COT 3100 Fall 2017 Homework #3
Please Consult WebCourses for the due date/time

1) In general, you were told in class that for all integers a and b and positive integers n, if $a \equiv b \ (mod \ n)$, then $f(a) \equiv f(b) \ (mod \ n)$, where f is any function that operates on integers only. Using the definition of mod only, prove this specifically for the function $f(a) = a^2$.

2) Convert the following values from the bases indicated to base 10:

     i) 3645_7 iv) 30020_4
     ii) $AAF7_{16}$ v) 101101011001_2
     iii) 12345_9

3) Convert the following base 10 values to the bases indicated:

     i) 12435 to base 12   iv) 4921 to base 7
     ii) 79770 to base 16   v) 88264 to base 8
     iii) 691 to base 2

4) Prove that if n is an integer, then n(3n+1) is an even integer.

5) Prove that if n is an odd integer, then $n^4 \equiv 1 \ (mod \ 16)$. You may use the result from problem 4 to aid you in this proof. (Hint: At some point when you do your algebra, you should get an expression of the form a(3a + 1) where a is an integer. It is extremely helpful when you get to this point to use the result proved in question 4.)

6) Let x and y be integers such that $12 \mid (3x + 4y)$. Prove that $12 \mid (21x + 16y)$.

7) Give a summary of the life and mathematical contributions of Evariste Galois. Please aim for a length of roughly 200 - 400 words. ***Your summary must be typed.*** Please state the sources you used in writing your summary.