**What is the purpose of learning GCF, LCM, Factors and Prime Factorization?**

 Aside from the fact that you need to know these skills to pass the 6th grade and will use it in learning new math skills in the future, why do we really need this stuff?

**Factoring** is a common mathematical process used to break down the factors, or numbers, that multiply together to form another number. Some numbers have multiple factors. The number 24, for instance, results when you multiply the factors of 6 and 4, 8 and 3, 12 and 2, and 24 and 1. Factoring is useful in resolving various numbers-related problems.

**Usefulness**

When you divide a number by one of its factors, the result is another factor. For instance, 24 divided by the factor 3 yields 8. If you have a pie with eight pieces that you want to divide among four people, factoring helps you deduce that each person should get two pieces. Eight pieces divided by four people equals two pieces per person. Or four people times two pieces per person equals eight pieces.

**GCF**: Do we want to split things into smaller sections? Are we trying to figure out how many people we can invite? Are we trying to arrange something in rows or groups?

**LCM**: Do we have an event that will be repeating over and over? Will we have to purchase or get multiple items in order to have enough? Are we trying to figure out when something will happen again at the same time?

**Ex 1:** Scarlett is making identical balloon arrangements for a party. She has 32 maroon balloons, 24 white balloons and 16 orange balloons. She wants each arrangement to have the same number of each color. What is the greatest number of arrangements that she can have if every balloon is used?

**Ex 2:** Harmony has swimming lessons every fifth day and diving lessons every third day. If she had a swimming lesson and a diving lesson on May 5th, when will be the next date on which she has both swimming and diving lessons?

**Ex 3:** Boxes that are 12 inches tall are being stacked next to boxes that are 18 inches tall. What is the shortest height at which the two stacks will be the same height?

**Ex. 4:** You are making pumpkin pies for the bake sale. Piecrusts are sold in packages of 3. Pie filling is sold in 4-can packages. What is the least number of piecrusts and filling that you can buy to have the same number of each? How many packages of each should you buy?

**Prime Factorization and Factors**:

Prime Factorization (or integer factorization) is a commonly used mathematical problem often used to secure public-key encryption systems. A common practice is to use very large semi-primes (that is, the result of the multiplication of two prime numbers) as the number securing the encryption. In order to break it, they would have to find the **prime factorization** or more \*\*prime numbers\*\* that multiplied together result in the original number.

First off, a bit of elementary math review. What is a prime number? A **prime number** is any number that is only evenly divisible by 1 and itself. 2 is a prime number, as is 3, 5, 7, 11, 13, 17, and so on. There are an infinite number of prime numbers (that is numbers don’t get to a point where they are always divisible by something). Additionally, all numbers have exactly one prime factorization – that is to say, every number can be reached by multiplying some prime numbers together.

Computationally speaking, it’s relatively easy to generate a fairly large prime number. You go fairly high up in numbers and then check backwards – if this divisible by anything? So, we can generate our two prime numbers together. Then we multiply them together – simple enough. As a quick example, using easier to understand primes: 

Okay – so 589 is the result of multiplying these two primes together. You see – multiplying two numbers is a mathematically easy problem, and it scales well when you get into the bigger numbers. However, \*\*factoring\*\* numbers is a computationally difficult problem. It’s easy for smaller numbers, but once you start dealing with very large numbers, it can take computers, days, months, years, even centuries to solve. **There is no easy shortcut for factoring numbers** – it’s a trial and error process. You would have to try all of the primes that are less than 589 until you found which prime numbers that when multiplied together come to 589. This works for smaller numbers, but once you begin dealing with very large numbers the amount of possible numbers you need to check against each other becomes so large that even modern computers are not able to do it in a reasonable time frame.

**Your Notes:**