**Math 3515 – Assignment 1**

1. In class we proved the first distributive laws for sets (IRA Prop 1.1.3). Prove the second distributive law and visualize it by drawing appropriate Venn diagrams.
2. In class we proved the first De Morgan law (IRA Thm 1.1.4). Prove the second De Morgan law . Could you visualize it using Venn diagrams?
3. (a) True or false: if x is divisible by 3, then is divisible by 3. If false, give a counterexample; if true, prove it.

(b) True or false: if is divisible by 3, then is divisible by 3. If false, give a counterexample; if true, prove it.

1. (a) Is every number of the form a prime number? *Note: those that are are called Mersenne Primes (see* [*https://primes.utm.edu/mersenne/*](https://primes.utm.edu/mersenne/) *for more info).*  
   (b) Is every number of the form , prime, a prime number?  
   (c) Assume that there is a largest prime number P. Would the number be prime? Use that fact to prove that there are infinitely many prime numbers.
2. For the function , find:
   1. and
   2. and and
3. In class we defined a relation on the set by calling and related if . For the resulting equivalence classes we defined addition and multiplication as follows:
4. List all elements related to (1,5), to (8,2), and to (7,7)
5. Find and as well as and
6. Find a better notation for the equivalence classes and
7. Prove that the relation on defined via if is an equivalence relation. Here
8. Show that if we change the domain of the relation in (7) to it is no longer an equivalence relation.
9. For the relation defined in (7), define .
   1. Show that =
   2. Show that the multiplication is indeed well-defined