Factor Frenzy: Common Factors and Greatest Common Factor

Strand: Computation and Estimation

Topic: Determining factors, common factors, and greatest common factor

Primary SOL: 4.5   The student will
    a) determine common multiples and factors, including least common multiple and greatest common factor

Related SOL: 4.2ab, 4.4a

Materials

- Multiplication table
- Finding the Greatest Common Factor activity sheet (attached)
- Factor Frenzy Game Directions (attached)
- Factor Frenzy Game Recording Sheet (attached)
- Factor Frenzy Game Board (attached)
- Common Factors Venn Diagram activity sheet (attached)
- Game markers (e.g., checkers, colored chips, colored cubes) in two different colors
- Two large paper clips, per pair of students

Vocabulary

common factors, divisor, factor, factor pair, greatest common factor (GCF), multiple, product

Student/Teacher Actions: What should students be doing? What should teachers be doing?

1.   Write the mathematical term *factor* on the board, and ask students to think about what comes to mind when they see this word. Then ask students to share some of their ideas, listening for the following conversations or thoughts: a number that, when multiplied by a number, produces a product; a number that is multiplied to get a product; a number that can divide evenly into a number.

    a. Then set up two lists. As a suggestion, see the one pictured below. Headings should be titled "factor" and "not a factor." Write the number 24 and then start calling out numbers, some factors and some not factors, and have children show a thumbs-up if what you called is a factor or a thumbs-down if what you called is not a factor. After the class reaches consensus, write the number you called under the correct heading. Suggested numbers to use for the lists are included in the following graphic:

24	
Factor	**Not a Factor**
1 24 12 6 8 4 3 2	48 5 9 7 10 18

b. Use the factors organized in the lists and student ideas volunteered when describing a factor and in deciding whether a number was a factor or not to work as a class and develop a definition for the term *factor*. Write on the board, "*A factor is ____,*" and ask students to use the sentence frame to write a definition and give an example of a number and its factors. Allow time for the students to work on their definitions. Call on several volunteers to share and record their definitions on the board. When you have a few reasonable definitions on the board, ask students to come to a consensus on a mathematical definition for *factor*, given their suggestions.

2. Next, have students determine the factors for 12. Prompt them to give the *factor pairs*, not just one number. For example, if a student says that 4 is a factor of 12, ask how they know that. The response should be: "Because 4 x 3=12," or "Because 4 groups of 3 equals 12," or "3 groups of 4 equals 12." Ask students whether they can draw a picture that would justify that 4 x 3 = 12. Ask students to work in groups to determine the other factor pairs for 12. After some time working, have students share out the other factor pairs. The students should share 1 x 12 = 12, 2 x 6 = 12, and 3 x 4 = 12. Record these on the board, and ask, "What do you notice about the pairs?" If a student shares, for instance, 4 x 3 = 12 after 3 x 4 =12 has been shared, have a class discussion regarding how the factor pair still uses the same two factors, even though the order of the factors is reversed.

3. Pose the following to students. "Using the lists of factors we have generated for 12 and 24, what similarities and differences do you see?" Have student pairs discuss. Listen carefully for students who notice that the numbers have common factors. Once you hear this, guide the conversation to share this idea. Ask students to share the common factors of 12 and 24. Ask: *"Are there any strategies we could use to ensure that we have found all of the common factors that 12 and 24 have?" "Would organizing the factors in some way be helpful to be sure we have identified all common factors?"* Monitor discussions, paying close attention to organization strategies students may use to determine the common factors, including writing both sets of factors in a table or list in numerical order. Have students share organization strategies and common factors (1, 2, 3, 4, 6, 12).

4. Model writing organized lists of factors for 24 and factors for 12, and record on the board as shown below.

Factors of 12: 1, 2, 3, 4, 6, 12

Factors of 24: 1, 2, 3, 4, 6, 8, 12, 24

Ask, *"What is the greatest common factor of 12 and 24?"* Record the common factors.

Common factors of 12 and 24: 1, 2, 3, 4, 6, 12

Discuss what the greatest common factor is. Write this information on the board.

Greatest Common Factor of 12 and 24: 12

Call on volunteers to explain in words what the greatest common factor represents. Ask whether there could be more than one greatest common factor, and have students explain their thinking. At this time, also mention the abbreviation GCF can be used for greatest common factor. Ask, "So, if 12 is a factor of 24, is it surprising that 2, 3, 4, and 6 are also factors of 24?"

