 written on? Multiples of 2 and 4

9. On what other list are **all** the multiples of 9 written on? Multiples of 3

10. On what other two lists are **all** the multiples of 10 written on? Multiples of 2 and 5