

# How to Solve: LCM and GCD

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YouTube Video Link to this Post is [LCM and GCD Basics](#), [LCM and GCD Advanced](#)

Following is covered in this post

- What is LCM and how to find LCM of 2 or more numbers using three methods.
- What is GCD and how to find GCD of 2 or more numbers using three methods.
  - Listing Out Multiples
  - Common Division Method
  - Prime Factorization Method
- How to find LCM and GCD of Exponents and Fractions.

## Properties of LCM and GCD

**Prop 1: LCM of 0 and any number does not exist**

- $\text{LCM}(0, a) = \text{Does not exist}$

**Prop 2: GCD of 0 and any number is equal to the number itself. (Because all whole numbers are factors of 0. So, a will be also be a factor of 0.)**

- $\text{GCD}(0, a) = a$

**Prop 3: LCM of 1 and any number is equal to the number itself**

- $\text{LCM}(1, a) = a$

**Prop 4: GCD of 1 and any number is equal to 1**

- $\text{GCD}(1, a) = 1$

**Prop 5: Product of two numbers = Product of their LCM and GCD**

- $a*b = \text{LCM}(a,b) * \text{GCD}(a,b)$

**Prop 6: LCM of two numbers is always a multiple of their GCD**

- $\text{LCM}(a,b) = \text{GCD}(a,b) * k$  [where k is an integer]

**Prop 7: LCM of two numbers always lies between the larger of the two numbers and the product of those two numbers**

- $\text{Larger}(a,b) \leq \text{LCM}(a,b) \leq a*b$

**Prop 8: GCD of two numbers is always smaller than or equal to the smaller of those two numbers**

- $\text{GCD}(a,b) \leq \text{Smaller}(a,b)$

**Prop 9: LCM of two numbers is equal to the larger of the two numbers when one number is multiple of other**

- $\text{LCM}(a,b) = \text{Larger}(a,b) \Rightarrow$  either a is a multiple of b or b is a multiple of a

**Prop 10: LCM of two numbers is equal to the product of those two numbers when the numbers are co-prime**

- $\text{LCM}(a,b) = a*b \Rightarrow$  a and b are co-prime numbers

Co-prime numbers are numbers which have only one factor in common (i.e. 1)

**Prop 11: GCD of two numbers is equal to the smaller of the two numbers when one number is multiple of other**

- $\text{GCD}(a,b) = \text{Smaller}(a,b) \Rightarrow$  either a is a multiple of b or b is a multiple of a

**Prop 12: GCD of two numbers is 1 when the numbers are co-prime**

- $\text{GCD}(a,b)=1 \Rightarrow$  a and b are co-prime numbers

**Prop 13: All numbers can be written as a multiple of their GCD**

- a and b can be written as a multiple of their GCD
- $a = \text{GCD}(a,b) * k$  [where k is an integer]
- $b = \text{GCD}(a,b) * t$  [where t is an integer]

**Prop 14: All multiples of LCM are divisible by the numbers whose LCM we have calculated**

- Multiples of  $\text{LCM}(a,b)$  will be divisible by both a and b

**Prop 15: a + b and a - b will always be divisible by GCD(a,b)**

- $a+b \text{GCD}(a,b) = ka+b \text{GCD}(a,b) = k$  [where k is an integer]
- $a-b \text{GCD}(a,b) = ta-b \text{GCD}(a,b) = t$  [where t is an integer]

## Sample Word Problems

**Prob 1:** Joe has 12 A-grade projects and Chris has 18 B-grade projects. They have to divide up the projects into small teams with equal number of projects in each team; each team can have either A-grade project or B-grade project only. If there is no remainder, find the largest possible number of projects in each team.

**Prob 2:** Joe and Chris were each given a piece of wood of equal length. Joe cuts his wood piece into equal lengths of 12 cm, while Chris cuts his wood piece into equal lengths of 18 cm. If there was no remainder in both cases, find the shortest possible length of wood given to them.

**Prob 3:** Two steel pieces of length 340 cm and 408 cm are to be cut into pieces of all the same length without remainder. Find the greatest possible length of the pieces.

**Solutions:**

Prob 1:  $\text{GCD}(12,18) = 6$

Prob 2:  $\text{LCM}(12,18) = 36$

Prob 3:  $\text{GCD}(340,408) = 68$