5. Now give students an opportunity to apply organizational strategies to identify factors, common factors, and the greatest common factor of several numbers. Distribute the Finding the Greatest Common Factor activity sheet, and let students work alone for 5–10 minutes. Circulate around the room to gain a sense of who has some understanding of how to find the greatest common factor and who is having difficulty. Then pair students with a peer of similar ability. Seat the pairs that need help close to each other so that you can work with those pairs.

6. After student pairs have completed their activity sheet, take a few minutes to debrief the activity.

7. Distribute the Factor Frenzy Game Recording Sheet and the Factor Frenzy Game Board to each pair, as well as two large paper clips and two colors of cubes/chips to use as markers. Model with the class how to play the game using the directions on the Recording Sheet. Have pairs of students play the Factor Frenzy Game, applying the strategies they have been using throughout the lesson. If pairs finish early, have them draw another recording form on notebook paper and play again. Students who had difficulty in independent practice should work in a guided group with the teacher to continue to reinforce the concept of finding common factors and greatest common factor.

8. After giving some time for the students to play the game, ask, *"What were some of the strategies you used to play this game?" "How did this game help you practice multiplication facts? Division facts?"* Have students share with their partner how they could have made the game more challenging.

Assessment

- **Questions**
  - What is the greatest common factor for 12 and 18? Explain how you know your answer is correct.
  - When playing the Factor Frenzy Game, is it important to know what numbers your opponent has covered? Why, or why not?
  - When playing the Factor Frenzy Game, is it important to know what numbers your opponent needs to cover to win? Why, or why not?
  - When playing the Factor Frenzy Game, is it important to know what numbers you have covered? Why, or why not?
  - When playing the Factor Frenzy Game, is it important to know what numbers you need to cover to win? Why, or why not?
  - If you need to cover 54, what factors could possibly work?

- **Journal/writing prompts**
  - Given the numbers 36 and 45, explain how to find the greatest common factor.
  - Given the numbers 42 and 12, explain why 5 could not be a greatest common factor.
  - Explain why 23 and 17 only have 1 as a common factor.
  - Explain why the greatest common factor for 14 and 28 is 14.

- **Other Assessments**
  - On an exit ticket, explain how knowing the factors of a number are helpful in mathematics.

Extensions and Connections

- View the Khan Academy video, [The Greatest Common Factor Explained](#).
- Have students complete the Common Factors Venn Diagram activity sheet (attached) to continue practice with finding the greatest common factor.
- Find the greatest common factor for 6, 12, and 15. How can a Venn diagram with three circles be used to organize the factors?
- Solve the problem, "How can you split 24 cookies and 18 drinks into equal groups so that all the cookies and drinks are used?" Teacher answer key: Because 6 is the greatest common factor, if there are 6 groups, each group could have 4 cookies and 3 drinks. Students may draw pictures or make charts and may not realize they are finding the greatest common factor, so have a class discussion based on their solutions.
- Solve the following problem. Hot dogs come 10 to a package. Hot dog buns come 8 to a package. If we want one hot dog for each bun for a picnic with none left over, what is the fewest number of whole packages each we need to buy? How many packages of each item would we have to buy? Teacher answer key: Because 40 is the least common multiple for 8 and 10, you need to buy 4 packages of hot dog buns and 5 packages of hot dogs. Students may draw pictures or make charts and may not realize they are finding the least common multiple, so have a class discussion based on their solutions.
- What is the difference between a multiple and a factor?
- Using the numbers 18 and 24, find the greatest common factor. Then find the least common multiple. Then explain the similarities and differences in the process to find each.

Strategies for Differentiation

- Provide a multiplication table or a calculator for use during the activities.
- Provide a hundreds chart.
- Create an anchor chart, including a definition and strategies for determining factors, common factors, and greatest common factors.

Note: The following pages are intended for classroom use for students as a visual aid to learning.

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Finding the Greatest Common Factor (GCF)

Directions: For each pair of numbers, answer the questions that help you identify the greatest common factor.

The pair of numbers	Factors of the first number	Factors of the second number	Common Factors	Greatest Common Factor (GCF)
6 and 15				
12 and 28				
12 and 17				
24 and 64				
35 and 55				
27 and 18				

Factor Frenzy Game Directions

Materials

- Factor Frenzy Game Board
- A pile of game markers (e.g., checkers, colored chips, colored cubes) in two different colors
- Two large paper clips

Object of Game

To be the first player to cover four squares in a row horizontally, diagonally, or vertically on the Factor Frenzy Game Board.

