



***Mathematics**

Problem Solving and Factorization

Noah had a complex problem of many variables that he needed to solve--how do you build an ark, where do obtain two of each type of animal, how much food to feed the animals, and more. These factors, and a host of others, proved for a while to stump Noah. But in time he prevailed, as will students problem-solving to find the perfect "prime," factor that is.

Kentucky Mathematics Arts

Number Computation (2.7, 2.8, 2.12) Grades 4-6

Academic Expectations:

2.7 Students understand number concepts and use numbers appropriately and accurately.

2.8 Students understand various mathematical procedures and use them appropriately and accurately.

2.12 Students understand mathematical structure concepts including the properties and logic of various mathematical systems.

Ohio Mathematics Standards: Number, Number Sense and Operations

Benchmarks Grade 4

E. Recognize and classify numbers as prime or composite and list factors.

K. Analyze and solve multi-step problems involving addition, subtraction, multiplication and division of whole numbers.

Grades 5-6

G. Apply and explain the use of prime factorizations, common factors, and common multiples in problem situations.

Objective

Students will:

- Recognize the defining characteristic(s) for prime and composite numbers.
- Solve multi-step problems that factor in prime numbers.

Assessment

Student will be able to:

- Find the prime factors of a given number.
- Compare the prime factors of numbers to solve a problem.
- Identify and explain steps that are needed to solve multi-step problems that factor in prime numbers.

Sample selected response items to gauge student understanding:

1. Which of the following numbers is **NOT** a prime number?

- a. 3
- b. 9
- c. 13

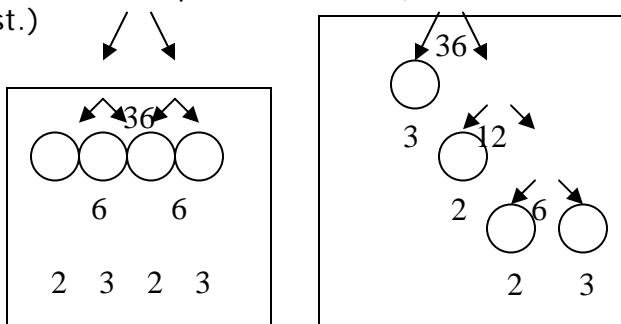
Answer: 9

2. What would be the next prime number in this sequence? 5, 7, 11, 13, _____.

Answer: 17

3. Start with the number 36. Show all of the steps needed to reduce this number down into its prime factors. (List all factors from least to greatest.)

Answer: (strategies)



Vocabulary

- Prime number
- Composite number
- Factor
- Prime factor/factorization

Materials

- Handout (optional)
- Pencils
- Paper
- Calculator (optional)

Activity

Noah's Favorite Number

Teacher will:

Optional: Make enough copies of the Handout, "Noah's Favorite Number" for each student.

1. Recall the stanza from song from the Children's Theatre Production, *Noah's Ark*, "Everything has order. Every animal in its place. Coming through two by two with majesty and grace."
2. Emphasize the importance of the number two in the story. Explain to students the number two as a "prime number or factor."
3. Introduce or review the concept of "prime and composite numbers."
 - a. Prime- a number that has two distinct number divisors—1 and the prime number itself. The first ten numbers are 2, 3, 5, 7, 11, 13, 17, 19, 23, and 29.
 - b. Composite-a counting number/positive integer divisible by one or more numbers other than itself and 1. The first ten numbers are 4, 6, 8, 9, 10, 12, 14, 15, 16, and 18.
4. Present a variety of numbers and have students identify if they are prime or composite numbers.

5. Present four different numbers to the students (e.g., 70, 128, 300, 810) and have students to identify the number that is Noah's favorite number using "prime factorization" and their problem solving skills. (Noah's favorite number is the one that has only 2's as its prime factors (e.g., $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$). Students will list all of the prime factors for each given number from least to greatest. The Handout, "Noah's Favorite Number" may be used for this step.
6. Challenge students to identify other numbers that Noah would like (e.g., numbers that only have 2's for their prime factors.)
7. Have students compare and contrast with classmates their use of multiple methods and strategies for finding prime factors.



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Handout: Noah's Favorite Number

Name _____

Noah's Favorite Number

Directions: Use prime factorization to find out which of the following four numbers is Noah's favorite number. State your reason for choosing this number at the bottom of this paper.

| | |
|----------------|----------------|
| 300 / \ | 128 / \ |
| Prime Factors: | Prime Factors: |
| 810 / \ | 70 / \ |
| Prime Factors: | Prime Factors: |

Noah's favorite number is _____ because _____.



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Handout: Answer Key: Noah's Favorite Number

Directions: Use prime factorization to find out which of the following four numbers is Noah's favorite number. State your reason for choosing this number at the bottom of this paper.

| | |
|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| <p>300 3 100 2 50 2 25 5 5</p> <p>Prime Factors: 2, 2, 3, 5, 5</p> | <p>128 2 64 2 32 2 16 4 8 2 2 2 4 2 2</p> <p>Prime Factors: 2, 2, 2, 2, 2, 2, 2</p> |
| <p>810 5 162 9 18 3 3 9 2 3 3</p> <p>Prime Factors: 2, 3, 3, 3, 3, 5</p> | <p>70 7 10 2 5</p> <p>Prime Factors: 2, 5, 7</p> |

Noah's favorite number is _____ 128 _____
because _____,

Noah collected 2 of every animal. The prime factors for 128 are all 2.