**Greatest Common Factor**

*The highest number that divides exactly into two or more numbers.
It is the "greatest" thing for simplifying fractions!*

**Greatest Common Factor** is made up of three words

* *Greatest*,
* *Common* and
* *Factor*

Let us start with the last word:

**What is a "Factor" ?**

Factors are the numbers you multiply together to get another number:



Sometimes we want to find ALL the factors of a number:

The factors of 12 are **1,2,3,4,6** and **12** ...

... because **2** × **6** = 12, or **4** × **3** = 12, or **1** × **12** = 12.

**What is a "Common Factor" ?**

Let us say you have worked out the factors of two or more numbers:

Example:

|  |
| --- |
| The factors of 12 are **1, 2, 3, 4, 6** and **12** |
| The factors of 30 are **1, 2, 3, 5, 6, 10, 15** and **30** |

Then the ***common* factors** are those that are found in both numbers:

* Notice that **1,2,3** and **6** appear in both lists?
* So, the **common factors** of 12 and 30 are: **1, 2, 3** and **6**

It is a *common* factor when it is a factor of two or more numbers.
(It is then *"common to"* those numbers.)

Here is another example:

Example: What are the common factors of 15, 30 and 105?

|  |
| --- |
| The factors of 15 are **1, 3, 5,** and **15** |
| The factors of 30 are **1, 2, 3, 5, 6, 10, 15** and **30** |
| The factors of 105 are **1, 3, 5, 7, 15, 21, 35** and **105** |

The factors that are common to all three numbers are **1, 3, 5** and **15**

In other words, the **common factors** of 15, 30 and 105 are **1, 3, 5** and **15**

**What is the "Greatest Common Factor" ?**

It is simply the **largest** of the common factors. In our previous example, the largest of the common factors is 15, so the **Greatest Common Factor** of 15, 30 and 105 **is 15**

The "Greatest Common Factor" is the largest of the common factors (of two or more numbers)

**Why is this Useful?**

One of the most useful things is when we want to simplify a fraction:

Example: How could we simplify **12/30** ?

At the top we found that the Common Factors of 12 and 30 were 1, 2, 3 and 6, and so the **Greatest Common Factor is 6**.

This means that the **largest** number we can divide both 12 and 30 evenly by is **6**, like this:

|  |  |  |
| --- | --- | --- |
|   | ÷ 6 |   |
| do  |
| 12 |  =  | 2 |
|  |  |
| 30 | 5 |
| do  |
|   | ÷ 6 |   |

The Greatest Common Factor of 12 and 30 is **6**.

And so **12/30** can be simplified to **2/5**

**Finding the Greatest Common Factor**

Here are three ways:

**1.** You can:

* find all **factors** of both numbers (I have an [All Factors Tool](http://www.mathsisfun.com/numbers/factors-all-tool.html) to help you),
* then select the ones that are **common** to both, and
* then choose the **greatest**.

Example:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Two Numbers** | **All Factors** | **Common Factors** | **GreatestCommon Factor** | ***Example SimplifiedFraction*** |
| 9 and 12 |  **9**: 1,3,9**12**: 1,2,3,4,6,12 | 1,3 | **3** | 9/12 » 3/4 |

And another example:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Two Numbers** | **All Factors** | **Common Factors** | **GreatestCommon Factor** | ***Example SimplifiedFraction*** |
| 6 and 18 |  **6**: 1,2,3,6**18**: 1,2,3,6,9,18 | 1,2,3,6 | **6** | 6/18 » 1/3 |

**2**. You can find the [prime factors](http://www.mathsisfun.com/../prime-factorization.html) and combine the common ones together:

|  |  |  |  |
| --- | --- | --- | --- |
| **Two Numbers** | **Thinking ...** | **GreatestCommon Factor** | ***Example SimplifiedFraction*** |
| 24 and 108 | **2** × **2** × 2 × **3** = 24, and**2** × **2** × **3** × 3 × 3 = 108 | 2 × 2 × 3 = **12** | 24/108 » 2/9 |

**3.** And sometimes you can just **play around** with the factors until you discover it:

|  |  |  |  |
| --- | --- | --- | --- |
| **Two Numbers** | **Thinking ...** | **GreatestCommon Factor** | ***Example SimplifiedFraction*** |
| 9 and 12 | **3** × 3 = 9 and **3** × 4 = 12 | **3** | 9/12 » 3/4 |

But in that case you had better be careful you have found the **greatest** common factor.

**Greatest Common Factor Tool**

There is another *easy* method, you can use our [Greatest Common Factor Tool](http://www.mathsisfun.com/greatest-common-factor-tool.html) to find it automatically.

**Other Names**

The "Greatest Common Factor" is often abbreviated to "GCF", and is also known as:

* the "Greatest Common Divisor (GCD)",
* the "Highest Common Factor (HCF)", and also
* the "Greatest Common Denominator".
* Numbers (Year 5, General)

What is the greatest common factor of 6 and 15?

A

2

B

3

C

6

D

15

|  |
| --- |
| What is the greatest common factor of 45 and 105?A15B25C35D45 |
| What is the greatest common factor of 24 and 40?A4B6C8D12 |

|  |
| --- |
| What is the greatest common factor of 27 and 126?A6B9C18D27  |
| What is the greatest common factor of 72 and 162?A9B18C20D24 |

|  |
| --- |
| What is the greatest common factor of 144, 216 and 324?A12B18C24D36 |