

Factors and Multiples

Factors are numbers or expressions that are multiplied together. A **prime number** is a whole number greater than 1 that has exactly two whole number factors, 1 and itself. The table shows all the prime numbers less than 100. A **composite number** is a whole number greater than 1 that has more than two whole number factors.

Prime Numbers Less Than 100

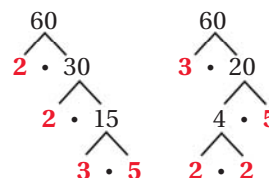
2, 3, 5, 7, 11, 13, 17, 19, 23,
29, 31, 37, 41, 43, 47, 53, 59,
61, 67, 71, 73, 79, 83, 89, 97

When you write a composite number as a product of prime numbers, you are writing its **prime factorization**.

EXAMPLE Write the prime factorization of 60.

Use a *factor tree*. Write 60 at the top. Then draw two branches and write 60 as the product of two factors. Continue to draw branches until all the factors are prime numbers. Two factor trees for 60 are given at the right. Both show $60 = 2 \cdot 2 \cdot 3 \cdot 5$.

▶ The prime factorization of 60 is $2^2 \cdot 3 \cdot 5$.



A whole number that is a factor of two or more nonzero whole numbers is a **common factor** of the numbers. The largest of the common factors is the **greatest common factor (GCF)**.

EXAMPLE Find the greatest common factor (GCF) of 18 and 45.

Method 1 List factors.

Factors of 18: 1, 2, 3, 6, **9**, 18

Factors of 45: 1, 3, 5, **9**, 15, 45

The GCF is 9, the greatest of the common factors.

Method 2 Use prime factorization.

Prime factorization of 18: $2 \cdot 3 \cdot 3$

Prime factorization of 45: $3 \cdot 3 \cdot 5$

The GCF is the product of the common prime factors: $3 \cdot 3 = 9$.

A **multiple** of a whole number is the product of the number and any nonzero whole number. A **common multiple** of two or more numbers is a multiple of all of the numbers. The **least common multiple (LCM)** is the smallest of the common multiples.

EXAMPLE Find the least common multiple (LCM) of 12 and 15.

Method 1 List multiples.

Multiples of 12: 12, 24, 36, 48, **60**, ...

Multiples of 15: 15, 30, 45, **60**, ...

The LCM is 60, the least of the common multiples.

Method 2 Use prime factorization.

Prime factorization of 12: $2^2 \cdot 3$

Prime factorization of 15: $3 \cdot 5$

Form the LCM of the numbers by writing each prime factor to the highest power it occurs in either number: $2^2 \cdot 3 \cdot 5 = 60$.