Directions

1. Each player tosses a game marker onto the game board. The player whose marker lands on the largest number chooses a game-marker color, collects a pile of markers in that color, and becomes player 1. Player 2 collects a pile of markers in the other color.

2. Player 1 places two paper clips at the bottom of the game board so that they point to two different factors. Then, player 1 multiplies the two factors and places one of his/her game markers on the product square on the game board. Player 1 records the factors and product on the Factor Frenzy Game Recording Sheet.

3. Player 2 slides *one* paper clip to point to a different factor, leaving the other paper clip in place. It is permitted to slide the paper clip to point to the same factor as the other paper clip. Then, player 2 multiplies the two factors and places one of his/her game markers on the product square. Player 2 records his/her play on the recording sheet.

4. Players take turns sliding *one* paper clip, multiplying the two factors, covering the product, and recording the play. The first player to cover four squares in a row horizontally, vertically, or diagonally wins!

Tip: Try to figure out in advance what product(s) you need next in order to cover four squares in a row. Then, see whether you can move a paper clip to achieve one of those products!

Factor Frenzy Game Recording Sheet

PLAYER	FACTORS	PRODUCT
1	__ × __	
2	__ × __	
1	__ × __	
2	__ × __	
1	__ × __	
2	__ × __	
1	__ × __	
2	__ × __	
1	__ × __	
2	__ × __	
1	__ × __	
2	__ × __	
1	__ × __	
2	__ × __	

Factor Frenzy Game Board

1	2	3	4	5	6
7	8	9	10	12	14
15	16	18	20	21	24
25	27	28	30	32	35
36	40	42	45	48	49
54	56	63	64	72	81

Factors

1 2 3 4 5 6 7 8 9

Common Factors Venn Diagram

Name _____ **Date** _____

Directions

1. Write the two given numbers in the boxes above the circles.

2. List the factors of each number in the circle below the box, placing <u>common factors</u> in the overlapping parts of the two circles.

3. Identify and circle the <u>greatest common factor</u> (<u>GCF</u>) of the two given numbers (i.e., the largest number in the overlapping parts).
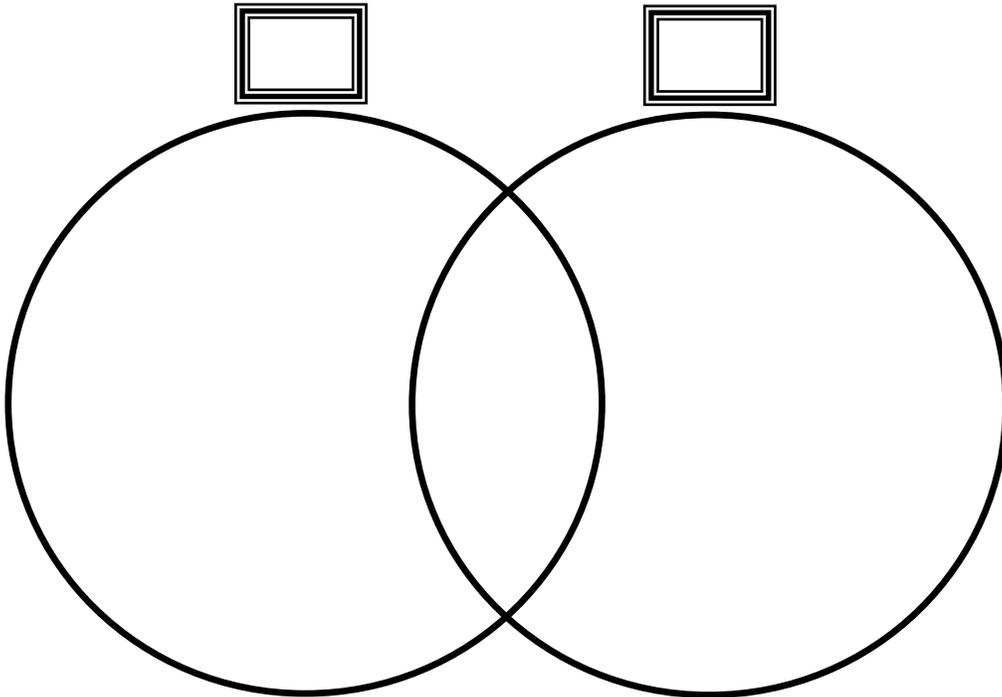
4. Explain the diagram to someone who does not know what it means.