***Discrete Math1*. Handwriting Assignment #2 Solution**

1. What is the difference between a vacuous proof and a trivial proof?  
   
2. Prove that if *m* is an even integer, then *m*+7 is an odd integer. You need to prove it different ways: by direct proof, by indirect proof, and proof by contradiction.   
   by direct proof  
   by indirect proof  
   proof by contradiction  
   
3. Consider the following statements.  
     
   1. If Dominic goes to the racetrack, then Helen will be mad.  
   2. If Ralph plays cards all night, then Carmela will be mad.  
   3. If either Helen or Carmela gets mad, then Veronica (their attorney) will be notified.  
   4. Veronica has not heard from either of these two clients.  
     
   From these, can we conclude the following?  
     
   **Dominic didn’t go to the racetrack and Ralph didn’t play cards all night.**  
   Write each of these statements in symbolic form.   
   Clearly label what your Boolean variables represent.  
   Then establish the validity of the conclusion. You must clearly label which rule of inference is used for each step.  
     
   
4. Prove that 4n -1 is divisible by 3, for all positive integers n.  
   **proof) for n=1, 41-1=3 is divisible by 3  
    We assume that for n=k, 4k -1 is divisible by 3.  
    For n=k+1, 4k+1 –1= 4\*4k -1 = (3+1) 4k – 1= 3\*4k + 4k -1  
    3\*4k is divisible by 3 and 4k -1 is divisible by 3. So, for n=k+1, it holds!**
5. Consider the Fibonacci sequence 1, 1, 2, 3, 5, 8, ... given by  
    f1 = 1,  
    f2 = 1,  
    fn = fn-1 + fn-2 for n > 2.  
   Show that f3n is even, for all natural numbers n.

