



Name: _____ Date: _____

Student Exploration: Finding Factors with Area Models

Vocabulary: composite number, factor, prime number, prime factorization

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

1. Write two different pairs of whole numbers that multiply to 8. _____

Each number you listed above is a **factor** of 8 – that is, each one is a whole number that divides 8 with no remainder. Each pair is called a *factor pair* for 8.

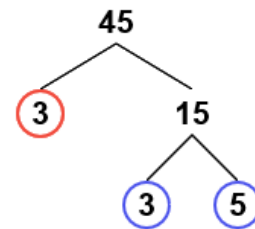
2. In the blanks below, list as many factor pairs for 18 and 19 as you can.

A. 18 _____ B. 19 _____

A **composite number** is a number that has more than two factors. A number with only one pair of factors (1 and itself) is called a **prime number**.

Gizmo Warm-up

In the *Finding Factors with Area Models* Gizmo, you can factor any number from 2 to 100 using factor trees. A sample factor tree is shown to the right.



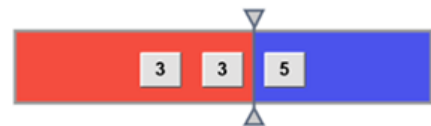
1. Set the **Number to be factored** slider to 45.

A. Which two factors of 45 appear as the first factor pair, at the top of the factor tree? _____

B. What are the length and width of the green rectangle in the Gizmo? _____

C. What is the area of that rectangle? _____

2. In the top right corner of the Gizmo is a red-and-blue box with number tiles in it. Move the vertical probe in the box to the right, so it sits between 3 and 5, as shown to the right.




A. What factor pair now appears at the top of the factor tree? _____

B. What are the dimensions of the green rectangle now? _____

C. Did the area of the rectangle change? _____



Activity A: Factor pairs and area models	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> Set the Number to be factored to 12. 	
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1. Before using the Gizmo, consider the number 12, and its factors.

- A. List all the factor pairs of 12. _____
- B. In the Gizmo, the first factor pair at the top of the “12” factor tree should be 2 and 6. Fill in the first row of the table below about this factor pair of 12.

Factor pair	Factor tree	Rectangle	Area
2 and 6			

- C. Move the vertical probe in the red-and-blue box to find another factor pair for 12. Record your observations for that pair in the second row of the table above.
- D. One factor pair of 12 is not shown in the Gizmo. What is it? _____

2. Set the **Number to be factored** to 60.

- A. List the factor pairs that you get by moving the vertical probe in the red-and-blue box.
- _____
- B. The number tiles in the red-and-blue box can be moved. Drag the 3 to the left to turn 2, 2, 3, 5 into 3, 2, 2, 5. What additional factor pairs can you get with this new order?
- _____
- C. Which factor pair of 60 is not shown in the Gizmo? _____

(Activity A continued on next page)



Activity A (continued from previous page)

3. Set the **Number to be factored** to 53.

A. What are the factors of 53? _____

B. Based on that, what type of number is 53? _____ Explain. _____

4. The factors of any number always include 1 and the number itself, but the Gizmo does not always show this pair. Explore several other **Numbers to be factored** in the Gizmo.

A. List three other numbers that show only 1 and itself as factors. _____

B. Why do you think the Gizmo handles these numbers in this way? _____

5. This Gizmo represents numbers as a green rectangle. Some numbers can be shown as a square. Use the Gizmo to explore which numbers can be represented in this way.

A. Circle the numbers in the list below that can be represented by a square area model. (Remember, for some numbers, you may have to reorder the number tiles in the red-and-blue box to be able to come up with the square.)

4 5 9 20 36 64 70

B. What do these numbers have in common? _____

C. Name another number that you think could be represented with a square area model. _____ Use the Gizmo to check your answer.

6. List all the factor pairs for each number below. Then use the Gizmo to check your answers.

A. 27 _____

B. 63 _____

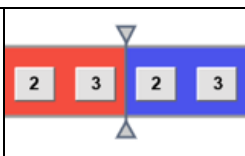
C. 79 _____

D. 80 _____

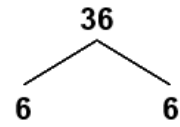
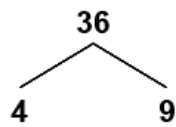
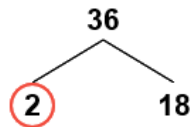
E. 81 _____

F. 99 _____



Activity B: Prime factorization	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> Set the Number to be factored to 36. 	
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- In the Gizmo, be sure that the **Number to be factored** is set to 36.
 - Use the Gizmo to complete the factor trees for 36. Be sure to circle the number at the end of each branch, like the Gizmo does.



- What type of number are all the circled numbers? _____
- How are the factor trees of 36 different? _____
- How are they similar? _____
- How are the circled numbers in each factor tree related to the number 36? _____

- The product of the prime factors of a number is called its **prime factorization**. Write the prime factorization of 36. _____

- Set the **Number of be factored** to 90.
 - Write 90 as a product of prime numbers. _____
 - Is it possible to have two different prime factorizations of the same number? _____
Why or why not? _____

(Activity B continued on next page)



Activity B (continued from previous page)

3. In the spaces below, create factor trees for the numbers given. Use the factor tree to write the prime factorizations in the blanks. Be sure to use exponents and write the factors in order from least to greatest. Then check your answers in the Gizmo.

A. $16 =$ _____

C. $56 =$ _____

B. $38 =$ _____

D. $96 =$ _____

4. Invent a way to use the Gizmo to come up with the prime factorization of 1000. (Remember, the Gizmo can only factor numbers up to 100.)

A. Explain your method. _____

B. Show your factor tree for 1000 in the space below.

