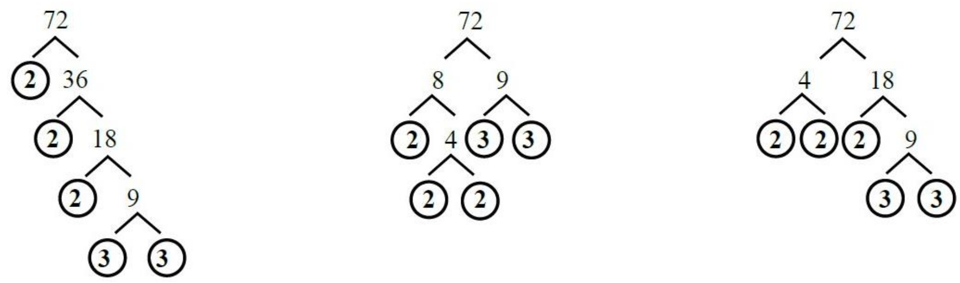
Prime Factorization Using the Factor Tree

Lecture Notes

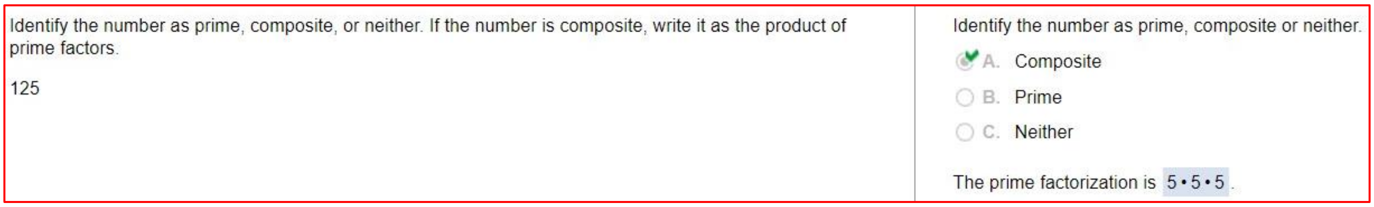
Notes

- **Prime Factorization** is listing all the prime numbers of a composite number in factored form.
  - Ex: the prime factorization of 18 is $2 \cdot 3 \cdot 3$
- A **factor tree** is an easy and a visual method to obtain prime factorization in factored form.
  - There is also a *Division Up Method*, but we will not cover it in this course.
- To use the factor tree method on a composite number, find two factors that equal the original number. For example (see below), you can use any two factors of 72 (except $1 \cdot 72$).
  - Use any pair of these factors: $2 \cdot 36$ or $8 \cdot 9$ or $4 \cdot 18$.
  - There is no right or wrong path (factors you choose) when using the factor tree.
  - Continue "breaking down" (factoring) each composite number until all you have left are prime numbers in that "branch" of the tree.
  - Circle the prime numbers as you go down the tree.
  - The process is done when the "ends" of all branches contain only prime numbers.

Example: Find the prime factorization of 72.



Notice that it does not matter which numbers you choose as factors along the way (which "path" you take). When finished, the same factors will be obtained. The prime factorization of 72 is **$2 \cdot 2 \cdot 2 \cdot 3 \cdot 3$**


Identify the number as prime, composite, or neither. If the number is composite, write it as the product of prime factors.

125

Identify the number as prime, composite or neither.

A. Composite

B. Prime

C. Neither

The prime factorization is $5 \cdot 5 \cdot 5$.

Identify the number as prime, composite or neither. If the number is composite, write it as the product of prime factors.

1155

Identify the number as prime, composite or neither.

- A. Prime
- B. Neither
- ✔ C. Composite

What is the prime factorization?

$3 \cdot 5 \cdot 7 \cdot 11$

(Type factors in order from smallest to largest.)

Identify the number as prime, composite or neither. If the number is composite, write it as the product of prime factors.

90

Identify the number as prime, composite or neither.

- A. Neither
- ✔ B. Composite
- C. Prime

What is the prime factorization?

$2 \cdot 3 \cdot 3 \cdot 5$

(Type factors in order from smallest to largest.)

Identify the number as prime, composite or neither. If the number is composite, write it as the product of prime factors.

245

Identify the number as prime, composite or neither.

- ✔ A. Composite
- B. Prime
- C. Neither

What is the prime factorization? $5 \cdot 7 \cdot 7$

(Type factors in order from smallest to largest.)

Find the prime factorization of 112.

The prime factorization is $2 \cdot 2 \cdot 2 \cdot 2 \cdot 7$.

(Type your answer in factored form. Do not include 1 as a factor.)

- Notice that the instructions say not to include 1 as a factor. And the reason is that 1 is not a prime number, it is neither prime nor composite.

Find the prime factorization of 294. Write your answer with exponents when repeated factors appear.

Which is the prime factorization of 294?

- A. $2 \cdot 3 \cdot 7^3$
- ✔ B. $2 \cdot 3 \cdot 7^2$
- C. $2 \cdot 3^2 \cdot 7$
- D. $2 \cdot 3 \cdot 7 \cdot 7$

- Notice that the instructions say to use *exponential form* for repeated factors.

Find the prime factorization of 343.

The prime factorization is 7^3.

(Write answers with exponents when repeated factors appear.)

Find the prime factorization of 117. Use exponents when repeated factors appear.

The prime factorization is $3^2 \cdot 13$.

Find the prime factorization of 225.	The prime factorization is $3 \cdot 3 \cdot 5 \cdot 5$.

Find the prime factorization of 675.	The prime factorization is $3 \cdot 3 \cdot 3 \cdot 5 \cdot 5$.