**Euler's Totient Theorem aka Fermat–Euler theorem**

Shubho

Oct 9, 2015, 11:56 PM

[I Published it here first](https://sites.google.com/site/vinceandcode/number-theory/euler-s-totient-theorem-1)

|  |
| --- |
| **What is Euler's Totient Theorem?**  If two positive integer a and n are [co-primes](https://en.wikipedia.org/wiki/Coprime_integers)  then  aφ(n)is congruent to 1 (mod n).  <http://weknowmemes.com/generator/uploads/generated/g1351798677223035265.jpg>  **lets dig deeper**  what is φ(n)? //(phi of n)  This is called Euler Totient Function, aka Phi function.  φ(n) = number of integers that are [co-prime](https://en.wikipedia.org/wiki/Coprime_integers) with n (less than n).  ex. φ(10) = 4;      [co-primes are: 1,3,7 & 9]  note: if n is a prime number then φ(n) will be n-1;  lets see an example 13 is a prime number. φ(13) = 13-1= 12;  [1,2,3,4,5,6,7,8,9,10,11,12]  This seems good. now lets get back to our main theorem and lets give it a closer look  "If two positive integer a and n are [co-primes](https://en.wikipedia.org/wiki/Coprime_integers) then aφ(n)is congruent to 1 (mod n)."  this means if we multiple a with itselfφ(n) times and divide the result  with n we will  get a remainder of 1  Is that clear?  <http://i.imgur.com/gGPYQmo.gif>  no?  lets look into an example  lets say a = 5 and n = 8 (they are relatively prime);  φ(8) = 4; [1,3,5,7 are co prime to 8]  aφ(n)  54= 625;  625/8 = (78\*8)+1.  1 is the remainder.  this is it  <http://38.media.tumblr.com/3297e10e5546f2ca173cd0ee07008963/tumblr_mt1afae6Iw1sphybio1_400.gif> |